PROCEEDINGS OF ABSTRACTS VIII. INTERNATIONAL AGRICULTURAL, BIOLOGICAL, LIFE SCIENCE CONFERENCE AGBIOL 2026

06-09 SEPTEMBER 2026

ISTANBUL, TÜRKİYE

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Organized by
Trakya University
Istanbul Beykent University
International Researchers Association

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WELCOME NOTES

You are welcome to our VIII. AGBIOL Conference that is organized by Trakya University, Beykent University and International Researchers Association. The aim of our conference is to present scientific subjects of a broad interest to the scientific community, by providing an opportunity to present their work as oral or poster presentations that can be of great value for global science arena. Our goal was to bring three communities, namely science, research and private investment together in a friendly environment of Edirne, Turkey in order to share their interests and ideas and to get benefit from the interaction with each other.

In September 2018, we organized the first AGBIOL Conference with more than 700 scientists and researchers from all over the world with over 800 scientific papers. Due to COVID-19 situation, II. AGBIOL 2020 has organized fully on-line event which was one of the biggest online conferences in recent years in the world with 499 papers and 1133 authors with 333 oral and 166 e-poster presentations from 55 countries. Due to COVID-19 situation, AGBIOL 2021 was organized online again. AGBIOL 2022 conference was organized with a worldwide participation from 44 countries over 522 papers contributed by over 1300 authors. AGBIOL 2023 was organized with a record and worldwide participation from 33 countries 833 papers contributed by over 2000 authors with 522 oral and 311 poster presentations. AGBIOL 2024 consisted of 835 papers contributed by about 2000 authors with worldwide record participation again from 55 countries with 522 oral and 311 poster presentations. AGBIOL 2025 was organized with a worldwide record participation from 60 countries 988 papers contributed over 2300 authors with 400 oral and 588 poster presentations.

The AGBIOL 2026 is normal participation as well as with online participation in Beykent University in Istanbul, Turkey on 06-09 September, 2026. The program included oral talks by invited prominent scientists and oral and e poster presentations by participants in selected topics from the submitted abstracts focusing on Agriculture, Biology and Life Sciences topics.

There is a worldwide record participation again in AGBIOL 2026 from 61 countries 1057 papers contributed over 2500 authors then 800 of them were accepted and then the conference was organized with 390 oral and 410 poster presentations.

With care for our nature and environment, we aim the green congress, meaning that as little as possible papers will be used. Abstract book is published in electronic book and is distributed to the participants by e mail for online participants. All the e-posters are prepared in electronic form and then submit to via the conference e mail and exhibited in electronical poster boards as well as in online e poster hall in our web page during the conference.

The participants with paid conference fee accessed all the normal and virtual presentation talks in each session, as well as to visit the virtual poster hall via preliminary provided. The abstracts were published in the Conference Abstract and Proceedings Book. Participants might send us their full papers, which based on their preferences are published either in our Conference Abstract and Proceedings Book or in selected International Indexed Scientific Journals.

Conference Topics:

Agriculture, Forestry, Life Sciences, Agricultural Engineering, Aquaculture and Biosystems, Animal Science, Biomedical science, Biochemistry and Molecular Biology, Biology, Bioengineering, Biomaterials, Biomechanics, Biophysics, Bioscience, Biotechnology, Botany, Chemistry, Chemical Engineering, Earth Sciences, Environmental Science, Food Science, Genetics and Human Genetics, Medical Science, Machinery, Pharmaceutical Sciences, Physics, Soil Science.

We would like to thank all of you for joining this conference and we would like to give also special thanks to TUBITAK and collaborators for giving us a big support to organize this event.

Prof Dr Yalcin KAYA
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SYSTEM OF BULGARIAN PLANT GENETIC RESOURCES DOCUMENTATION – DESIGN, STRUCTURE AND STATUS

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ABSTRACT

Plant gene pool includes any genetic material of actual or potential value for food and agriculture. The Bulgarian Genebank Documentation is a comprehensive information framework developed to ensure effective conservation, exploration, collection, characterization, evaluation, and sustainable use of national plant genetic resources. Coordinated by the National Crop Genebank, the system is designed in accordance with international documentation standards, including FAO/Bioversity and European catalogue EURISCO. Its structure integrates passport data, storage information, and digital records of seed accessions, maintained in the different level of germplasm conservation and management. The national collection includes: advanced cultivars, breeding lines, landraces (traditional and old varieties, local population and crop wild relatives) from field and vegetable crops. The information system enables traceability of accessions, supports data exchange with European and global databases, and facilitates research, breeding, and policy development. Built on a modular digital architecture, it ensures secure data management, regular updates, and interoperability with external platforms. Currently, the system contains extensive documentation of conserved germplasm collections, reflecting ongoing efforts in digitization and quality control. The documentation system represents a strategic tool for safeguarding Bulgaria's agrobiodiversity and strengthening participation in international plant genetic resources networks.

Acknowledgement: These results have been achieved under the project IS-PGR-SADOVO "Intelligent system for managing Bulgarian plant gene pool, conserved in the genebank of IPGR-Sadovo" with the financial support of the Ministry of Education and Science, Contract number KP-06-H86/9/09.12.2024 of Bulgarian National Science Fund. Modern genebank data library is an essential working tool for guaranteeing quality and efficiency in conservation work with regard to biodiversity preservation.

Keywords: accession, genebank, descriptors, expedition, introduction, crop breeding

PLATFORM FOR ACCESS TO SEEDS AND SCIENTIFIC KNOWLEDGE – RESULTS FROM IS-PGR-SADOVO PROJECT

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ABSTRACT

The GeneBank System was developed to enhance transparency, collaboration, and innovation in plant genetic resources management. Coordinated by the Institute of Plant Genetic Resources – Sadovo, the initiative aims to provide open and structured access to seed collections and research data. The platform integrates passport data, phenotypic and agronomic evaluations, and documentation of conserved germplasm, ensuring long-term preservation and accessibility. The creation of a relational database for phenotypic evaluation of seeds from different plant species is of key importance for the management, scientific value and sustainability of any genebank. The MARViN VisionLine measuring equipment is a high-tech analysis system that uses computer vision (cameras and software) to precisely measure color, shape, size and other visual parameters of seeds. It detects color anomalies and creates color-calibrated images for documentation. The results are characterized by high accuracy, precision, flexibility and the ability to integrate into other information systems. A collection of common bean (Phaseolus vulgaris L.) with diverse geographical origin was analyzed. The new data complements the passport, evaluation and characterization of accessions. By promoting open science principles, the digital platform supports plant breeders, researchers, farmers, and policymakers in developing resilient and sustainable crop varieties. A key result is the digitization and systematization of national plant genetic resources collections, aligned with international standards of FAO for biodiversity conservation. The platform also strengthens knowledge transfer between science and practice, fostering innovation in agriculture under changing climate conditions. Overall, the GeneBank System contributes to conserving agrobiodiversity while advancing open access to scientific knowledge at national and international levels.

Acknowledgement: This research work was carried out under the project IS-PGR-SADOVO "Intelligent system for managing Bulgarian plant gene pool, conserved in the genebank of IPGR-Sadovo" with the financial support of the Ministry of Education and Science, Contract number KP-06-H86/9/09.12.2024 of Bulgarian National Science Fund.

Keywords: common bean, genebank collection, phenotyping, conservation, digitalization

FROM CONSUMER PREFERENCES TO VALUE CHAIN UPGRADING: ALIGNING RICE QUALITY, MARKETING, AND SUPPLY SYSTEMS IN INDONESIA

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ABSTRACT

This study investigates how evolving consumer preferences influence value creation and transformation within Indonesia's rice value chains, with a particular focus on the alignment between market demand and supply-side responses. In many smallholder-based food systems, rice production remains largely oriented toward volume, availability, and price stability. However, changing consumption patterns driven by urbanization, rising incomes, and shifting lifestyles increasingly reflect consumer demand for differentiated quality attributes, including texture, aroma, cleanliness, safety, packaging, and product consistency. Using a mixed-methods approach, the study integrates quantitative data from consumer surveys conducted among urban households in Makassar City with qualitative insights gathered from key value chain actors in South Sulawesi, including farmers, traders, millers, and retailers. This approach enables a comprehensive understanding of how consumer expectations are transmitted, interpreted, and responded to along the rice value chain. The findings reveal a significant misalignment between consumer preferences and prevailing supply-side practices. Although consumers place substantial value on sensory and quality-related attributes, rice marketing and production systems continue to operate with limited product differentiation, weak quality-based pricing mechanisms, and insufficient standardization. As a result, consumer demand for higher-value rice products is not effectively translated into incentives for producers and other upstream actors. This mismatch is further reinforced by structural constraints such as information asymmetry, fragmented coordination among chain actors, and the dominant role of intermediaries in market transactions. Together, these factors weaken the transmission of demand signals and limit opportunities for quality upgrading and value addition. The study concludes that strengthening rice value chains in Indonesia requires a shift from production-oriented strategies toward a more demand-responsive approach. Enhancing information flows, improving institutional coordination, and aligning incentives with consumer-valued quality attributes are essential to building more competitive, inclusive, and sustainable rice-based food systems.

Keywords: Demand–supply alignment, Consumer preferences, Value chain governance, Food system transformation, Smallholder agriculture

GLOBAL COFFEE MARKETS AND THE TRANSFORMATION OF CULTURAL ECOLOGICAL RELATIONS AND SOCIAL INEQUALITIES IN SMALLHOLDER AGROFORESTRY SYSTEMS IN HIGHLAND TORAJA, INDONESIA

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ABSTRACT

This study examines how global coffee markets reshape cultural–ecological relations and generate uneven social outcomes within smallholder agroforestry systems in Highland Toraja, Indonesia. While existing scholarship on coffee production often addresses ecological sustainability, market integration, and rural livelihoods as separate analytical domains, this study adopts an integrated human–environment perspective to understand how these dimensions co-evolve under ongoing processes of commodification. In doing so, it highlights the ways market expansion not only affects economic behavior but also transforms ecological management, cultural meaning, and social relations in coffee-growing communities. Using a qualitative case study approach, the research combines in-depth interviews, field observations, and value chain analysis to examine how market-driven transformations are experienced and negotiated by local actors. The study focuses on how increasing demand for specialty coffee, quality differentiation, and market traceability influences farming practices, local institutions, and community life. The findings show that commodification has reconfigured agroforestry systems by encouraging quality-oriented production, selective intensification, and greater engagement with external standards and buyer expectations. At the same time, these transformations are reshaping cultural practices and local knowledge systems associated with coffee cultivation. Importantly, the study finds that these changes do not simply result in cultural erosion or the disappearance of traditional systems. Instead, farmers adapt through hybridized practices that combine inherited ecological knowledge with market-oriented innovations. However, the benefits of these transformations are distributed unevenly. Better-resourced farmers are more able to access information, capital, and market networks, enabling them to capture emerging opportunities more effectively than others, thereby deepening social differentiation and inequality. In addition, the pursuit of market competitiveness introduces socio-ecological trade-offs that may weaken the long-term resilience of the agroforestry system. This study contributes to the literature by reframing coffee systems as dynamic human–environment interactions shaped by power, institutions, and market forces. It underscores the importance of policies that promote inclusive governance, support hybrid knowledge systems, and balance economic, ecological, and cultural objectives in smallholder agricultural transformation.

Keywords: Human–environment dynamics, Coffee value chains, Agroforestry systems, Commodification, Social inequality

INSTITUTIONAL ARRANGEMENTS AND FARMER WELFARE IN COCOA VALUE CHAINS EVIDENCE FROM SOPPENG DISTRICT, INDONESIA

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ABSTRACT

This study examines how institutional arrangements shape farmer welfare within cocoa value chains in South Sulawesi, Indonesia, a region where smallholder farmers dominate production yet capture only a limited share of value. This condition raises important concerns regarding the effectiveness and inclusiveness of existing institutional interventions aimed at improving smallholder livelihoods. Adopting a qualitative research design, the study draws on in-depth insights from semi-structured interviews and focus group discussions involving key actors across the value chain, including farmers, local traders, cooperatives, private-sector firms, and government agencies. The analysis identifies a diverse range of institutional arrangements, including informal collector-based systems, cooperative-based models, private partnership schemes, and program-driven interventions initiated by external agencies. Each arrangement exhibits distinct governance structures, coordination mechanisms, and participation requirements, which shape how benefits are distributed among actors. The findings reveal that these institutional configurations produce uneven welfare outcomes, reflecting inherent trade-offs between inclusiveness, efficiency, and equity. Informal systems tend to offer broader access and flexibility for farmers but often limit opportunities for upgrading, value addition, and long-term income growth. In contrast, more formalized arrangements—such as cooperatives and partnerships can enhance productivity, quality standards, and market access, thereby increasing income potential, yet they remain selectively accessible due to entry barriers and institutional requirements. Furthermore, institutional performance is strongly influenced by power asymmetries, unequal access to information, and persistent coordination failures, all of which reinforce disparities among farmers. By integrating perspectives from value chain analysis and institutional theory, this study demonstrates how institutional diversity and governance conditions jointly shape welfare outcomes. The findings underscore the urgency of designing more integrated, adaptive, and inclusive institutional strategies to ensure equitable participation and promote sustainable development within the cocoa sector.

Keywords: Inclusive development, Power asymmetry, Market participation, Rural livelihoods

GOVERNANCE AND COORDINATION FAILURES IN COCOA VALUE CHAINS: INSTITUTIONAL CONSTRAINTS AND STAKEHOLDER DYNAMICS IN POLMAN DISTRICT, INDONESIA

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ABSTRACT

This study investigates how institutional arrangements and stakeholder dynamics shape governance structures, coordination mechanisms, and value distribution within the cocoa value chain in Polewali Mandar (Polman) District, West Sulawesi, Indonesia. Grounded in the framework of New Institutional Economics, the analysis integrates transaction cost economics, agency theory, and collective action perspectives to examine the underlying structural and relational constraints affecting smallholder farmers. Using a qualitative approach based on in-depth interviews, focus group discussions, and stakeholder mapping, the study captures the interactions among farmers, local collectors, traders, cooperatives, and government actors. The findings reveal that the cocoa value chain is characterized by fragmented coordination and a predominance of informal, intermediary-based governance. Local collectors emerge as central actors who mediate market access, provide informal credit, and control price information. While their presence helps reduce transaction costs and enables farmers' participation in the market, it simultaneously entrenches dependency relationships and reinforces asymmetric power dynamics. Consequently, farmers experience limited bargaining power and reduced capacity to capture higher value. In addition, weak farmer organizations, low levels of trust and collective action, limited access to market information, and misaligned quality incentives further exacerbate coordination failures and institutional inefficiencies. These conditions result in a skewed distribution of value toward downstream actors, restricting opportunities for functional and economic upgrading among smallholders. The study argues that the persistent inefficiencies observed in the cocoa sector are fundamentally institutional rather than purely technical. Therefore, addressing these challenges requires systemic interventions aimed at strengthening farmer institutions, improving horizontal and vertical coordination, enhancing market transparency, and reinforcing policy and governance support to foster a more inclusive and efficient cocoa value chain.

Keywords: cocoa value chain, coordination failure, New institutional economics, smallholder farmers, value distribution, institutional constraints

BIOFORTIFICATION IN POTATO

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ABSTRACT

In recent years, biofortification applications have gained strategic importance in enhancing the nutritional value of plant and animal products for human and animal health. Through fertilization methods applied to the soil or foliage, these practices aim to eliminate deficiencies in essential nutrients such as Fe, Zn, Se, Vitamin A (β-carotene), and folate. Biofortification primarily focuses on developing new varieties aimed at improving the edible organs of plants and their capacity for nutrient storage. Staple food crops essential for the global population, such as wheat, maize, potato, and rice, are generally deficient in necessary micronutrients. This inadequacy leads to various health issues, including stunted growth, weakened immune systems, and increased susceptibility to multiple diseases. Through crossbreeding and selection, molecular breeding, or genetic engineering, more than 400 biofortified varieties belonging to 12 species have been developed. Micronutrient enrichment has become a significant breeding target for the potato, which is well-integrated into local food systems and consumed in substantial quantities. Notably, potatoes provide significant amounts of essential nutrients such as Vitamin C, Vitamin B6, Vitamin K, iron, and folate. While nutrient composition may vary slightly among potato cultivars, pigmented (colored) potatoes, in particular, emerge as rich sources of various antioxidants—including polyphenols, anthocyanins, carotenoids, and flavonoids—maintaining their appeal as a healthy food option even after cooking. The International Potato Center has developed potato varieties with higher iron content than commercial cultivars through traditional breeding methods; it has been determined that women consuming these potatoes can meet up to 50% of their daily iron requirements. Furthermore, it has been established that potatoes subjected to foliar iodine fertilization can supply up to 25% of the daily intake, thereby mitigating the drawbacks associated with conventional salt consumption.

Keywords: Translocation, potato, iron, zinc, selenium

EFFECT OF ALFALFA PHENOLOGICAL STAGES ON FORAGE NUTRITIVE VALUE AND LOCAL GOAT MILK QUALITY IN ARID REGIONS

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ABSTRACT

In Mediterranean and arid regions, dairy goat production depends largely on forage resources whose nutritional value changes with plant maturity and environmental conditions. Alfalfa (Medicago sativa L.) is one of the most widely used forages because of its high protein content, palatability, and importance in ruminant feeding systems. However, variations in its phenological stage may significantly affect both forage nutritive value and milk characteristics. This study aimed to evaluate the effects of different alfalfa phenological stages on forage quality and on the physicochemical and hygienic quality of milk produced by local goats. The results showed a clear effect of phenological stage on alfalfa composition. Crude protein content was highest at early flowering (approximately 50.5% DM) and decreased to about 40.2% DM at full flowering, whereas crude fiber increased from 28.2% to 36.6% DM with advancing maturity. Organic matter digestibility ranged from 82.9% to 96.5%, and energy values varied from 1.34 to 1.48 UFL/kg DM. These changes were reflected in milk composition. Milk fat content increased from 3.78% at the bud stage to 5.78% at full flowering, while milk protein content ranged from 1.68% to 2.07%. Milk dry matter increased from 10.3% to 11.8%, whereas lactose remained relatively stable (3.76–3.87%). Milk pH ranged from 6.39 to 6.88, and microbiological analysis indicated good hygienic quality, with total bacterial counts below 2×10^5 CFU/mL. Overall, alfalfa maturity stage influenced both forage nutritive value and the physicochemical quality of milk in local goats under arid Mediterranean conditions, with potential implications for feeding strategies.

Keywords: alfalfa phenological stage, forage quality, local goats, milk composition, Mediterranean production systems, arid regions

SELECTION CRITERIA IN BREEDING COTTON FOR HIGH TEMPERATURE STRESS TOLERANCE

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ABSTRACT

High temperature stress is one of the major abiotic factors directly affecting yield and fiber quality in cotton. The impact of this stress is determined by the interaction of several variables, including the intensity and duration of heat, plant species, and developmental stage. In this context, both the severity and timing of stress play a critical role in determining plant response. The flowering stage is particularly sensitive, and exposure to high temperatures during this period leads to significant yield losses. Under high temperature conditions, physiological disruptions such as stomatal closure, protein denaturation, enzyme inactivation, and membrane damage occur in plants. These changes collectively disrupt normal cellular functioning. As a consequence, photosynthesis decreases while respiration increases, leading to an imbalance in carbohydrate metabolism. In particular, elevated night temperatures accelerate respiration, causing carbohydrate depletion, which results in boll shedding, malformed bolls, and reduced fiber quality. Three main selection criteria are used to identify heat-tolerant cotton genotypes: yield components, morphological traits, and physiological parameters. These criteria are widely accepted in breeding programs. Yield components include boll number, boll weight, seed number, and fiber quality. Morphological traits involve adaptive characteristics such as leaf shape, pubescence, and leaf thickness. Such traits may contribute to improved heat dissipation and water use efficiency. Physiological criteria are assessed through measurements such as chlorophyll content (SPAD), membrane stability, canopy temperature, and stomatal conductance. In conclusion, the development of cotton cultivars tolerant to high temperature stress requires the integrated evaluation of these three groups of traits. Therefore, a holistic approach is essential in breeding programs. The most effective breeding strategies rely on selecting genotypes that minimize yield loss and maintain physiological stability under stress conditions.

Keywords: cotton, breeding, heat stress, abiotic stress

TEMPERATURE TOLERANCE AND PHENOTYPIC PLASTICITY IN PLANTS

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ABSTRACT

Temperature is the most fundamental external factor determining the rate of plant growth and development. Minimum temperatures at which growth occurs at its lowest level, optimum temperatures where metabolic functions peak, and maximum temperatures where enzymatic structures begin to degrade and the synchronization between male and female reproductive organs is disrupted, lie at the core of environmental influences. In the process of global climate change, the frequency and severity of temperature fluctuations are increasing alongside temperature rises, negatively impacting crop productivity. In our country, sudden temperature increases observed at the end of winter, commonly referred to as "false spring," and the subsequent seasonal cold spells or frost events are experienced. The composition of the plasma membrane is influential in maintaining the stability of cellular functions, while the composition of thylakoid membranes is critical for sustaining photosynthetic capacities. Heat Shock Proteins (HSPs) stand at the forefront of the primary mechanisms developed by plants in response to temperature stress. In summer crops such as cotton, soybean, maize, and peanut, sowing is performed when soil temperatures reach 15–18°C and above. However, in certain years, anomalies occur in April and May post-sowing, and low temperatures adversely affect both germination and early seedling development. Furthermore, early-stage seedling pathogens negatively impact the plant. Phenotypic plasticity is the ability of a genotype to produce different physiological, morphological, developmental, and biochemical phenotypes when exposed to diverse conditions. The plasticity of a given trait depends on genetics and environmental factors. A high level of phenotypic plasticity is defined as a minor change in temperature leading to a broad phenotypic modification in plants. Temperature fluctuations between 20–30°C in maize have negatively affected stem and root development and significantly increased transpiration. Similar to winter crops, temperature fluctuations in summer crops exert a greater negative impact during the generative stage. High temperatures limit the attainment of yield potential by shortening the period required for seed setting and development. Additionally, extreme heat during the flowering period can directly affect pollination and fertilization. Breeding programs aimed at achieving high phenotypic plasticity should be developed. It has been proven that epigenetic modifications can also contribute to positive changes at the gene level.

Keywords: Temperature fluctuate, tolerance, yield losses

STRATEGIES FOR ACCELERATING GENETIC PROGRESS IN MODERN AGRICULTURE: SPEED BREEDING AND ENVIRONMENTAL MANIPULATION TECHNIQUES

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ABSTRACT

This study provides a comprehensive analysis of "speed breeding" technology, a revolutionary approach in modern plant breeding, and its impact on agricultural sustainability. Traditional breeding methods progress slowly due to natural growth cycles and seasonal limitations; developing and registering a new variety, typically takes between 7 and 10 years. However, biotic and abiotic stress factors caused by climate change necessitate that breeders act much faster. Inspired by NASA's efforts to grow plants in space and later optimized by Dr. Lee Hickey and his team at the University of Queensland, speed breeding has emerged as the most effective way to overcome these time constraints. The fundamental mechanism of speed breeding involves taking control of the plant's biological clock and developmental stages within an artificial environment. In this process, five key environmental parameters are optimized: light duration (photoperiod), temperature regime, humidity control, carbon dioxide enrichment, and plant nutrition. Particularly for strategic crops such as cotton, soybeans, and wheat, extending the daily photoperiod to 18–24 hours dramatically shortens the plant's life cycle. Maintaining daytime temperatures between 25-30°C and implementing controlled nighttime temperature drops enhances the plant's metabolic rate, encouraging early flowering and seed set. Through this method, the number of generations obtained per year, which is typically only 1 or 2 under traditional conditions, can be increased to 3 to 9 generations per year in controlled greenhouses or growth chambers, depending on the plant species. Another significant point highlighted in the study is the integration of this method with modern biotechnological tools. When speed breeding is combined with genomic selection, molecular markers such as SSR (Simple Sequence Repeats), and high-tech phenotyping systems, it provides not only speed but also high genetic precision. For plants with long vegetation periods like cotton, the process of improving traits such as fiber quality and yield can be reduced by half. Consequently, speed breeding has become one of the most critical technological tools at the center of agricultural innovation, providing time and cost efficiency in developing varieties resistant to changing environmental conditions. By bypassing geographical and seasonal barriers, this technology ensures that resilient genotypes are identified and deployed faster than ever before.

Keywords: Speed breeding, Photoperiod, Climate change, Plant genetics, Agricultural innovation

STUDY OF THE IMPACT OF A NEW FORMULATION OF NITROGEN FERTILIZERS FOR FOLIAR FEEDING ON COMMON WHEAT AND WAYS TO ENHANCE ITS PRODUCTIVITY

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ABSTRACT

Periodic application of organic fertilizers maintains a constant supply of organic matter in the soil and increases fertility. Foliar feeding provides plants with an additional amount of nutrients in an easily digestible form. Research on the influence of fertilization on soil changes is gaining particular relevance due to the annual use of mineral fertilizers, the introduction of intensive varieties into practice, and the need to obtain environmentally friendly and economically efficient production. The question of the change in the nutritional regime of the soil as a result of fertilization can be successfully studied only in the conditions of long-term fertilizer experiments with the accumulation of nutrients under specific conditions. In foliar feeding of plants, an additional amount of nutrients is supplied in an easily assimilable form. Foliar fertilization and biostimulants can be applied throughout the entire growing season. Foliar feeding also enhances the physiological activity of the plants' root system. The aim of the present study is to determine the effectiveness of the application of the new formulation of nitrogen fertilizer for foliar feeding Clean Fertilizer N28 based on the active cultivation of common wheat variety Avenue. The results prove the influence of the factors in both years of the experiment. The analysis of variance shows differences between the factors. When considering the independent influence of the elements, it was found that the strongest influence is: stem height, spike length, number of spike in a spike and mass of grains in a spike, proven at $p < 0.001$. The yield increases in the harvest year 2025. to 73,7 kg/ha, although its influence over the years is not proven.

Keywords: common wheat, nitrogen, nitrogen fertilizer

OPTIMIZATION OF AQUEOUS EXTRACTION METHODS OF ALGAE FOR IMPROVED GERMINATION OF HORDEUM VULGARE L.

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ABSTRACT

The use of algae-based biostimulants has gained increasing attention as a sustainable and eco-friendly strategy to enhance plant performance under diverse environmental conditions. These natural products are rich in bioactive compounds such as phytohormones, polysaccharides, and antioxidants, which can positively influence plant growth and early developmental stages. In this study, aqueous extracts derived from brown algae were evaluated for their potential to improve barley (Hordeum vulgare L.) seed germination and early seedling development. Four extraction methods—maceration, autoclaving, water bath heating, and sonication—were employed to obtain a broad range of bioactive compounds, and their effects were tested at four concentrations (1%, 3%, 5%, and 10%). Germination assays were conducted under controlled laboratory conditions, and key parameters including germination percentage and seedling vigor index were assessed to evaluate treatment efficiency. The results demonstrated that both extraction method and concentration significantly influenced germination outcomes. Among the tested treatments, maceration-derived extracts at lower concentrations (1% and 3%) exhibited the most pronounced positive effects, enhancing germination performance and seedling vigor compared to other extraction methods and higher concentrations. In contrast, increasing concentrations (5% and 10%) tended to reduce or inhibit germination, indicating a clear dose-dependent response. The superior performance of maceration extracts may be attributed to the preservation of heat-sensitive bioactive compounds, which are likely degraded during thermal extraction processes such as autoclaving and water bath treatment. Overall, this study supports the potential of brown algae aqueous extracts as effective and environmentally friendly seed priming agents, while emphasizing the importance of optimizing both extraction technique and application dose for improved agricultural applications.

Keywords: Hordeum vulgare L., Macroalgae, Extract methods, Germination, Algae-based biostimulant

EMPOWERMENT AND SUSTAINABLE COFFEE CULTIVATION: THE ROLE OF KNOWLEDGE AND GOOD AGRICULTURAL PRACTICES IN ENHANCING ARABICA COFFEE PRODUCTIVITY IN INDONESIA

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ABSTRACT

Smallholder coffee farmers in developing countries continue to face major challenges in maintaining sustainable agricultural production due to limited technical knowledge, low adoption of Good Agricultural Practices (GAP), and insufficient access to continuous agricultural assistance. These constraints frequently contribute to unstable productivity and reduced farm sustainability. In Indonesia, Arabica coffee farmers in Humbang Hasundutan Regency experience similar conditions despite the region's strong potential as one of the country's leading coffee-producing areas. This study investigates the role of farmer empowerment in promoting sustainable coffee cultivation through the enhancement of farmer knowledge and GAP adoption. Specifically, the study evaluates the impact of the *Bertani Untuk Negeri* (BUN) Program on farmer knowledge, expectation fulfillment, GAP adoption, and Arabica coffee productivity among smallholder farmers in Indonesia. A quantitative survey approach was employed involving 36 Arabica coffee farmers participating in the BUN Program. Data were analyzed using the Wilcoxon Signed-Rank Test and Spearman Rank Correlation analysis. The findings reveal significant improvements in farmer knowledge, expectation fulfillment, GAP adoption, and coffee productivity following participation in the program. Furthermore, farmer knowledge exhibited a significant positive relationship with GAP adoption and coffee productivity, while GAP adoption demonstrated a strong positive correlation with productivity improvement. These findings indicate that participatory farmer empowerment programs play an important role in strengthening sustainable coffee farming systems by facilitating knowledge transfer and encouraging the adoption of sustainable agricultural practices. This study contributes to the growing literature on sustainable agriculture, agricultural extension, and farmer empowerment by providing empirical evidence regarding the effectiveness of empowerment-based interventions in improving smallholder coffee farming systems in developing countries. The findings also provide practical implications for policymakers, agricultural extension institutions, and rural development organizations in designing sustainable farmer capacity-building programs for the coffee sector.

Keywords: Arabica coffee, farmer empowerment, Good Agricultural Practices (GAP), sustainable agriculture, agricultural extension, coffee productivity, smallholder farmers, knowledge transfer, sustainable coffee cultivation

SUSTAINABLE RISK MANAGEMENT AND SMALLHOLDER BEEF CATTLE WELFARE: A HOUSE OF RISK–PARETO INTEGRATION FRAMEWORK FOR AGRIBUSINESS RESILIENCE IN INDONESIA

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ABSTRACT

Smallholder beef cattle farming constitutes over 70% of Indonesia's national herd and serves as a critical pillar for rural livelihoods, protein security, and decentralized economic development. However, in Soppeng Regency, South Sulawesi, these enterprises remain highly vulnerable to systemic shocks due to fragmented management practices, constrained capital access, and limited institutional support. This study identifies and prioritizes risk mitigation strategies in smallholder beef cattle farming through the integrated application of the House of Risk (HOR) framework and Pareto analysis. Primary data were collected via structured surveys administered to 85 smallholder farmers and processed through a rigorous two-stage analytical pipeline. HOR-1 quantified operational vulnerabilities by calculating the Risk Index (RI) across five critical events, weighting occurrence frequency, financial impact severity, and farmer preparedness. HOR-2 subsequently mapped underlying causal drivers to compute the Aggregate Risk Potential (ARP), enabling the formulation of targeted, resource-efficient mitigation actions aligned with smallholder capacity. Results reveal that sudden livestock mortality (RI = 31.06) and disease outbreaks (RI = 28.63) constitute the most severe operational threats. These events are predominantly driven by institutional and managerial gaps, specifically the absence of emergency standard operating procedures (RA2, ARP = 269.82) and inadequate vaccination coverage (RA1, ARP = 263.33). Pareto analysis confirms that these two dominant risk agents account for 53.9% of total systemic risk potential, and when combined with climate adaptation deficits (RA5), collectively explain 75.6% of aggregate vulnerability. The novelty of this research lies in embedding the HOR–Pareto architecture within a Sustainability–Welfare–Resilience Nexus, which explicitly quantifies how targeted mitigation translates into stabilized household cash flows, enhanced animal welfare standards, and strengthened ecological adaptive capacity. These findings demonstrate that risk exposure in smallholder systems is fundamentally institutional rather than purely exogenous. Consequently, the study recommends prioritizing protocol-driven interventions, integrated biosecurity enhancement, and digital extension services as core mitigation strategies. The analytical process incorporated sensitivity testing to validate ranking stability under varying preparedness scenarios, ensuring robust prioritization under resource-constrained conditions. Furthermore, the proposed mitigation matrix directly addresses critical policy gaps by advocating for mandatory biosecurity compliance as a prerequisite for agricultural credit schemes, alongside the deployment of localized early-warning systems. Implementing these measures will directly reduce income volatility, mitigate zoonotic transmission risks, and improve access to productive financing. Ultimately, this framework aligns smallholder risk management with national beef self-sufficiency targets, climate-smart livestock pathways, and SDGs 1, 2, 13, and 15, providing a scalable, evidence-based model for advancing multidimensional welfare and long-term agribusiness resilience in Indonesia.

Keywords: Risk Management, Smallholder Cattle Farming, House of Risk, Pareto Analysis, Sustainability, Farmer Welfare, Agribusiness Resilience

TECHNO-ECONOMIC IMPACT OF MAJOR PESTS ON THE PROFITABILITY OF APRICOT ORCHARDS IN SEMI-ARID ZONES: CASE OF M'CIF COMMUNE, ALGERIA

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ABSTRACT

Apricot cultivation represents a socio-economic cornerstone of agricultural activity in the semi-arid Hodna basin of Algeria, particularly within the M'cif commune of Bou Saâda. However, this strategic arboricultural sector faces severe, escalating phytosanitary pressures that drastically threaten orchard longevity, fruit quality, and overall farm profitability. In a context exacerbated by climate change and water scarcity, this techno-economic study evaluates the field effectiveness, financial cost-benefit ratio, and operational viability of current pest control methods implemented by local smallholders. Empirical data were gathered through comprehensive structured surveys across 70 representative farms, encompassing a total production area of 300 hectares. The diagnostic field assessment reveals that the stone fruit borer (Capnodis tenebrionis) and the Mediterranean fruit fly (Ceratitis capitata) constitute the most frequent, destructive, and economically damaging bioaggressors. Capnodis tenebrionis causes irreversible structural damage leading to tree mortality, while Ceratitis capitata severely depreciates market revenues through direct fruit spoilage. From a techno-economic standpoint, quantitative analysis demonstrates that both biological alternatives (such as mass trapping and prophylactic cultural practices) and conventional chemical treatments yield comparable short-term profitability. Both strategies successfully secure an average yield increase of 45 kg per tree compared to neglected, untreated control plots. Nevertheless, comparative margin analysis indicates that exclusive chemical control induces significantly higher input costs, erodes long-term economic returns, and generates substantial ecotoxicological risks, including pest resistance and chemical residues. Consequently, this study strongly advocates for a paradigm shift toward the widespread institutional support and adoption of Integrated Pest Management (IPM) strategies. Combining targeted, localized irrigation management to enhance tree vigor with eco-friendly mass trapping emerges as the most financially viable and ecologically sustainable alternative to optimize gross margins while preserving fruit production dynamics in Algerian fragile arid ecosystems.

Keywords: Apricot cultivation, pests, integrated pest management, M'cif, profitability.

BIOCHEMICAL, MORPHOLOGICAL AND AGRONOMIC CHARACTERIZATION OF NEW OLIVE HYBRIDS DEVELOPED FOR MEDITERRANEAN CLIMATE RESILIENCE

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ABSTRACT

The olive tree (Olea europaea L.) is a key perennial crop in Mediterranean agroecosystems, which are increasingly exposed to climate change and recurrent water deficits. In this context, the characterization of novel genotypes developed through breeding programs of the Moroccan National Institute for Agricultural Research (INRA) is critical for identifying elite material combining productivity and adaptive resilience. This study aimed to assess the functional variability of five olive hybrids (Dalia, Tassaout, Agdal, Mechkate, and Baraka) obtained from controlled crosses between Moroccan parental genotypes (Menara and M26) and Mediterranean cultivars, including Picholine Languedoc (France), Manzanilla de Sevilla and Arbequina (Spain), and Leccino (Italy). A multidisciplinary approach integrating biochemical, morphological, and agronomic traits was employed to capture genotype-dependent variability. Statistical analyses were performed in R software, using one-way analysis of variance (ANOVA) followed by post hoc multiple comparisons to discriminate homogeneous groups. Pearson correlation analyses were further conducted to investigate functional relationships among physiological, biochemical, and morphological traits. Results revealed significant genotypic effects across all measured traits, highlighting substantial phenotypic plasticity among hybrids. Specific genotypes exhibited enhanced accumulation of osmoprotectants, particularly soluble sugars, together with a more efficient antioxidant capacity, suggesting improved physiological resilience under water-limited conditions. Conversely, other hybrids displayed superior vegetative growth and agronomic performance, reflecting strong productive potential. Notably, certain genotypes combined stress-adaptive biochemical traits with favorable growth attributes, indicating an intermediate strategy between tolerance and productivity. Overall, the observed variability underscores the existence of valuable genetic resources for olive breeding under Mediterranean constraints. These findings provide a robust basis for the selection of superior genotypes integrating drought adaptation and agronomic performance and contribute to the development of climate-resilient olive cultivars suitable for future environmental scenarios.

Keywords: Olea europaea, olive breeding, genetic improvement, biochemical traits, antioxidant metabolism, agronomic performance, climate change

EFFECTS OF SOME ORGANIC AND INORGANIC TREATMENTS ON GERMINATION, OXIDATIVE DAMAGE, AND METABOLIC REGULATION IN SAFFLOWER (CARTHAMUS TINCTORIUS L.) SEEDS

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ABSTRACT

Safflower (Carthamus tinctorius L.) is an economically important oilseed crop with versatile applications worldwide, including oil production, the food industry, cosmetics, and bioenergy (biodiesel). The cultivation of safflower in arid and low-productivity agricultural lands holds great significance for supporting sustainable agricultural production and the economic utilization of marginal areas. In this study, the effects of $CaCO_3$ (5%, 10%, and 15%), K_2SiO_3 (2%, 4%, 6%, and 8%), and molasses (2% and 4%) treatments on germination characteristics and seed chemical properties of safflower were investigated. For this purpose, seeds subjected to pre-treatment for 8 hours in solutions prepared at the specified concentrations were sown in petri dishes, and germination parameters were determined. The remaining seeds were dried in an oven at 65°C, ground, and converted into powder form. The resulting samples were used to determine proline, protein, glucose, sucrose, and pyruvate contents, total phenolic compounds and flavonoids, as well as indicators of oxidative stress and membrane damage including malondialdehyde (MDA), hydrogen peroxide (H_2O_2), lipoxygenase (LOX) activity, and electrolyte leakage (EL). The results revealed that 20% $CaCO_3$ application led to a marked decrease in germination count along with glucose, sucrose, total phenolic compound and flavonoid contents, and amylase activity, while maximizing proline, MDA, H_2O_2, and EL levels and LOX activity. On the other hand, 5% $CaCO_3$, 2% molasses, 2% K_2SiO_3, and 4% K_2SiO_3 treatments increased germination count, flavonoid and total protein contents, and amylase activity, while suppressing MDA, H_2O_2, and EL levels and LOX activity. The findings demonstrated that high $CaCO_3$ application (particularly at 20%) suppressed germination and metabolic activities in safflower seeds, thereby increasing oxidative stress, whereas low-dose $CaCO_3$, molasses, and K_2SiO_3 treatments improved germination performance and biochemical activity while reducing oxidative damage. Therefore, it is suggested that the combined use of low-dose $CaCO_3$ with molasses and K_2SiO_3 applications has the potential to support plant development in the cultivation of safflower in marginal and calcareous soils.

Keywords: Safflower (Carthamus tinctorius L.), Oxidative stress, Seed germination, Metabolic regulation

FACILITATION AND RESIDUAL BENEFITS OF INOCULATED LEGUME CROP FOR CEREAL UNDER COMBINED STRESS OF DROUGHT AND P DEFICIT

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ABSTRACT

Enhancing the performance of nitrogen fixing legume symbiosis through their inoculation with selected rhizobacterial inoculum could improve not only their production but also, their beneficial effects to associate crops under limiting constraints. Indeed, legume-based cropping system is a pioneer for sustainable agriculture in low input agrosystems. Thus, our research aimed at inoculation of faba bean crops with selected rhizobacterial consortia to enhance their nitrogen fixing potential under combined stress of water deficit and phosphorus limitation and hence improve their facilitation and residual effects to wheat crop associated in intercropping or in rotation. The experiments were conducted under greenhouse and in farmer fields on P-deficient soil during two successive years. Faba bean and wheat plants were inoculated with selected consortia containing rhizobia and sysnergistic PGPRs and submitted to combined stress of water deficit and P limitation. Three cropping patterns, faba bean sole crop, faba bean/wheat intercrop and wheat sole crop were considered. The plants flowering and maturity stages were considred for plant growth, physiology and yield components assessment. The inoculated plots of the first year were used as precedent to evaluate the residual effects of faba bean crop on wheat associated in rotation. The results showed that combined stress of water deficit and P limitation significantly reduced bean and wheat plants growth and nodulation and caused physiological disturbances. Meanwhile, inoculation with selected rhizobacterial consortia improved plant nutrition and performance under stress. Furthermore, intercropping with faba bean increased wheat performance up to 30%. Faba bean as precedent crop enhanced yield of wheat associated in rotation. Besides, soil fertility indicators highlighted the beneficial effects of legumes as precedent crop. Indeed, intercropping-conditioned soils increased soil organic matter (SOM) by 3.88 %, compared with soils from wheat sole-cropping (2.36 %). Available soil P content was highest in faba bean-conditioned soil (51.72 $\mu g \cdot g^{-1}$), while microbial biomass P (MBP) reached 67.8 $\mu g \cdot P \cdot g^{-1}$ in intercropping under well-watered conditions, 30.40 % higher than in wheat sole crop as precedent (52 $\mu g \cdot g^{-1}$). We conclude that legume-based cropping systems, especially rotations involving faba bean and intercropping, significantly improved wheat performance through increased root growth, nutrient uptake, and microorganism-mediated soil fertility, justifying their important role in climate-resilient and sustainable cropping systems

Keywords: Cropping system, faba bean, intercropping, phosphate, rotation, water deficit, wheat

EVALUATION OF REDOX STATUS AND CYTOKINE PROFILE IN PESTICIDE-EXPOSED FARMERS

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ABSTRACT

Pesticides constitute a major public health concern and are associated with various chronic diseases such as cancers, neurological disorders, cardiovascular diseases, diabetes, and other metabolic disturbances. In Algeria, farmers are exposed to these substances over prolonged periods. Although effects on consumers are often highlighted, farmers represent the primary population affected. This study aims to evaluate alterations in redox status, inflammatory profile, and lipid metabolism among pesticide-exposed farmers in the Tlemcen region. The study included 160 farmers and 160 voluntary controls. After informed consent, blood samples were collected. Biochemical parameters included total cholesterol, triglycerides, and lipoproteins (VLDL, LDL, HDL). The inflammatory profile was assessed by measuring cytokines (IL-2, IL-6), C-reactive protein, and plasma homocysteine. Oxidative status was evaluated by measuring malondialdehyde and carbonyl proteins. The antioxidant system was assessed through the activity of superoxide dismutase, catalase, and glutathione peroxidase in erythrocytes. The results show that pesticide exposure is associated with metabolic complications, including hyperglycemia, increased glycated hemoglobin, and signs of renal dysfunction in exposed farmers. A significant increase in total cholesterol and triglycerides was observed, along with a decrease in HDL-cholesterol and an increase in triglyceride-rich VLDL and LDL fractions. Regarding inflammation, a significant elevation of pro-inflammatory cytokines, CRP, and homocysteine was observed. In addition, increased oxidative stress was evidenced by elevated levels of MDA and carbonyl proteins, together with decreased antioxidant enzyme activities. **In conclusion**, pesticide exposure is associated with significant alterations in redox status, inflammatory profile, and lipid metabolism in farmers, highlighting the importance of regular medical monitoring and appropriate preventive measures.

Keywords: Pesticides, Farmers, Biochemical parameters, Pro-inflammatory cytokines, oxidant/antioxidant status.

CARBON FARMING AS AN ADAPTATION MECHANISM FOR AGROCENOSES UNDER CLIMATE STRESS CONDITIONS

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ABSTRACT

Soil and climate are interconnected and jointly affect the quality and quantity of crop production, ensuring food security. Progressive climate change and the accompanying adverse weather phenomena are having an increasingly negative impact on the soil, exacerbating degradation processes. In light of this, it is rational to introduce adaptation mechanisms while simultaneously halting and minimizing adverse environmental changes. Utilizing sustainable agricultural practices, carbon farming helps in the restoration and protection of natural resources, primarily soils. This agriculture focuses on improving soil health, and consequently its functionality, by increasing organic matter and strengthening the soil's sorption and sequestration capacities. Such action aims, among other things, to counteract the greenhouse effect not only by limiting CO2 emissions from soils but also by reducing the release of nitrous oxide (N2O) based on sustainable fertilizer management. In relation to these tasks, the key techniques of carbon farming aim to reverse the degradation process by minimizing mechanical interference and maximizing the input of organic matter. Above all, the significance of conservation agriculture (no-till, i.e., abandoning deep inversion tillage), the use of year-round cover crops (CO2 assimilation, erosion protection, and support for the soil microbiome), mulching (crop residues left on the field surface create a physical protective barrier at the soil-atmosphere interface, maintaining even moisture and temperature), and the introduction of agroforestry (integrating trees and shrubs with annual crops contributes to the creation of a microclimate, improves CO2 sequestration, and forms natural barriers against pathogens) must be emphasized. The implementation of the above techniques translates into tangible benefits for the ecosystem and strengthens the pillars of sustainable development (ESG), creating a circular economy in agriculture with simultaneous optimization of water retention and thermal insulation, reduction of evaporation, protection against erosion, and the restoration of trophic webs. The economic aspect, expressed through support within EU eco-schemes and the developing market of carbon credits, is also of significant importance as they become a crucial financial motivator. They allow for the diversification of farm income, which partially compensates farmers for the initial risks and costs associated with the agrotechnical transformation within the framework of carbon farming. However, the implementation of these assumptions encounters a number of limitations, from agrotechnical to institutional, which are particularly evident in warmer, drier climate zones. At this point, competition for water must be emphasized, which is of great importance in semi-arid regions, as cover crops can competitively deplete water reserves in the soil profile, leading to a decrease in the yield of main crops. Furthermore, higher temperatures favor a faster process of organic matter mineralization, leading to the loss of soil organic carbon and its increased emission into the atmosphere in gaseous form. Such conditions force the use of different practices than those proposed for temperate climates. Also, abandoning traditional tillage while simultaneously applying crop residue mulch can paradoxically facilitate the survival of pests and pathogens as well as weed compensation, which often forces the increased use of plant protection products.

Taking all this into account, it is necessary to be aware of the pros and cons of carbon farming techniques, which should be introduced in a reasonable manner, adapted to the currently prevailing soil and climate conditions, so as not to contribute to greater damage in the soil environment and a reduction in crop production. Despite these challenges, a holistic approach to carbon soil management currently constitutes one of the most important adaptation mechanisms. Suitably optimized agrocenoses cease to be passive recipients of climate stress and become a key buffer mitigating the effects of weather extremes, as well as an active tool in the global pursuit of climate neutrality.

Keywords: CO2 emission, ESG, sustainable agricultural practices

MICROBIAL DEGRADATION OF RICE RESIDUES BY SOIL-BORNE LIGNOCELLULOLYTIC BACTERIA AND THEIR EFFECTS ON RICE GROWTH

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ABSTRACT

This study aimed to develop environmentally friendly biofertilizer strategies by utilizing lignocellulosic residues generated after rice (Oryza sativa L.) harvest through microbial processes. Two isolates, Bacillus sp. S2 and Pseudomonas sp. K2, obtained from rice cultivation fields in Samsun and Kırklareli, were characterized for plant growth-promoting traits, including lignin and cellulose-degrading enzyme activities, phosphate and potassium solubilization, and nitrogen fixation potential. Molecular identification was performed using 16S rRNA alongside gyrB and rpoB gene regions, revealing that isolate S2 shared 98% similarity with Bacillus velezensis/Bacillus amyloliquefaciens species, while isolate K2 showed 97% similarity to Ectopseudomonas chengduensis, E. alcaliphila, and P. sihuiensis. Greenhouse experiments evaluated the effects of these isolates, applied together with rice straw, on various parameters including physiological plant traits (chlorophyll content, nitrogen balance index, soluble sugar, proline, protein), soil chemical (pH, electrical conductivity, macro-microelement concentrations), and biological properties (microbial biomass, β-glucosidase, and phosphatase enzyme activities). The results indicated that rice straw alone improved several parameters (e.g., chlorophyll content, shoot biomass, microelement concentrations) relative to the control, demonstrating its effectiveness as an organic matter source. Co-application with microbial isolates further enhanced some of these effects. Specifically, S2 contributed to increased soluble sugar levels, microbial biomass, enzyme activities, and iron uptake, while K2 improved iron bioavailability and other microelement contents. Reduced proline levels in microbial treatment groups suggested that plants were not under stress and that these isolates potentially support physiological growth. Limited differences observed between the straw-only and microbial treatment groups for some parameters may be related to the early vegetative stage when the analyses were performed. Overall, the combined use of rice straw and microbial isolates offers a synergistic and environmentally friendly approach that integrates waste recycling with microbial fertilization, representing a promising strategy for sustainable agriculture.

Keywords: Biofertilizer, Lignocelulolytic bacteria, Oryza sativa, Sustainable agriculture applications

ANTIFUNGAL ACTIVITY OF ACACIA TORTILIS LEAF AND BARK EXTRACTS AGAINST FUSARIUM OXYSPORUM F. SP. ALBEDINIS — CASE OF SOUTH-WESTERN ALGERIA

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ABSTRACT

Fusarium oxysporum f. sp. albedinis (FOA), the main cause of the Bayoud disease, is arguably the most devastating to date to palms in North Africa (Morocco and Algeria), with over 10 million palm trees destroyed within a century. Given the limitations of chemical and prophylactic control methods and the persistence of the fungus in the soil for several years, Bayoud seriously threatens food security, the oasis economy, and date palm grove biodiversity; plant extracts represent a promising and ecologically sustainable alternative. This study evaluates the Acacia tortilis's leaf and bark extracts' in vitro antifungal activity, obtained by three extraction methods (Soxhlet, reflux and maceration) and four solvents (methanol, ethyl acetate, dichloromethane and distilled water), against nine FOA strains isolated from date palm leaves. The results demonstrate that the methanolic leaf extract exhibits the highest inhibitory activity (up to 57.35% at 100 mg/ml), with a minimum inhibitory concentration (MIC) of 125 mg/ml and minimum fungicidal concentration (MFC) of 250 mg/ml. The MFC/MIC ratio ≤ 2 classifies these extracts as fungicidal. These results confirm the bioactive potential of A. tortilis for biocontrol of FOA and open prospects for development of natural biopesticides. Our results showed that methanolic maceration and reflux delivered the highest extraction yields (14.20% and 12.50% for leaves; 10.09% and 8.03% for bark, respectively). Both the methanolic and ethyl acetate extracts exhibited MIC values of 125 mg/ml and MFC values of 250 mg/ml, a MFC/MIC ratio of 2 — consistent with fungicidal rather than fungistatic activity. Taken together, promising a native bioresource for the development of plant-based antifungal agents within an integrated bayoud management strategy.

Keywords: Acacia tortilis, Fusarium oxysporum, antifungal activity, Bayoud, date palm, leaf, bark extracts, Algeria.

DEVELOPMENT OF AN ENVIRONMENTALLY SAFE DEFOLIATION TECHNOLOGY BASED ON PH-SENSITIVE DEFOLIANTS

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ABSTRACT

The application of defoliants in modern agriculture plays an important role in facilitating mechanized harvesting, reducing labor costs, and increasing production efficiency. However, conventional defoliants often exhibit high chemical activity and may persist in soil and water environments for extended periods, resulting in environmental contamination and adverse effects on non-target organisms. Therefore, the development of environmentally safe defoliation technologies has become a significant challenge in sustainable agriculture and green chemistry. This study aims to develop an environmentally safe defoliation technology based on pH-sensitive defoliants and to investigate the possibility of controlling defoliant activity according to environmental pH conditions. The proposed concept is based on the assumption that pH-sensitive systems can selectively activate defoliants in the naturally acidic microenvironment of plant leaf surfaces while maintaining low activity in soil and aquatic environments. Such selective activation may reduce the chemical burden on the environment and improve the ecological safety of defoliation practices. The research was conducted using a modeling approach to evaluate the pH-dependent behavior of a pH-sensitive system. Three model environments representing acidic (pH ≈ 5), neutral (pH ≈ 7), and alkaline (pH ≈ 8) conditions were prepared. The activity of the model system was assessed through indicator-based observations under different pH conditions. The results demonstrated that the highest activity was observed in the acidic environment, while significantly lower activity was recorded under neutral and alkaline conditions. These findings indicate a strong dependence of system activity on environmental pH. The obtained results confirm the feasibility of utilizing pH-sensitive systems for controlled defoliant activation. The proposed approach may contribute to reducing environmental pollution, protecting soil and water resources, and preserving beneficial microorganisms. Furthermore, it provides a scientific basis for the development of next-generation environmentally friendly defoliants and sustainable agricultural technologies. The study highlights the potential of pH-responsive systems as an effective strategy for improving the environmental safety and efficiency of defoliation processes.

Keywords: defoliants, pH-responsive defoliants, environmental safety, environment, controlled activity, sustainable agriculture.

MITOTIC ACTIVITY AND GERMINATION RESPONSES OF (CAPSICUM ANNUUM L). CULTIVARS UNDER DROUGHT STRESS CONDITIONS

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ABSTRACT

Drought stress is one of the most significant abiotic factors limiting plant growth, development, and productivity worldwide, particularly under changing climate conditions. With this objective, we used 15 Bulgarian pepper (Capsicum annuum L.) cultivars obtained from Maritsa Vegetable Crops Research Institute (MVCRI, Plovdiv, Bulgaria) and used for drought stress screening. All tested cultivars were grown in greenhouses located in the fields of MVCRI in 2025 under two irrigation regimes: 100% irrigation rate (non-stress, NS) and 50% irrigation rate (drought stress, DS). Drought stress treatment began at the onset of mass flowering and was maintained throughout the reproductive period. Each pepper cultivar (both NS and DS) was represented by three independent biological replicates. Pepper is a facultatively self-pollinating crop, which implies cross-pollination between individual genotypes. To preserve the phenotypic and genotypic purity of the studied genotypes, for gamete selection, and for the other tasks during the growing season in the phases of budding, flowering, and the beginning of fruiting of the flower buds of the plants, insulators will be placed several times, which will be previously made by hand. After the laces are shaped, they will be released and re-labelled with handmade labels. Pollen collection will also be manual. Mature fruits were harvested separately from each treatment, and seeds obtained from these fruits were used as seed material for subsequent analyses. To determine the effect of drought stress on these seeds, seed germination and mitotic index (MI) assays were performed independently for each biological replicate. The seeds from the NS and DS groups were surface-sterilized and germinated on moistened filter paper in controlled laboratory conditions for 15 days. The pepper roots were fixed in acetic-alcohol (1:3, v/v) and stored in 70% ethanol at +4 oC. According to the standard Feulgen technique, fixed root tips were hydrolyzed in 1 N HCI at 60 oC for 10 min and transferred to Schiff's reagent for 30 mins in the dark. Squash preparations were made in 2% aceto-orcein. The mitotic analysis included mitotic index (MI) and scoring of aberrant cells. In each cultivar containing three replicates of NS and DS groups, five well-spread preparations were chosen, and at least 2000 cells were scored. Root cell preparations were photographed with the Image Pro-Express software, assisted by an Evolution LC color camera and an Olympus BH-2 microscope. Our results revealed a decrease in seed germination across all DS applications, except for cultivar DS4. However, the resulting decline was statistically significant only in cultivars DS1, DS2, DS9, DS12, and DS15. Utilizing the Feulgen method, the mitotic index (MI) results were significantly reduced after DS. In addition to the decrease in MI among the DS groups, chromosomal aberrations, such as sticky metaphases, bridges, and lagging chromosomes, were frequently observed significantly in DS4, DS5, DS7, DS8, DS9, DS10, DS11, DS12, DS13, DS14, and DS15. The presence of C-mitosis (Chromosomes spread throughout the cell without forming a metaphase plate) was observed in both NS and DS groups. Based on our findings, drought stress has a negative impact on seed germination, MI, and chromosome abnormalities in Bulgarian pepper cultivars.

Keywords: chromosome abnormalities, drought stress, mitotic index, seed germination, pepper

ASSESSMENT OF IRRIGATION WATER SUPPLY DEFICIT AND GROUNDWATER DEPENDENCE UNDER MEDITERRANEAN CONDITIONS

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ABSTRACT

Water scarcity and increasing pressure on water resources represent major challenges for sustainable irrigated agriculture, particularly under Mediterranean conditions characterized by high evapotranspiration and irregular rainfall. This study aimed to assess crop water requirements and evaluate the adequacy of irrigation water supply within a Mediterranean irrigated area. Crop water requirements were estimated using the FAO-CROPWAT model based on climatic, soil, and crop data and were compared with water volumes delivered through the irrigation network. Under average climatic conditions, annual crop water requirements were estimated at 9,5 Hm^3 for an irrigated area of 2001 ha. The results showed a significant difference between crop water requirements and the water volumes supplied, particularly during periods of high demand, resulting in a persistent water deficit. As a result, groundwater has become an important additional source of irrigation water, increasing pressure on aquifer resources. Furthermore, the comparison between theoretical requirements and water volumes used showed important differences in irrigation practices. Total water use was estimated at 10.1 Hm^3, which was about 6% higher than crop water requirements. Water use was higher than crop water requirements for citrus and fruit trees, whereas vegetable crops showed a moderate water deficit. These differences can be explained by the absence of irrigation scheduling, limited knowledge of crop water requirements, and inadequate water management practices. The findings underline the need to improve irrigation planning, enhance water-use efficiency, and promote integrated water resources management to ensure sustainable irrigated agriculture under increasing water scarcity.

Keywords: Water Requirements, Irrigation, Network efficiency, CROPWAT, Sustainable water management

DIFFERENCES IN NODULE AND SHOOT DEVELOPMENT IN FORAGE PEA AND LENTIL ARE LINKED TO THE RHIZOBIAL GENOTYPE

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ABSTRACT

The interaction of legumes with nitrogen-fixing bacteria results in the development of root nodules, in which rhizobia provide fixed nitrogen to their host legumes; in return, rhizobia receive nutrients and energy produced by the plant. This study evaluates the variability of symbiotic efficiency on growth of two cultivars of pea and lentil inoculated with 16 different rhizobial genotypes originating from sub-humid and semi-arid regions of eastern Algeria. The genotypes being defined by the combination of haplotypes characterized by rRNA intergenic spacer (IGS) and a nodulation gene marker (nodD region). Analysis of shoots and nodules is an effective method to examine plants growth. The results revealed that efficiency is linked to the rhizobial genotype. Shoot development of forage pea and lentil was affected by rhizobial genotype. On average, the strains of genotype originating from sub-humid zones were more effective than the strains of genotype originating from the semi-arid zone for both tested plants. A statistically significant interaction between cultivar and rhizobial genotype was only found for nodule number, size and biomass in forage pea. A low number of large sized nodules and high biomass of shoot characterized pea plants inoculated by rhizobial genotypes originating from sub-humid zones. The formation of nodules and nitrogen fixation are energy-consuming processes, where by legumes develop a minimal necessary number of nodules for an optimal growth. In conclusion, the inoculation of plants cultivated in a semi-arid soil with effective strains from a sub humid origin might be more beneficial under severe environmental.

Keywords: Rhizobial genotype, Pisum sativum, Lens culinaris, nodule development, shoot development.

FARM-LEVEL ECONOMIC AND ENVIRONMENTAL BENEFITS OF FURCELLARIA LUMBRICALIS DIGESTATE BIOSTIMULANT: A 1,000 HA SCENARIO IN THE BALTIC SEA REGION

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ABSTRACT

Marine macroalgae of the Baltic Sea, particularly Furcellaria lumbricalis, represent a strategically underutilized biological resource with demonstrated potential for bioeconomy product development. This study quantitatively assesses the farm-level agronomic, economic, and environmental benefits of a Furcellaria lumbricalis digestate-based biostimulant within a 1,000 ha crop production scenario in the extended Baltic Sea region. The research methodology integrates three evidence layers: (1) laboratory vegetation experiments with Furcellaria lumbricalis digestate as biostimulant (basil and radish cultures); (2) international meta-analyses on biostimulant efficacy and (3) a synthetic 1,000 ha farm-level scenario model parameterised on meta-analytic mean values and author's calculations. Results demonstrate a triple-win effect: a 17.9% yield increase (895 t additional production per 1,000 ha), a 15% reduction in mineral fertiliser costs (savings of EUR 45,000 per 1,000 ha), and a 25% reduction in nitrogen losses (from 30 to 22.5 kg N/ha), generating a combined annual economic benefit of EUR 224,000 per 1,000 ha farm. Laboratory experiments confirm that a 3% digestate concentration significantly enhanced plant biomass by 52.7–85.4% compared to control, while 75% of the standard nitrogen dose with biostimulant addition maintained yield at the level of full mineral fertilisation. Scenario extrapolation to the Baltic Sea region Cluster III countries (Latvia, Lithuania, Estonia, Poland) indicates indicative cumulative benefits of EUR 440–880 million per year at 5–10% arable land coverage. These results position Furcellaria lumbricalis biostimulant as a viable tool for sustainable intensification aligned with EU Farm to Fork and Baltic Sea eutrophication reduction objectives.

Keywords: Furcellaria lumbricalis, marine biostimulant, Baltic Sea bioeconomy, 1,000 ha farm scenario, nitrogen losses, sustainable intensification, Farm to Fork

IDENTIFICATION OF MACROSIPHUM ROSAE IN ROSA SPP, SHRUBS, IN THE TIRANA AREA, ALBANIA

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ABSTRACT

Roses are considered one of the most sought-after plants worldwide. They have high vitamin C content and are widely used for juices, jams, and syrups. In addition, they are also used as ornamental plants for decorating natural environments and indoor spaces such as homesand offices. Roses have also found favorable conditions for growth and cultivation in Albania. The city of Albania that carries the scent of roses is Permeti. Roses are susceptible to various pests and diseases that may affect their health and aesthetic appearance. Among the pests that attack roses especially at the beginning of spring, the most hazardous are aphids. The rose aphid, Macrosiphum rosae, is one of the most important pests of roses worldwide and causes economic damage. The aim of this study was to identify this pest in our country. The study was conducted during 2025, from early March to late October, in the Botanical Garden of the Agricultural University of Tirana. For aphid identification, field observations were carried out; specimens were prepared as fixed slide-mounted preparations and compared with taxonomic keys and standard descriptions. The species collected in the Botanical Garden corresponded to the description of Macrosiphum rosae. This study confirmed the presence of this aphid in our country and its role in causing significant damage to rose shrubs.

Keywords: Roses, Macrosiphum rosae, aphids, identification, taxonomic key, microscope, pest

POPULATION DYNAMICS OF THE POTATO TUBER MOTH (PHTHORIMAEA OPERCULELLA) IN THE DIVJAKË REGION, ALBANIA

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ABSTRACT

Potato (Solanum tuberosum L.) is one of the most economically important agricultural crops in Albania. Among its major insect pests, the potato tuber moth, Phthorimaea operculella (Zeller, 1873), causes significant yield losses both in the field and during storage. The aim of this study was to evaluate the seasonal population dynamics of this pest under the agroecological conditions of the Divjakë region, one of the main potato-producing areas in Albania.The study was conducted from March to October 2025 in a 1-ha potato field planted with the Arizona cultivar. Population dynamics were monitored using two Delta Econex pheromone traps, and moth captures were recorded periodically throughout the growing season.The results showed that adult activity began in April, with low capture levels below the economic threshold. During the first potato production cycle (March–June), the pest population remained at low levels. The first generation was completed at the end of June in the epigeal part of the host plant. This infestation had no impact on the yield. A marked increase in moth captures was observed during July, August, and September, coinciding with temperatures ranging from 33 to 38°C and the development of successive generations. High temperatures and low humidity favored rapid reproduction, resulting in a significant increase in population density. A gradual decline in captures was recorded from late September through October, corresponding to decreasing temperatures and the end of the cropping cycle. The findings indicate that early potato production is exposed to a relatively low risk of infestation by P. operculella, whereas the second production cycle is considerably more vulnerable due to the accumulation of successive generations and favorable climatic conditions. Continuous monitoring using pheromone traps is an effective tool for predicting population fluctuations and supports.

Keywords: Potato, (Phthorimaea operculella), monitoring, population, management.

COMPARATIVE EVALUATION OF DROUGHT TOLERANCE IN DIVERSE TRITICUM SPECIES USING THERMAL RETENTION, MEMBRANE STABILITY, AND STRESS INDICES

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ABSTRACT

The identification of drought-tolerant germplasm is essential for developing climate-resilient wheat cultivars. This study aimed to compare drought tolerance among diverse Triticum species and breeding materials using thermal retention indices derived from UAV-based thermal imaging, membrane damage measurements, and stress tolerance indices. A total of 96 genotypes representing eight wheat groups, including durum landraces, durum breeding lines, Polish wheat, Khorasan wheat, tetraploid check cultivars, bread wheat landraces, Indian dwarf wheat, and hexaploid check cultivars, were evaluated under well-watered and water-deficit conditions. Thermal images acquired by an unmanned aerial vehicle were processed in Pix4D to calculate thermal energy retention (TE Retention) indices at both tillering (TL) and heading (HD) stages. Cell membrane stability was assessed as membrane damage at the same growth stages using electrolyte leakage measurements. Grain yield obtained under irrigated and drought conditions was subsequently used to calculate four complementary drought indices, namely Relative Efficiency Index (REI), Stress Non-Stress Production Index (SNPI), Modified Stress Tolerance Index 1 (K1STI), and Modified Stress Tolerance Index 2 (K2STI). Principal component analysis (PCA) was performed separately for tetraploid and hexaploid materials to examine relationships among physiological and stress-related variables. Considerable variation was observed both among and within wheat groups for all evaluated traits. Membrane damage generally increased under drought conditions, although the magnitude of the response varied substantially among genotypes. Thermal retention indices also exhibited broad variation, indicating differences in canopy thermal behavior and energy conservation under water deficit. The distribution of stress indices revealed distinct response patterns among wheat groups. Durum breeding lines generally displayed higher SNPI values and broader variation than the other tetraploid groups, whereas bread wheat landraces exhibited the greatest variability for the modified stress tolerance indices. In contrast, check cultivars tended to show narrower distributions, reflecting more stable responses across the evaluated indices. PCA effectively separated genotypes according to their physiological responses and stress index profiles. In tetraploid materials, membrane damage, thermal retention, and stress indices contributed strongly to genotype discrimination, while several durum breeding lines and Khorasan wheat genotypes exhibited favorable associations with REI, K1STI, and K2STI. In contrast, Polish wheat and certain durum landraces showed greater variability. Among hexaploid materials, bread wheat landraces displayed wider dispersion than Indian dwarf wheat and check cultivars, suggesting greater diversity in drought response. Several landraces combined relatively high thermal retention with favorable stress index values, whereas others were characterized by increased membrane damage and lower drought adaptation.

These findings demonstrate that integrating UAV-derived thermal traits with membrane stability measurements and complementary stress indices provides a rapid and informative approach for discriminating drought responses among genetically diverse wheat materials. The combined use of these physiological and agronomic indicators offers a practical approach for early-stage drought screening and the identification of promising germplasm for wheat improvement programs.

Keywords: drought tolerance, UAV thermal imaging, membrane stability, stress indices, Triticum spp.

COMPARATIVE EVALUATION OF SOYBEAN MEAL AND RAPESEED MEAL IN DIETS FOR GROWING WESTERN THIN-TAILED LAMBS

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ABSTRACT

This study was conducted to evaluate the effects of replacing soybean meal with rapeseed meal on the growth performance, body development, and ruminal fermentation characteristics of growing Western Thin-Tailed (Queue Fine de l'Ouest) lambs. Twenty-four lambs (12 males and 12 females), aged 4–5 months and with an average initial body weight of 13.15 kg, were randomly assigned to one of two homogeneous dietary treatments. The control group (C5) received a concentrate based on triticale, soybean meal, and a vitamin–mineral premix (VMP), whereas the experimental group (C6) received a concentrate in which soybean meal was completely replaced by rapeseed meal. Hay and water were provided ad libitum throughout the 64-day experimental period. Chemical analysis showed that the C6 diet contained higher concentrations of neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), and ash, but a lower ether extract content than the C5 diet. Lambs fed the control diet consumed significantly more feed than those receiving the rapeseed meal diet (70.90 vs. 65.96 kg; $P < 0.05$). However, dietary treatment had no significant effect on growth performance. Final body weight, average daily gain (176.8 vs. 163.4 g/day; $P > 0.05$), and feed conversion ratio (5.57 vs. 5.54) were comparable between the two groups. Sex was the primary source of variation, with males exhibiting significantly greater feed intake, body weight, and average daily gain than females. Body condition score improved in both groups, with a slightly higher final score in lambs fed the control diet (2.60 vs. 2.27). Scrotal circumference increased progressively throughout the trial in both dietary groups, with no significant differences between treatments. Similarly, ruminal fermentation parameters, including pH and ammonia concentration, were unaffected by either diet or sex. These results indicate that rapeseed meal can successfully replace soybean meal in diets for growing lambs without compromising growth performance, feed efficiency, body development, or ruminal fermentation. The use of rapeseed meal therefore represents a viable, locally available, and economically attractive protein source that could reduce reliance on imported soybean meal and enhance the sustainability of sheep production systems.

Keywords: lambs, rapeseed meal, soybean meal, intake, growth, feed conversion ratio, fermentation

EVALUATION OF THE PHYSICOCHEMICAL PROPETIES OF AGRICULTURAL IRRIGATION WATER: CASE OF BOUKERDANE DAM IN ALGERIA

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ABSTRACT

Irrigation is a key element that directly influences crop productivity. Similarly, the quality of the water used could also affect soil and crops. Consequently, this study aims to characterize the physico-chemical properties of water from the Boukerdane dam (Northern Algeria) used for irrigation. Samples were collected at different times of the year: from April to December 2025. The analysis suite was determined with parameters such as pH, electrical conductivity, dissolved oxygen concentration, and essential nutrient levels. The main seasonal variations in these parameters were examined using time series analysis. For example, water temperature rose sharply from April (18.58 °C) to July (30.22 °C), then fell to its lowest point in December (12.48 °C). This trend should be seriously considered by managers, given that this is the likely hydraulic storage point for irrigation water. In addition, conductivity and total dissolved solids levels tend to increase over time. This is a good indication that water ion concentration should be monitored to ensure that it does not exceed a level that is dangerous for crop growth. These results underline the importance of regular monitoring of the physico-chemical properties of irrigation water for sustainable agricultural management. The research will provide a basis for future predictions and the mechanisms by which political decisions influence water management in the future.

Keywords: Physical-chemical properties, Irrigation water, Boukerdane dam, Algeria.

EFFECTS OF NITROGEN AND PHOSPHORUS FERTILIZERS ON SEED YIELD AND MULTIVARIATE QUALITY TRAITS OF GUAR (CYAMOPSIS TETRAGONOLOBA (L.) TAUB.)

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ABSTRACT

Rising temperatures and irregular rainfall in Mediterranean cropping systems increase the need for drought-tolerant legumes that combine stable yield with high nutritional quality. Guar (Cyamopsis tetragonoloba (L.) Taub.) is a promising low-water-demand legume with biological nitrogen fixation capacity. This study evaluated the effects of nitrogen (N) and phosphorus (P) fertilization on seed yield and integrated seed quality traits of guar under Mediterranean transitional conditions in northwestern Türkiye. A factorial randomized complete block design with three N levels (0, 30, and 60 kg ha-1) and five P levels (0, 30, 60, 90, and 120 kg ha-1) was conducted under field conditions. Seed yield, thousand-seed weight, crude protein, seed oil, fiber fractions (NDF, ADF, and ADL), dry matter digestibility (DMD), and organic matter digestibility (OMD) were determined. Principal component analysis (PCA) was used to examine multivariate relationships among quality traits. Seed yield ranged from 594.8 to 1684.5 kg ha-1, with the highest value obtained at 30 kg N ha-1 and 120 kg P ha-1. Crude protein ranged from 23.48% to 30.59%, reaching its maximum at 60 kg N ha-1 and 120 kg P ha-1. The highest digestibility values (DMD: 71.49%; OMD: 70.59%) were recorded at 30 kg N ha-1 and 90 kg P ha-1. The first two PCA components explained 83.8% of total variation and separated protein and digestibility traits from structural fiber components. Overall, 30-60 kg N ha-1 combined with 90-120 kg P ha-1 can be recommended to optimize both seed yield and nutritional quality of guar in water-limited Mediterranean production systems.

Keywords: Guar, seed yield, seed quality, digestibility, nitrogen fertilization, phosphorus fertilization, Mediterranean conditions

FIRST REPORT OF MYCOSPHAERELLA CITRI, THE CAUSAL AGENT OF CITRUS GREASY SPOT IN GEORGIA

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ABSTRACT

Commercial citrus cultivation in Georgia began in the early nineteenth century. The oldest citrus-growing region is the Black Sea coastal zone, particularly the Adjara–Guria region, where mandarins, oranges, lemons, grapefruits, and other citrus species have traditionally been cultivated under open-field conditions. According to FAOSTAT, Georgia ranks 30th among the world's citrus-producing countries and annually produces approximately 60,000–80,000 tons of citrus fruits. However, the country's geographical location, its role as a major Eurasian transport corridor, and the impacts of climate change have increased the risk of introducing new plant pathogens, thereby negatively affecting the phytosanitary status of citrus orchards. Newly introduced invasive pathogens readily adapt to the humid subtropical climate of the Black Sea region, leading to reduced yields, deterioration of fruit quality, and, in severe cases, tree decline or death. To evaluate the phytosanitary status of citrus orchards, systematic monitoring has been conducted considering orchard age, altitude above sea level, crop phenological stage, periods favorable for disease development, agronomic practices, and other environmental factors. Long-term monitoring has shown that citrus plantations in the Adjara–Guria region are characterized by a high incidence and severity of scab, melanose, anthracnose, alternaria, fusarium, and phytophthora diseases. During surveys conducted between 2023 and 2025, symptoms of citrus greasy spot were observed for the first time in Georgia. These symptoms had not been detected during previous monitoring programs. Initial symptoms consisted of small, pale-yellow lesions associated with slightly raised blisters on the abaxial surface of leaves. As the disease progressed, dark brown to black oily lesions developed at these sites, becoming increasingly conspicuous and glossy on the upper leaf surface. The tissue surrounding the lesions remained green for an extended period before the affected leaves gradually turned yellow and prematurely abscised. Greasy spot symptoms were recorded at the following locations:
Kobuleti Municipality:
Alambari - 60 m a.s.l., on mandarin and grapefruit (N41°43′16″-E41°57′18″);
Achkvistavi - 186 m a.s.l., on mandarin (N41°52′53″-E41°52′21″);
Chakvi - 26 m a.s.l., on mandarin, lemon, and orange (N41°50′59″-E41°53′52″).
Khelvachauri Municipality:
Makho - 120 m a.s.l., on mandarin and lemon (N41°55′48″-E41°56′44″);
Gonio - 32 m a.s.l., on mandarin, orange and grapefruit (N41°56′01″-E41°57′22″).
Chokhatauri Municipality:
Sameba - 210 m a.s.l., on lemon and grapefruit (N42°48′18″-E42°14′14″);
Bukistsikhe — 206 m a.s.l., on mandarin (N42°00′59″–E41°20′58″).

The pathogen was successfully isolated from symptomatic leaves under laboratory conditions on PDA. Morphological examination confirmed, for the first time in Georgia, that citrus greasy spot is caused by Mycosphaerella citri Whiteside, whose anamorphic stage is Stenella citri-grisea (F.E. Fisher) Sivanesan (syn. Cercospora citri-grisea Fisher). The present study documents the first occurrence of citrus greasy spot in Georgia and highlights the increasing risk of the introduction and establishment of invasive fungal pathogens in citrus-growing regions. These findings emphasize the importance of continuous phytosanitary monitoring, early disease diagnosis, accurate pathogen identification, and the implementation of integrated disease management strategies to minimize the economic and ecological impacts of emerging citrus diseases.

Keywords: Phytosanitary Monitoring, Greasy Spot, Mycosphaerella citri, Invasive Pathogen.

GENOME-BASED IDENTIFICATION AND BIOCONTROL POTENTIAL OF PSEUDOMONAS PROTEGENS GEOFBI_PSPRTG_001 AGAINST ECONOMICALLY IMPORTANT PLANT PATHOGENS

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ABSTRACT

Plant diseases caused by fungal and bacterial pathogens continue to threaten sustainable agricultural production worldwide. Biological control using rhizosphere-associated bacteria represents an environmentally friendly alternative to chemical pesticides. Among these beneficial microorganisms, Pseudomonas protegens is recognized for its broad-spectrum antimicrobial activity and plant growth-promoting properties. Rhizosphere soil samples collected from different regions of Georgia were screened for antagonistic bacteria. The isolates were evaluated in vitro against economically important phytopathogens, including Alternaria alternata, Fusarium oxysporum, Colletotrichum gloeosporioides, Ralstonia solanacearum. The most active isolate was characterized by morphological and biochemical methods and identified by whole-genome sequencing (NGS). Dual-culture assays demonstrated that the selected isolate significantly inhibited the growth of all tested fungal pathogens. Distinct inhibition zones developed between the bacterial colony and fungal mycelia, accompanied by reduced mycelial growth, sporulation, and spore germination. Microscopic examination revealed marked inhibition of conidial germination and abnormal germ tube development, indicating the production of potent antifungal metabolites. The isolate exhibited strong antibacterial activity against R. solanacearum, as demonstrated by a distinct inhibition zone of 22.0 ± 0.9 mm in diameter. Whole-genome sequencing identified the isolate as Pseudomonas protegens GEOFBI_PsPrtg_001 (NCBI BioSample accession: SAMN54096872). The observed broad-spectrum antagonistic activity is consistent with P. protegens' genomic potential to synthesize multiple antimicrobial secondary metabolites associated with biological control. These findings demonstrate that P. protegens GEOFBI_PsPrtg_001 is a promising biocontrol agent for

sustainable crop protection. Its genome sequence provides a valuable resource for elucidating antimicrobial mechanisms and supports the future development of microbial biopesticides.

Acknowledgments: This research was supported by the Shota Rustaveli National Science Foundation (SNSF) of Georgia [grant №FR-25-7228].

Keywords: Pseudomonas protegens, biological control, whole-genome sequencing, plant pathogens, sustainable agriculture.

SPATIAL DISTRIBUTION OF FLAT-HEADED BORER, SPHENOPTERA SERVISTANA OBENBERGER,1929 IN SOME FRUIT TREES IN THE ORCHARDS OF CENTRAL IRAQI

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ABSTRACT

Flat-headed tree borer, *Sphenoptera servistana* Obenberger, 1929 ([Coleoptera; Buprestidae]) is an important wood-boring pest that threatens stone fruit tree species in many countries of the world, including Iraq. Borer eggs are oval and white. The larvae have an enlarged prothorax that gives a flat-headed appearance and are creamy in color; the pupae are creamy white in color; the adult beetles are bright metallic in color and are flattened in lateral profile. Field Surveys were conducted during 2023- 2024 to explore the spatial distribution of Flat-Headed Borer (FHB), *Sphenoptera servistana* through the entrance holes of newly hatched larvae (a small circular hole) and the exit hole of adults (a D- shaped hole) in Blood Plum (cherry-plum), apricot trees, Apple and Citrus, this is according to their distribution on the stems and branches of trees. The results indicated that the spatial distribution of FHB *S. servistana* on apricot trees was: 23, 12, 10, 9, 6, 6, and 2 eggs per 10 cm of stem or branch in the middle third of the tree, the junction of two branches, the side facing the sun's rays, a middle-aged branch, an old branch, the side opposite the sun's rays, and the lower third of the tree, respectively, compared with 32, 21, 16, 15,9,8, 9, 8, and 4 in Blood plum trees. Also, the results indicated that the average number of FAB larval entry holes per 1 meter of the stem of a medium-aged apricot tree (moderate infestation) is 12 holes (Some larval entry holes cannot be detected due to cracks on the tree stems). The average number of FAB adult exit holes per 1 meter of the stem in a medium-aged apricot tree (moderate infestation) is 46 holes. The average number of adult tree borer exit holes per 1 meter on a mature Blood plum tree (with severe infestation) is 114 holes, compared with 23 larval entry holes. However, there are no entry or exit holes in the stems of apple and citrus trees. The parts of the tree most susceptible to infestation by FAB borers: The basal part of the infected tree's trunk, located at ground level; the point where two branches of the tree junction; the side of the tree trunk most exposed to the sun, as it is a vulnerable area; trees in open and sparse places; stems and branches of trees that are cracked and wounded; and the insect prefers middle-aged branches to lay eggs. This field survey is extremely important for diagnosing the level of FAB infestation and identifying its entry and exit points on tree stems to determine an effective control method.

Keywords: Flat-Headed borer, Sphenoptera servistana, Spatial distribution, apricot and Blood plum orchards, Iraq

CLIMATE-DRIVEN SHIFTS IN THE SEASONAL DEVELOPMENT AND POPULATION DYNAMICS OF CYDIA POMONELLA IN SOUTHERN BULGARIA

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ABSTRACT

Climate variability increasingly affects the development, phenology, and population dynamics of major insect pests in temperate fruit-growing regions. This study investigates climate-driven changes in the seasonal development of the codling moth (Cydia pomonella L.), the most economically important apple pest, in Southern Bulgaria over a five-year period (2021–2025). Detailed climate records, including mean daily temperatures, temperature extremes, rainfall, and accumulated growing degree days (GDD), were analyzed together with long-term monitoring data on adult flight activity and population intensity. The results reveal a consistent shift of the biofix towards earlier dates, accompanied by a marked increase in accumulated heat units and a higher likelihood of additional generations under warmer conditions. Temperature anomalies were strongly correlated with peak flight intensity, indicating accelerated pest development in years with elevated thermal accumulation. Warmer springs and extended summer periods contributed to earlier emergence, prolonged flight activity, and increased population pressure. These findings demonstrate that ongoing climatic changes are reshaping the population dynamics of C. pomonella, creating new challenges for pest management in apple orchards. The study highlights the importance of integrating climate-responsive monitoring tools, adjusting treatment thresholds, and refining degree-day models to improve the timing and effectiveness of control measures. Understanding the relationship between climatic trends and pest development is essential for developing adaptive integrated pest management strategies that ensure sustainable apple production under changing environmental conditions.

Keywords: Cydia pomonella, climate change, degree-days, population dynamics, apple orchards, phenology, integrated pest management

PHENOLOGICAL RESPONSES OF APPLE CULTIVARS TO CHANGING CLIMATIC CONDITIONS IN SOUTH-CENTRAL BULGARIA

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ABSTRACT

Apple phenology is highly sensitive to climatic variability and shifts in the timing and duration of key developmental stages may significantly influence fruit production, quality, and orchard management. Understanding how different cultivars respond to changing environmental conditions is essential for optimizing orchard practices and ensuring stable yields. This study investigates the phenological responses of five commercially important apple cultivars (Braeburn, Jonagold, Fuji, Chadel, and Florina) grown in South-Central Bulgaria over a three-year period (2023–2025). Phenological observations were conducted using the BBCH scale (51–87), covering bud development, flowering, fruit set, fruit growth, and harvest maturity. Each cultivar was monitored at regular intervals to capture the progression of critical phenophases and to quantify interannual variability. Climate data for the same period, including mean daily temperatures, temperature extremes, rainfall, and accumulated growing degree days (GDD), were analyzed to assess their impact on cultivar specific phenological patterns. The integration of phenological and climatic datasets allowed for the identification of key drivers influencing the onset and duration of developmental stages. The results reveal a consistent trend toward earlier onset of spring phenophases, particularly budburst and flowering, across all cultivars. Several developmental stages were shorter, suggesting accelerated physiological processes under warmer conditions. The results underscore the importance of cultivar selection and adaptive orchard management strategies under ongoing climate change conditions. Improved understanding of cultivar specific responses provides valuable insights for optimizing pruning schedules, thinning practices, irrigation planning, and harvest timing. The study contributes to regional knowledge on climate driven phenological dynamics and supports the development of resilient apple production systems in South-Central Bulgaria.

Keywords: apple phenology, BBCH scale, climate change, degree-day, cultivar differences, flowering time, fruit development, South-Central Bulgaria

MELATONIN AS A PROTECTANT AGAINST SALT AND DROUGHT STRESS: PRESERVATION OF ION BALANCE AND MEMBRANE INTEGRITY

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ABSTRACT

Global climate change poses a significant threat to agricultural production and food security, particularly by increasing the frequency and severity of abiotic stress factors such as salt and drought. These stress conditions lead to osmotic imbalance, ion toxicity (especially Na^+/K^+ imbalance), excessive reactive oxygen species (ROS) production, and disruption of cell membrane integrity in plants, resulting in growth and yield losses. Melatonin, a critical plant hormone, stands out in the fight against these negative effects due to its strong antioxidant properties and regulatory roles in stress response mechanisms. Melatonin improves essential physiological processes such as seed germination, photosynthesis, and carbon fixation, as well as enhancing stress tolerance by promoting the accumulation of osmolytes, sugars, and other endogenous hormones (auxins, gibberellic acid, and cytokinins). Furthermore, it enhances the activity of enzymatic and non-enzymatic antioxidant systems, enabling effective ROS clearance and regulating the expression of stress-responsive genes. Studies show that melatonin plays a significant role in maintaining Na^+/K^+ ion homeostasis, preserving cell membrane integrity, reducing lipid peroxidation, improving photosynthetic performance, and maintaining plant water balance under salt and drought stress. It also plays important roles in the regulation of stress-related genes and phytohormone signaling networks. These multifaceted effects of melatonin make it stand out as an environmentally friendly biostimulant in sustainable agricultural practices and a promising approach to enhancing stress tolerance against the negative impacts of climate change. A deeper understanding of melatonin's protective mechanisms on ion balance and membrane integrity will pave the way for innovative approaches to improving stress tolerance.

Keywords: melatonin, salt stress, drought stress, ion homeostasis, membrane integrity, antioxidant defense.

ADVANCES IN SEED COATING TECHNOLOGIES FOR VEGETABLE CROPS

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ABSTRACT

Vegetable crop production relies on rapid, uniform, and vigorous seed germination to ensure successful crop establishment and high productivity. However, vegetable seeds often exhibit poor emergence, low vigor, irregular germination, and increased susceptibility to biotic and abiotic stresses, limiting stand establishment and yield potential. Seed coating technology has emerged as an effective pre-sowing seed enhancement strategy that improves seed performance by delivering protective and bioactive compounds directly to the seed surface. In addition to facilitating seed handling and precision sowing, modern coating systems function as carriers for fungicides, insecticides, micronutrients, plant growth regulators, biostimulants, beneficial microorganisms, and nanomaterials, thereby promoting germination, seedling vigor, and stress resilience. Recent advances in biodegradable polymers, bio-based coating materials, and controlled-release formulations have further strengthened the role of seed coatings in sustainable vegetable production. This review summarizes recent developments in seed coating technologies, with particular emphasis on the principal coating approaches, including film coating, encrusting, pelleting, and priming-plus-coating, and their applications in economically important vegetable crops such as tomato, pepper, brassicas, onion, carrot, and lettuce. The effects of coating materials and functional additives on germination, seedling establishment, stress tolerance, disease suppression, and crop productivity are critically discussed. Finally, current challenges, emerging innovations, and future research directions for the development of environmentally friendly and high-performance seed coating systems are highlighted to support sustainable and climate-resilient vegetable production.

Keywords: seed coating, vegetable seeds, film coating, pelleting, biostimulants, sustainable agriculture, seed enhancement

INFLUENCE OF REMOVING THE OUTER SCALES OF THE CORM ON THE DEVELOPMENT AND PRODUCTIVITY OF GLADIOLI

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ABSTRACT

Gladiolus are one of the main flower crops used both for cut flowers. They are growing through corms. This also determined the scope of the study. The main goal of this article is to study the influence of removing the outer scales of the corm on the growth performance of different varieties of gladioli. The experiments were conducted with three varieties of gladiolus: Amsterdam, Oasis and Fado. The corms scales were removed immediately before planting. Whole unpeeled corms, planted at the same time and scheme, were used as controls. Planting was carried out during the period 25. 03. -5.04. 2023-2025 according to the 15 x 15 cm scheme. The phenological development of plants was observed - beginning and mass emergence, formation of the first leaves, appearance of the flower stalks, beginning and end of flowering. In the full flowering phase, biometric studies were carried out – flower stalk height, number of leaves, leaf length, fresh and dry weight of leaves, leaf area, number of flowers, length and diameter of the average flower. It was found that plants from peeled corms developed more dormant buds. These plants formed more leaves, with a larger area and weight. No changes in the height of the flower stalks were observed. Phenological development was close between the two methods of cultivation. Peeling of the corms in most plants caused the formation of a larger number of flower stalks, which led to a larger total number of flowers. The Fado variety emerged with the highest decorative value.

Keywords: corm, gladiolus, vegetative mass, flower, phenology

EFFECT OF FERTILIZATION REGIME AND UMBEL ORDERS ON HETEROBLASTY OF CARROT SEEDS

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ABSTRACT

The long flowering period in carrots, starting with the flowers from the king umbel and continuing with those from the umbels on the branches of the I, II and III order, leads to the formation and maturation of seeds at different stages of the development of the mother plant. This determines the different quality of the seeds, as well as the presence of heteroblastyt in the resulting seed production. The main objective of the present study is to investigate the influence of the nitrien regime and the order of the umbels on the quality of the seeds in carrots. Three levels of NPK were studied, as follows: N – 0, 50, 70, 90 kg.ha-1, P – 0, 90, 140, 190 kg.ha-1 and K – 0, 100, 150, 200 kg.ha-1, applied once and twice. The share of individual umbels in the formation of the total seed yield, the linear dimensions of the seeds - length, width and thickness, mass of 1000 seeds, the quality of the seeds by determining the germination energy, germination, speed and germination, as well as the morphological features of the seedlings - length of the embryo root and hypocotyl, and fresh and dry mass of the seedlings were determined. The different nutrient regime affects the quality of the seeds and the morphological parameters of the seedlings in carrots, helping to reduce the quality difference.

Keywords: Daucus carrota L., heteroblasty, germination, seed, vigour, yield

INTEGRATIVE REMOTE SENSING AND MULTISCALE IMAGERY FOR CLIMATE-NEUTRAL AND RESILIENT AGRICULTURE: THE AGROCLIN EARTH-OBSERVATION SERVICE FRAMEWORK

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ABSTRACT

Climate change is intensifying drought, water stress and soil degradation across Romanian agriculture, undermining productivity and the sector's transition towards climate neutrality. AgroCliN - the Excellence Research Centre Fostering Climate Neutrality and Resilience through Agriculture (2026–2030), coordinated by USAMVB with five partner institutions — addresses this challenge through interdisciplinary research. This contribution presents the design of Work Package 5 (WP5), which develops an integrative Earth Observation (EO) service framework combining multiscale imagery with in-situ and ex-situ data to support precision, climate-resilient farming. WP5 pursues three objectives: (i) using EO technologies to monitor crop health and optimise water use, enhancing resilience to climate change; (ii) integrating IoT-sensor networks and EO for precision agriculture; and (iii) developing the AgroCliN data-driven platform for integrated data access and decision support. The methodology spans six interconnected tasks. Crop phenology, water management and drought monitoring rely on Sentinel-1 SAR, Sentinel-2 optical and Unmanned Aerial System data through spectral vegetation indices and crop-growth models. Precision nitrogen management integrates Sentinel-2, EnMAP and PRISMA hyperspectral, and Pleiades Neo very-high-resolution (VHR) imagery to derive Nitrogen Nutrition Index estimates. Soil organic carbon (SOC) is estimated from multispectral, hyperspectral and radar time series using spectral indices, refined with VHR and hyperspectral UAS imagery. Early detection of crop diseases and pests exploits Spectral Disease Indices and crop-specific indices derived from multi-season UAS hyperspectral data. Crop yield estimation merges classified EO products with in-situ field measurements through geospatial and machine-learning modelling. All EO-based products feed a Decision Support System embedded in the AgroCliN platform, designed with user-centred interfaces and clear visualisations to empower farmers. The framework will be developed and validated at two experimental pilot sites where EO-derived products are cross-checked against continuous IoT soil and weather monitoring and laboratory analyses of crop, soil and water samples. Machine-learning algorithms progressively integrate outcomes across tasks to improve estimation accuracy. By translating heterogeneous multiscale observations into actionable agronomic services, WP5 is expected to deliver validated tools for water, nitrogen, carbon, phytosanitary and yield management, contributing to reduced agricultural inputs, enhanced soil carbon sequestration and the broader transition of Romanian agriculture towards climate neutrality and resilience. This work outlines the scientific approach, data architecture and expected contributions of the WP5 EO service framework in its first operational phase.

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Keywords: remote sensing, precision agriculture, Earth Observation, climate-neutral agriculture

SOLUBILIZATION OF INSOLUBLE ZINC COMPOUNDS BY NEWLY ISOLATED RHIZOBACTERIA AND OPTIMIZATION OF SOLUBILIZATION EFFICACY

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ABSTRACT

Due to the limited availability of plants in accessible, soluble forms of zinc (Zn), it is often in short supply in agricultural soils, despite being an essential element for optimal plant growth. Therefore, the main objective of this study was to isolate and identify a highly efficient Zn-solubilizing bacterial strain from the rhizosphere of Hydrangea macrophylla and to assess its capacity to solubilize insoluble Zn compounds (ZnO and ZnCO3). Using plate assay methods, three of the seven bacterial isolates that were recovered showed the capacity to solubilize inorganic Zn compounds. An inductively coupled plasma–optical emission spectrometer (ICP–OES) was used to quantify the Zn-solubilizing capacity of the most potent bacterial strain (AEYTU11) that was chosen based on its qualitative characteristics in broth culture. 16S rRNA gene amplification and sequence analysis were used to identify the bacterial isolate with a high capacity to solubilize Zn. Both insoluble Zn compounds were successfully solubilized by the AEYTU11 strain, although ZnO was more successfully solubilized than ZnCO3. A positive connection was found between Zn solubilization and a decrease in the pH of the culture medium. However, process parameters have a major impact on the in-vitro solubilization capability of microorganisms, highlighting the significance of optimizing the culture conditions. The effects of 17 different combinations of pH, incubation duration, and insoluble Zn compound levels on AEYTU11 strain-mediated Zn release from ZnCO3 were modelled using a Box-Behnken design (BBD) experiment. The AEYTU11 strain's solubilization efficiency rose by around 70% after process optimization. The optimization results demonstrate the usefulness of statistical optimization techniques for enhancing the development of biofertilizers and optimizing microbial Zn-solubilizing activity.

Acknowledgement: This work has received funding support from the European Union's Horizon Europe research and innovation program under the Marie Skłodowska Curie Grant Agreement No. 101126655, and the Scientific and Technological Research Council of Turkiye under the scope of Agreement No. 123C459.

Keywords: Zn-solubilizing bacteria, Zn-solubilization, Optimization, Box–Behnken design

INFLUENCE OF QUINCE ROOTSTOCKS ON VEGETATIVE GROWTH, INFLORESCENCE TRAITS, FLOWERING, AND FRUIT SET OF LOQUAT IN HIGH-DENSITY ORCHARD

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ABSTRACT

High production costs remain a major constraint for loquat cultivation. The expansion of loquat orchards in Turkey depends on cost reduction, increased productivity, and the supply of early and profitable products. High-density orchards using dwarf or semi-dwarf early cultivars offer a potential solution. The aim of the study is to investigate the vegetative growth and phenological characteristics of the loquat cultivar grafted on some quince rootstocks. In the experiment, 'Hafif Çukurgöbek (HÇG)' loquat cultivar grafted on three Quince rootstocks (BA 29, Quince A = MA, Quince C = MC) was used. The experiment was laid out in a completely randomized design with 5 replications and 6 plants were used in each replicate. In the study, vegetative growth parameters such as annual shoot length, trunk diameter of stock and scion and also structure canopy, phenological observations such as inflorescence characteristics (number of peduncles per cluster, number of flower buds per cluster, and number of flowers per cluster), and fruit set ratios (percent blossom ratios, % initial fruit set, and % final fruit set) of the cultivar/rootstock combinations were determined. Quince-C rootstock gave higher values in terms of annual shoot length, scion and rootstock diameter compared to Quince-A and BA-29 rootstocks. The differences between the rootstocks in terms of vegetative parameters were found to be statistically significant at 5% level. According to the three-year average, the flowering rate was found the highest in BA-29 rootstock, the lowest in MA rootstock. MA rootstock yielded the lowest value in the ratio of fruit harvested, while MC and BA-29 gave close values to each other. The data shows that BA-29 and MC give better results than the MA rootstock.

Keywords: loquat, quince rootstocks, vegetative growth, flowering, fruit set

IMPACTS OF THE 2023 TURKIYE EARTHQUAKES ON THE AGRICULTURE SECTOR OF HATAY PROVINCE

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ABSTRACT

On 6 February 2023, two major earthquakes (Mw 7.7 and Mw 7.6) struck Kahramanmaraş, Türkiye, followed by a third earthquake (Mw 6.4) in Hatay on 20 February 2023. These earthquakes were among the most devastating disasters in the history of the Republic of Türkiye, affecting approximately 14 million people across 11 provinces. The affected region accounts for nearly 16% of the country's agricultural production, with Hatay being one of the provinces that experienced the greatest destruction. This study assessed the impacts of the February 2023 earthquakes on the agricultural and food sector in Hatay using a mixed-methods approach combining official statistical data, field observations, damage assessment reports, and semi-structured interviews with farmers. The earthquakes caused approximately 24,000 fatalities in Hatay and resulted in the destruction or severe damage of 80,323 buildings. Agricultural lands, irrigation systems, livestock facilities, storage infrastructure, and other production assets sustained extensive damage. According to official records, 2,861 cattle, 13,625 small ruminants, 5,529 barns and livestock shelters, and 9,381 beehives were lost or damaged, while the poultry sector was affected in 39 commercial enterprises. In addition, disruptions in the supply of essential agricultural inputs, including seeds, fertilizers, feed, and irrigation water, significantly constrained agricultural production. Labor shortages caused by large-scale migration and damage to rural infrastructure further delayed agricultural recovery.
The findings indicate that the February 2023 earthquakes caused multidimensional disruptions extending well beyond direct physical damage, affecting agricultural production, supply chains, labor availability, and rural livelihoods. Strengthening disaster preparedness, rehabilitating agricultural infrastructure, and integrating resilience-based policies into long-term agricultural recovery strategies are essential for improving the sustainability and resilience of agroecosystems in earthquake-prone regions.

Keywords: agricultural production, disaster recovery, earthquake impacts, Hatay, Türkiye

GRAIN QUALITY OF LOCAL POPULATIONS OF THE UNDERUTILIZED GRASS PEA CROP

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ABSTRACT

Grass pea (*Lathyrus sativus* L.) is an underutilized crop despite its high potential for human consumption and livestock feed, particularly in Mediterranean conditions. This annual, cool-season grain legume is recognized for its resilience to environmental stress, thriving in unfavorable conditions such as drought, water stress, and waterlogging. Due to its ability to produce an economic yield with minimal inputs, grass pea is widely cultivated in subsistence farming across many developing countries. This study aims to characterize local varieties of *Lathyrus sativus* L. to promote their use as a concentrated forage crop. To achieve this, chemical analyses were conducted on flour from four local populations of grass pea seeds, and commercial reference flour for poultry. The comparison focused on dry matter content, moisture content, ash content, organic matter, protein content, and crude fiber. The results revealed significant differences between the populations in terms of dry matter content (P

Keywords: Grass pea (Lathyrus sativus L.), proteins, forage analysis, livestock feed

INSECTICIDAL EFFICACY OF DOLOMITE POWDER AGAINST RICE WEEVIL, SITOPHILUS ORYZAE, AND GRANARY WEEVIL, SITOPHILUS GRANARIUS (COLEOPTERA: CURCULIONIDAE) ON WHEAT GRAINS

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ABSTRACT

An estimated 18 million tons of food is lost and wasted every year in Turkey. More than 20,000 different types of pre and post-harvest insect pests damage almost one-third of the world's food production, causing more than $100 billion in losses annually. Post-harvest cereals are often infested by a variety of insect pests, leading to significant quantitative losses, including an estimated 5-30% weight loss and a reduction in nutritional and commercial value. Different control measures, including biological, chemical and physical, are used to control storage pests. However, misuse and overuse of synthetic insecticides lead to insecticide resistance, causing harmful or toxic effects on the environment, humans and non-target species. Inert powders have promising potential in the control of stored grain pests. Dolomite dust is another type of inert dust consisting of anhydrous calcium magnesium carbonate. According to MTA's prospective reserve surveys, the highest underground mineral reserve in Turkey is dolomite with 15.8 billion tons. This study aimed to determine the insecticidal efficacy of locally produced dolomite powder against two different stored grain pests infesting wheat grains under laboratory conditions. The efficacy of 500, 1000, 1500, and 2000 ppm concentrations of dolomite powder treated on wheat grains with a control group against S. oryzae and S. granarius was investigated. According to the experimental results for S. granarius, S. oryzae, the dolomite applications were found to be ineffective at either dose rate on the 1st day of exposure. At the highest concentration of application by the 7th day of exposure, mortalities were able to slightly reach a maximum of 14% in S. granarius and 60% in S. oryzae. For both species, dolomite powder caused the highest effectiveness after 21 days of treatment, as mortality reached 97.98% and 100% at a 2000 ppm dose rate, respectively. On the other hand, no mortality was observed in the control treatment throughout the exposure days. Higher application concentration of dolomite dramatically suppressed F1 and F2 adult emergence by 91.16% and 92.95% in S. granarius and 97.5% and 94.4% in S. oryzae as compared to the control group. Thus, it is concluded that the use of dolomite powder reduces the dependence on imported chemical pesticides as an environmentally friendly pest control alternative.

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Keywords: Inert dust, dolomite, surface application, contact mortality, stored grain pests

DROUGHT-INDUCED RESISTANCE OF PEPPER CULTIVARS TO FUSARIUM OXYSPORUM F. SP. CAPSICA

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ABSTRACT

The study was conducted during 2025–2026 at the Maritsa Vegetable Crops Research Institute, Plovdiv, Bulgaria, to evaluate the effect of water deficit on the response of pepper (Capsicum annuum L.) cultivars to infection with Fusarium oxysporum f. sp. capsici. Fifteen Bulgarian pepper cultivars representing different production purposes and fruit types were included in the study: Sivria 600, Milkana F1, Zlaten medal 7, Stryama, Delikates, Dan-Dan, Kaloyan, Byal Kalinkov, Kurtovska kapia 1, Ivaylovska kapia, Baltovska kapia, Zlatina, Balgarski ratund, Buketen 50, and IZK Rubin. During the first year, the cultivars were grown under field conditions using two irrigation regimes: optimal irrigation and reduced irrigation at 50% of the optimum irrigation level. Seeds harvested from these plants were used to produce seedlings for the second year of the study. The seedlings were artificially inoculated with a pure culture of F. oxysporum f. sp. capsici (isolate FOC1 from the collection of the Phytopathology Laboratory at the Maritsa Vegetable Crops Research Institute) using the Elenkov root-dip inoculation method. The tested cultivars differed in their response to the pathogen depending on the irrigation regime applied to the mother plants during the previous growing season. Resistance was evaluated based on the incubation period, disease incidence, and plant mortality. The combined effect of water deficit experienced by the mother plants and subsequent pathogen infection influenced disease development, resulting in a shorter incubation period and faster symptom development in some cultivars. The extent of these changes varied among the tested cultivars. The results indicate that the irrigation regime applied to the mother plants affected the response of plants grown from the harvested seeds to F. oxysporum f. sp. capsici, with the magnitude of the effect depending on the cultivar. These findings may contribute to the evaluation of pepper germplasm and support breeding programmes aimed at improving resistance to the combined effects of abiotic and biotic stress.

Acknowledgments: This work was financed by project KP-06-N86/5 „Competition for financial support for basic research projects – 2024"

Keywords: Capsicum annuum, Fusarium oxysporum f. sp. capsici, water deficit, resistance, Fusarium wilt.

CONTROL OF FUNGAL DISEASES IN GREENHOUSE CUCUMBERS THROUGH A FUNGICIDE TREATMENT SCHEME

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ABSTRACT

The article presents the results of a study evaluating the efficacy of a fungicide treatment scheme against aerogenic fungal diseases in greenhouse cucumbers. The experimental work was carried out in 2025 at the Maritsa Vegetable Crops Research Institute, Plovdiv, in an unheated steel-glass greenhouse using the cucumber cultivar 'Defense F1', transplanted during the second decade of April. Phytosanitary monitoring indicated that the primary fungal diseases affecting the crop in 2025 were downy mildew (Pseudoperonospora cubensis) and powdery mildew (Erysiphe cichoracearum). Regular preventive treatments with fungicides containing the active substances metalaxyl, folpet, and cymoxanil at standard application rates delayed the onset of downy mildew by 21 days. Subsequent saturation of the phylloplane with these active substances demonstrated high curative efficacy, reducing disease severity below the economic threshold of harmfulness (attack index of 3.75%), with an overall fungicide efficacy against downy mildew reaching 80%. Furthermore, incorporating azoxystrobin- and penconazole-based fungicides into the treatment scheme extended the incubation period of powdery mildew by more than one month, fully covering the active harvesting period. The evaluated scheme of prophylactic and curative fungicide treatments proved highly effective against economically important aerogenic diseases (downy mildew and powdery mildew) in greenhouse cucumbers and can be successfully recommended as part of the plant protection system in the commercial growing technology for this crop.

Keywords: greenhouse cucumbers, downy mildew, powdery mildew, treatment scheme model, fungicidal effect

ENABLING THE TRANSITION TO CLIMATE-NEUTRAL AND RESILIENT AGRICULTURE THROUGH INTERDISCIPLINARY RESEARCH AND DIGITAL INNOVATION

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ABSTRACT

Feeding a growing population while curbing the sector's climate impact is among the defining challenges of modern agriculture. Farming releases a significant share of anthropogenic greenhouse-gas (GHG) emissions and, at the same time, is directly harmed by rising temperatures, erratic rainfall, drought and flooding. These pressures weigh especially heavily on Romania, which pairs the EU's largest agricultural labour force with low technological uptake, widespread vulnerability to soil degradation, and projections pointing to continued growth in agricultural emissions through 2030. Against this backdrop, the present five-year programme (2026–2030) sets out to accelerate the shift from conventional practices toward a low-emission, resilient agricultural model, producing evidence-based tools for mitigation and pollution control along the whole food chain. The research unfolds across eight linked work packages, each targeting a specific environmental pressure. They pursue greater soil carbon storage through biochar and refined land management; richer above- and below-ground biodiversity via crop diversification, agroforestry and novel microbial biostimulants; cleaner resource use through advanced depollution materials, protected urea and hydroxyapatite-based biofertilizers; and lower livestock emissions through methanogenic-inhibitor feed and additive supplements. A further strand couples Earth Observation, hyperspectral and UAV imagery, IoT sensing and machine learning into a farmer-oriented platform and decision-support service for precision management. The remaining packages demonstrate and cost these solutions in field pilots through life-cycle and life-cycle-cost analysis and carry them into practice via a Living Lab that trains new farmers and researchers. Tested on long-standing experimental stations, the programme is expected to yield new datasets, functional models, biofertilizers and digital services, and to pinpoint pathways capable of bending Romania's upward emission curve. Its results are meant to inform policymakers, producers and consumers, reinforce national research capacity, and supply a replicable Agriculture 4.0 template for other at-risk farming regions. By joining fundamental science with field validation and stakeholder co-creation, the work pushes agriculture's contribution to climate neutrality and resilience past the current state of the art.

Acknowledgement: This work was supported by a grant of the Ministry of Education and Research, CCCDI – UEFISCDI, project number PN-IV-P6-6.1-CoEx-2024-0120, within PNIV.

Keywords: climate-neutral agriculture, soil carbon sequestration, precision agriculture, agricultural GHG mitigation

SCIENCE-BASED TOOLS AND DIGITAL SOLUTIONS FOR A LOW-EMISSION, RESILIENT ROMANIAN AGRICULTURE

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ABSTRACT

Feeding a growing population while curbing the sector's climate impact is among the defining challenges of modern agriculture. Farming releases a significant share of anthropogenic greenhouse-gas (GHG) emissions and, at the same time, is directly harmed by rising temperatures, erratic rainfall, drought and flooding. These pressures weigh especially heavily on Romania, which pairs the EU's largest agricultural labour force with low technological uptake, widespread vulnerability to soil degradation, and projections pointing to continued growth in agricultural emissions through 2030. Against this backdrop, the present five-year programme (2026–2030) sets out to accelerate the shift from conventional practices toward a low-emission, resilient agricultural model, producing evidence-based tools for mitigation and pollution control along the whole food chain. The research unfolds across eight linked work packages, each targeting a specific environmental pressure. They pursue greater soil carbon storage through biochar and refined land management; richer above- and below-ground biodiversity via crop diversification, agroforestry and novel microbial biostimulants; cleaner resource use through advanced depollution materials, protected urea and hydroxyapatite-based biofertilizers; and lower livestock emissions through methanogenic-inhibitor feed and additive supplements. A further strand couples Earth Observation, hyperspectral and UAV imagery, IoT sensing and machine learning into a farmer-oriented platform and decision-support service for precision management. The remaining packages demonstrate and cost these solutions in field pilots through life-cycle and life-cycle-cost analysis and carry them into practice via a Living Lab that trains new farmers and researchers. Tested on long-standing experimental stations, the programme is expected to yield new datasets, functional models, biofertilizers and digital services, and to pinpoint pathways capable of bending Romania's upward emission curve. Its results are meant to inform policymakers, producers and consumers, reinforce national research capacity, and supply a replicable Agriculture 4.0 template for other at-risk farming regions. By joining fundamental science with field validation and stakeholder co-creation, the work pushes agriculture's contribution to climate neutrality and resilience past the current state of the art.

Acknowledgement: This work was supported by a grant of the Ministry of Education and Research, CCCDI – UEFISCDI, project number PN-IV-P6-6.1-CoEx-2024-0120, within PNIV.

Keywords: climate-neutral agriculture; soil carbon sequestration; precision agriculture; agricultural GHG mitigation

SURVEY OF MULBERRY BADNAVIRUS 1(MBV-1) IN MULBERRY GENETIC RESOURCES IN TURKIYE

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ABSTRACT

Mulberry badnavirus 1 (MBV-1), *Badnavirus mori*, is a plant pathogenic virus infecting mulberry trees (*Morus species*). MBV-1 is an emerging virus that has recently attracted attention because of its potential impact on mulberry cultivation and the conservation of mulberry genetic resources. Since mulberry is an economically and ecologically important species used for fruit production, sericulture, and breeding programs, the spread of viral pathogens poses a significant risk to sustainable germplasm management. This study aimed to determine the occurrence and distribution of MBV-1 in mulberry genetic resources of Turkiye using molecular diagnostic methods. A total of 117 leaf samples were randomly collected from both symptomatic and asymptomatic mulberry trees maintained in genetic resource collections located in Malatya, Erzincan, Diyarbakır, and Elazığ provinces. Total DNA was extracted from all samples, and MBV-1 was detected by conventional polymerase chain reaction (PCR) using developed virus-specific primers. Of the 117 samples analyzed, 41 (35.0%) tested positive, whereas 76 (65.0%) were negative for MBV-1. The virus was detected in 12 samples (10.26%) from Malatya, 1 sample (0.85%) from Erzincan, and 28 samples (23.93%) from Diyarbakır, while no positive samples were identified in Elazığ. MBV-1 was detected in both symptomatic and asymptomatic trees, demonstrating that symptom observation alone is insufficient for reliable virus diagnosis. These findings provide the first comprehensive evidence of MBV-1 occurrence in Turkish mulberry genetic resources. This study emphasize the necessity of the economic risk analysis of the virus and routine molecular screening programs to support disease monitoring, prevent virus dissemination through propagation material, and ensure the long-term conservation and utilization of healthy mulberry germplasm.

Keywords: Mulberry Badnavirus 1 (MBV-1), Mulberry (Morus spp.), PCR, Plant virus, Virus Detection

HUMIC ACID-BASED BIO STIMULATION ENHANCES GROWTH AND EARLY DEVELOPMENT OF TRITICUM DURUM UNDER SEMI-ARID CONDITIONS IN EASTERN ALGERIA

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ABSTRACT

Humic substances are known for their benefits to improve soil quality, and consequently improve plants' growth. A study was carried out at the Technical Institute of Vaste Cultures (ITGC El-Khroub) in Constantine, using Triticum Durum Wheat known as "Wahbi", of Algerian origin as a plant material. The experimental trial is a randomized complete block design with 4 replications, consisting of 5 treatments: (T0**:** Control soil with no treatment, T1**:** Urea 46% at a dose of 133kg/Ha, T2**:** Humic acid at a dose of 1 L/Ha, T3**:** Humic acid at a dose of 1.5 L/Ha and T4**:** Humic acid at a dose of 2 L/Ha). The use of humic acid has shown an efficiency on all the studied parameters: number of plants per square meter, number of grains per ear, length of ears with and without awns, plant height, thousand grain weight (tgw), number of ears per square meter and yield per hectare. The R software was used for statistical calculations. The optimum HA dose of T4 resulted in a 62.73% increase in yield over the control soil, with improvements in grain number, ear length and plant height. The use of humic acid shown better effect on the plant growth parameters compared to Urea 46%, even at low doses. Statistical analysis using ANOVA demonstrated significant differences among the treatments for most agronomic parameters ($p < 0.05$), confirming the robust impact of humic acid applications compared to the control and urea treatments across yield and growth-related traits.

Keywords: Humic acid, Durum wheat, Yield, Plant growth, Soil fertility, ANOVA

INFLUENCE OF DROUGHT ON THE MORPHOLOGICAL AND QUALITY CHARACTERISTICS OF FOUR PEPPER (CAPSICUM ANNUUM L.) CV. KAPIA TUPE)

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ABSTRACT

Drought is one of the main abiotic stress factors that have a direct negative impact on the quantity and quality of plant production worldwide. In response to climate challenges, the development of genotypes with increased tolerance to water shortage is becoming a top priority for horticultural science and practice. The aim of the present study was to determine genotypic differences in drought tolerance among four pepper (Capsicum annuum L.) cv. Kapia type by assessing the quantitative and qualitative characteristics of yield. The experiment was conducted in greenhouses of the Maritsa Research Institute of Vegetable Crops, Plovdiv, Bulgaria, and was organized in a randomized complete block design (RCBD) with three replications, each replication consisting of ten individual plants. Pepper plants were tested under optimal and 50% reduced irrigation, which started during mass flowering. Yield and related characteristics, as well as fruit morphology and quality distribution, were assessed. Results show a different response of the pepper cultivars to water deficit. Yield is reduced by an average of 60.8%, and the average fruit weight decreases by an average of 25.4%. The variety Baltovska Kapia showed increased drought tolerance with the least loss of total and first-quality yield and the least reduced fruit parameters under water stress. This makes it suitable for developing new lines and varieties of pepper combining quality and tolerance.

Keywords: abiotic stress, drought, pepper, yield, fruit weight, tolerance

PHENOTYPIC CHARACTERIZATION OF PERSPECTIVE MS8 MALE-STERILE PEPPER (CAPSICUM ANNUUM L.) LINES WITH KAPIA GENETIC BACKGROUND

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ABSTRACT

The develop of new pepper male sterile lines with different fruit shape has strategic importance in pepper breeding. In F1 seed production, genic male sterility is an efficient and labor-saving approach because it eliminates the operations of manual emasculation and pollen application to the stigma surface, thereby reducing labor cost during the process. In the Balkan region, the Kapia-type cultivars occupy the largest share of the area, they have the greatest consumer demand and have the most significant economic contribution. The present study aimed to evaluate the stability of male sterility expression, as well as the degree of recovery of morphometric and phenotypic traits characteristic of the Kapia type in promising lines. The study was conducted during the 2024–2025 period in the experimental field at the Maritsa Vegetable Crops Research Institute, Plovdiv, Bulgaria. A total of 11 male-sterile advanced lines were evaluated, including five BC5P2×BC5P2 lines and one BC6P2×BC6P2 line derived from "Sofiyska kapia", as well as three BC5P2×BC5P2 lines and two BC6P2×BC6P2 lines derived from "Kapia 1300".". The lines from these two backcross combinations were developed from ms-8 male sterile line with conic fruit shape and repeated backcrossing with recurrent two Bulgarian Kapia-type cultivars which also were included in the study. Temporary microscopic slides were prepared to confirm male sterility. Morphometric and phenotypic traits included plant and stem height, number of primary branches, fruit length, width, weight, and wall thickness. The fruit traits were evaluated using Tomato Analyzer software. Fertile plants from the backcross generations exhibited kapia genetic background as the fruit characteristics similar to those of the Kapia-type recurrent parents, while stable expression of the male sterility trait was maintained in sterile plants. Cytological analysis confirmed the absence of pollen in the stamens of sterile plants. As a result, the expected ratio (1:1) of fertile to sterile plants was found to be. The obtained male-sterile lines represent promising source material for use as maternal components in F1 hybrid seed production and could be effectively incorporated into pepper breeding programs aimed at developing of new F1 Kapia type hybrids.

Keywords: hybridseed production, genic male sterility, morphometric analysis, backcross breeding

CHEMICALLY MODIFIED CHITOSAN DIFFERENTIALLY MODULATE THE PHOTOSYNTHETIC ACTIVITY IN PEA SEEDLINGS

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ABSTRACT

Chitosan is a promising natural biopolymer for sustainable agriculture due to its ability to promote plant growth and enhance stress tolerance. However, its application is limited by poor solubility at neutral pH and relatively high molecular weight. To overcome these limitations, chemically modified derivatives, including chitooligosaccharides and quaternized chitosans, have been developed with improved water solubility, enhanced bioavailability, and potentially greater biological activity in plants. We investigated the effects of seed priming with two chitooligosaccharides (aminochitooligosaccharide and chitooligosaccharide hydrochloride), and two quaternized trimethyl chitosans – TMC50 and TMC80 (with 50% and 80% degree of quaternization, respectively), on the photosynthetic performance and pigment composition of 14-day-old pea (Pisum sativum L.) seedlings. Photosynthetic activity was evaluated by chlorophyll a fluorescence induction curves (OJIP transients), and leaf chlorophyll, anthocyanin, and flavonoid contents were determined non-destructively with pigmentometer. OJIP analysis revealed that seed priming with chitooligosaccharides induced only minor changes in the photosynthetic performance, with chitooligosaccharide hydrochloride (100 mg/L) slightly reducing PIABS and PITOTAL. In contrast, the highly quaternized derivative TMC80 (500 mg/L) enhanced photosystem II functionality, as indicated by increased Fv/F0, φEo, PIABS and PITOTAL together with reduced ABS/RC and DI0/RC values. These changes suggest improved photochemical efficiency, more efficient electron transport toward photosystem I end acceptors, and lower energy dissipation. No significant differences were observed in leaf chlorophyll, anthocyanin, or flavonoid levels among the treatments. Our results demonstrate that the physiological effects of chitosan seed priming strongly depend on the chemical structure of the derivatives, with highly quaternized chitosan showing the greatest potential to enhance photosynthetic performance without altering leaf pigment composition.

Acknowledgements: This research was supported by Bulgarian Science Fund, grant number КП-06-Н86/2/15.12.2024.

Keywords: chitosan, chitooligosaccharides, quaternized chitosans, seed priming, photosynthesis

INFLUENCE OF MICROBIAL INOCULANTS ON THE BIOMETRIC INDICATORS AND THE QUALITY OF PEPPER SEEDLINGS

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ABSTRACT

In order to improve the quality indicators of pepper seedlings, variety Ivaylovska Kapiya, during the period 2024-2026, in an unheated steel-glass greenhouse of the Venlo type**,** variants of picking with PVC Conical planter and Avellina Tools planter were tested. The impact of the individual and combined application of the commercial products EKOprop[X] NX (E), Simargal (MO) and Trichodermin (Tr) on the biometric indicators and the Dixon Quality Index (DQI) of pepper seedlings was assessed. The results show that the biomodification of the substrates optimizes the biometric indicators of the plants. The average effect of the individual pickling with Avellina Tools compared to the Control - ordinary seedling is respectively: for the stem diameter - 15.3%; for the length and volume of the root - 26.4% and 23.5%; leaf area - 19.4% and fresh mass - 31.1%. The greatest length and volume of the root is registered in the plants picked with the seedling Avellina Tools and the introduction of Simargal into the substrate, with the increase compared to the control being respectively 43.1% and 41.5%. The plants in this variant also had the highest values for the stem diameter - 4.32 mm (by 22.3% compared to the control), followed by the variant with the introduction of Trichodermin. The positive effect is also confirmed by the size of the total vegetative mass per plant, with the increase being by 41.5% (with Samargal) and 36.7% (with Trichodermin) compared to the control. The lowest quality values were recorded in the control (\(DQI = 0.131\)). The independent introduction of EKOprop[X] NX (B4) significantly increases the quality (\(DQI = 0.274\)), but the maximum synergistic effect was registered in the variant Ekoprop + Trichodermin (B6), where the index reaches \(0.342\) and the stem diameter – \(5.2\text{mm}\). The study proves that the integration of combined biological products into seedling substrates and stress-free picking using Avellina Tools is a highly effective approach and an environmentally sustainable alternative to conventional chemical practices in modern industrial seedling production.

Keywords: pepper seedlings, greenhouse vegetables, EKOprop® NX, Simargal, Trichoderma, Dickson Quality Index (DQI), biomodified substrate.

STUDY OF THE INFLUENCE OF BIOPRODUCTS ON THE GROWTH AND PRODUCTIVE QUALITIES OF GREENHOUSE CUCUMBERS

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ABSTRACT

The experimental work was carried out in an unheated steel-glass greenhouse of the Venlo type at the Maritsa Agricultural Research Center - Plovdiv with greenhouse cucumbers of the Defense F1 variety. The aim of the research work is to study the influence of new bioproducts on the growth and productive qualities of vegetable crops from the Cucurbitaceae family. The best growth indicators are characterized by cucumbers grown on soil after treatment with a preparation based on Bacillus thuringiensis and subsequent inoculation with Endophytic bacteria (var. 6), in which the growth rate and leaf formation are respectively 3.86 cm/24 h and 0.64 pcs. l./24 h. The largest amount of first-quality production is formed by the variant grown on a soil background with Bacillus thuringiensis and foliar treatment with endophytic bacteria (var. 6) - 9578 kg/ha, and with the lowest values of the studied indicator are the cucumbers grown after combined treatment with Velum Prime and Bacillus thuringiensis (var. 3) - 7398 kg/ha. The largest amount of total yield is in cucumbers treated with Bacillus thuringiensis and subsequent inoculation with endophytic bacteria (var. 6) - 16697 kg/ha. The smallest values of this indicator were recorded in the variant with the introduction of Velum Prime (var. 1) - 13789 kg/ha. In terms of the average mass of first-quality fruits and total yield, only cucumbers treated with Bacillus thuringiensis (var. 5) are distinguished by smaller values, respectively 0.260 kg and 0.263 kg compared to those of the variants with Velum Prime + Endophytic bacteria (0.286 kg and 0.284 kg) and Velum Prime + Bacillus thuringiensis + Endophytic bacteria (0.287 kg and 0.287 kg). The highest percentage of first-quality production was found in cucumbers grown after soil treatment with a bioproduct based on Bacillus thuringiensis alone (var. 5) - 56.52% or with subsequent inoculation with Endophytic bacteria (var. 6) - 57.37%. The share of first quality fruits in relation to the total yield is less than half in the variants with Velum Prime - 46.00% and Velum Prime + Bacillus thuringiensis + Endophytic bacteria - 48.05%.

Keywords: organic products, greenhouse cucumbers, growth rate, yield, Bacillus thuringiensis

DEVELOPMENT AND PERFORMANCE EVALUATION OF WATER-RETENTIVE HYDROGEL FORMULATIONS TO IMPROVE WATER USE EFFICIENCY IN AGRICULTURE

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ABSTRACT

Water scarcity driven by climate change, population growth, and irregular rainfall patterns has made efficient water use in agriculture a critical issue for sustainable food production. Agricultural activities account for a large share of global freshwater consumption, and a significant portion of irrigation water is lost through evaporation, surface runoff, and deep percolation. Consequently, the need for technologies that can increase soil water retention capacity and improve irrigation efficiency is growing steadily. In recent years, hydrogel-based superabsorbent polymers have emerged as promising materials due to their ability to absorb large amounts of water and release it in a controlled manner to the plant root zone when needed. In this study, a water-retentive hydrogel formulation with properties comparable to commercial agricultural hydrogels was developed, and its potential agricultural performance was evaluated. The formulation was prepared using superabsorbent polymeric structures, organic stabilizers, and cross-linking agents. Laboratory- and pot-scale trials were planned to determine the water absorption capacity, swelling behavior, soil moisture retention performance, and effects on plant growth of the developed hydrogel recipe. Different hydrogel doses will be applied to the soil under controlled irrigation conditions, and the results will be compared with control groups. The developed hydrogel formulations are expected to reduce soil moisture loss, extend irrigation intervals, and support plant growth by providing a more stable moisture environment in the root zone. The developed system is also expected to contribute to sustainable agricultural practices by improving irrigation efficiency in arid and semi-arid regions. This study is expected to provide a basis for controlled-release fertilizer systems, biodegradable hydrogel technologies, and climate-resilient agricultural practices.

Keywords: Hydrogel, Water retention capacity, Sustainable agriculture, Superabsorbent polymer, Irrigation efficiency, Soil moisture

EFFECTS OF ESSENTIAL OILS AND THEIR ACTIVE COMPOUNDS ON TRIBOLIUM CASTANEUM: A SYSTEMATIC REVIEW (2018–2026)

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ABSTRACT

Essential oils (EOs) and their active compounds (ACs) have attracted increasing attention as promising plant-derived alternatives to synthetic insecticides for the management of the red flour beetle, Tribolium castaneum (Herbst), one of the most destructive pests of stored grains and food products worldwide. Owing to their natural origin, biodegradability, and generally lower toxicity to humans, non-target organisms, and the environment, EOs are considered attractive candidates for sustainable pest management. This systematic review aims to summarize and critically evaluate the current evidence regarding the biological activities of EOs and their ACs against T. castaneum. A comprehensive literature search was conducted in four scientific databases (Scopus, Web of Science, ScienceDirect, and PubMed) for studies published between 2018 and 2026. A total of 2,024 records were identified, of which 17 studies fulfilled the predefined inclusion criteria after screening and eligibility assessment. The selected studies investigated EOs obtained from 24 plant taxa belonging to nine botanical families, with Lamiaceae, Rutaceae, and Asteraceae being the most represented. The reported biological activities included contact toxicity and fumigant toxicity. Several active compounds also demonstrated significant insecticidal activity, suggesting that they contribute substantially to the bioactivity of the corresponding EOs. Overall, the findings highlight the considerable potential of EOs and their ACs as eco-friendly biopesticides for the protection of stored products and support further research aimed at developing effective commercial formulations and practical applications in integrated pest management programs.

Keywords: Tribolium castaneum, essential oils, active compounds, fumigant toxicity, contact toxicity, biopesticides, systematic review

DETERMINATION OF EFFICACIES OF SOME FUNGICIDES IN CONTROL OF FUSARIUM BLIGHT (FUSARIUM SPP.) DISEASE ON THE COOL-SEASON TURFGRASSES

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ABSTRACT

In this study, efficacy trials was conducted with some plant protection products against Fusarium blight disease, which is common in cool-season turfgrasses. The material of the research consists of isolates of Fusarium which is isolated and diagnosised from turfgrass, 7 cool season turfgrass species (*Lolium perenne, Festuca arundinacea, Festuca ovina, Festuca rubra var. commutata, Festuca rubra var. rubra, Poa pratensis, Agrostis tenuis*) and 3 preparates which one of them is biological fungicide (*Bacillus subtilis*) and 2 chemical fungicides (Boscalid + Pyraclostrobin, Hymexazol). The study was conducted on the experimental field belonging to the Department of Plant Protection, Faculty of Agriculture, Agean University. The trial was established randomized as split plot with four replications. Two factors were considered fungicide applications and turfgrass species. Evaluation of the trial was based on the severity of the disease and the efficacies of fungicides. As to the results of the research, the evaluations of the plant protection products and turfgrass species on disease severity were found statistically significant. The efficacies of application x species interactions on disease severity were determined also significant statistically within all measurements. As a result of the study, three fungicides as [*Bacillus subtilis* (Serenade SC), Boscalid + Pyraclostrobin (Signum WG), Hymexazol (Tachigaren)] used in the trial resulted in promising on the disease control and it has generally been observed that Signum WG is more effective. In general, it can be said that *Festuca ovina* is sensitive to diseases, whereas *Festuca arundinacea* and *Festuca rubra rubra* are resistant.

Keywords: Turfgrass, Fusarium blight, management, biological fungicide, chemical fungicide.

CONVERSION OF SOURDOUGH WASTE INTO AN ORGANIC AMINO ACID BIOSTIMULANT VIA PROTEASE-ASSISTED FERMENTATION

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ABSTRACT

Food and fermentation industry side-streams form the foundation of the circular economy for the production of biogas, animal feed, and fertilizers, as well as the recovery of value-added food ingredients (enzymes, antioxidants). This draft discusses a protease-assisted fermentation approach for converting sourdough waste into an organic amino acid-rich biostimulant. Sourdough waste may contain organic matter, microbial biomass, carbon sources and proteinaceous materials. Protease addition may accelerate the conversion of proteins into peptides and free amino acids, supporting a plant-available organic nitrogen fraction. The manuscript outlines fermentation indicators, analytical standardization needs and a proposed seedling bioassay design. This article discusses an approach to developing a fermented liquid biostimulant with high organic amino acid content using sourdough waste and the protease enzyme. Sourdough waste is a valuable by-product rich in microbial diversity, organic matter, carbon sources, and proteinaceous components. The protease enzyme accelerates the conversion of proteinaceous material into peptides and free amino acids, thereby facilitating the formation of nitrogenous organic fractions that are more readily utilized by plants. The study outlines the fermentation process, practical indicators such as pH and odor changes, analytical parameters essential for product standardization, and a proposed experimental design for assessing seedling development. While the current data support the research concept and process protocol, data regarding microbial analysis, amino acid profiles, organic matter content, phytotoxicity, and plant performance are required for peer-reviewed publication.

Keywords: sourdough discard, fermentation, protease, organic fertilizer, biostimulant, waste valorization

PHENOTYPIC CHARACTERIZATION OF SEED PROGENY OBTAINED FROM IN VITRO CUCUMBER REGENERANTS

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ABSTRACT

Cucumber is one of the important vegetable crops grown in field and greenhouse conditions in Bulgaria. Obtaining new modified forms, by applying in vitro methods and using the phenomenon of somaclonal variation, is one of the tasks in our cucumber breeding program. In our previous study, regenerant plants were obtained, which were selected and self-pollinated several times in the following years. The aim of the present study is to make a comparative characterization of the newly obtained inbred lines and the original variety Gergana. The study was carried out under greenhouse conditions at the Maritsa of Vegetable Crops Research Institute - Plovdiv, Bulgaria, in 2025 and 2026. A number of characteristics of the plant and the fruits distinguishes the resulting new forms. A comparative test of yield, earliness and productivity elements was carried out. Response to powdery and downy mildew attack on a natural background of infection was recorded. The results show that the six resulting progeny of regenerants differ significantly from each other, as well as from the original variety Gergana, which has been popular for the last 50 years. Line 105/3-1, which can serve as a parental component of new hybrid combinations, is distinguished by the highest values of the studied indicators.

Keywords: Cucumis sativus, progeny, somaclonal, variation, lines

COMPARATIVE EVALUATION OF MINI CUCUMBER HYBRIDS

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ABSTRACT

Cucumber (*Cucumis sativus* L.) of the mini type (Beith Alpha-type) are characterized by parthenocarpic formation of fruits 12-16 cm long. Compared to other types of cucumber, such as long-fruited parthenocarpic, salad and gherkins, they occupy a relatively small share in Bulgarian production. However, they are a favorite fruit of consumers due to their superior sensory qualities, such as crispy skin, sweet taste, pleasant cucumber aroma, etc. The goal of our breeding program was to make hybrid combinations between selected lines of the mini variety type and test them in a comparative variety trial to determine the most promising hybrid combination. The variety trial was conducted in greenhouse conditions at the Maritsa Vegetable Crops Research Institute - Plovdiv, Bulgaria in 2024 and 2025. The highest total yield was achieved by the crosses (PC x SC) 4- 1- 2 x DV (7365.89 kg/da) and E(7-1-6-7 x 1728/3-1b) x TM(8-2-6) (7466.80 kg/da), on average for the period. The largest number of fruits per plant are formed by the hybrid combinations LN x DV (29 pieces), (PCxSC) 4 - 1 - 2 x L 350 (29 pieces) and (PC x SC) 4 - 1 - 2 x DV (30 pieces). These hybrids have an average fruit weight typical of mini cucumber, 0.145-0.154 kg. The standard yield is presented in dynamics of the tested hybrid combinations in order to provide a more detailed characterization. The hybrid combination (PC x SC) 4-1-2 x DV stood out as the most promising in the comparative experiment conducted.

Keywords: Cucumis sativus, Beith Alpha-type, hybrids, yield

DEVELOPMENT AND PERFORMANCE EVALUATION OF NPK-BASED SLOW-RELEASE FERTILIZER FORMULATIONS

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ABSTRACT

Rising fertilizer consumption coupled with declining nutrient use efficiency has emerged as a major challenge for sustainable agriculture. Conventional NPK fertilizers suffer from substantial nutrient losses following soil application due to mechanisms such as leaching, volatilization, and fixation. Nitrogen loss via ammonia volatilization and nitrate leaching, in particular, leads to both economic inefficiency and environmental hazards. Consequently, interest in slow-release fertilizer technologies capable of releasing nutrients in a controlled manner aligned with crop demand has grown significantly. In this study, a slow-release NPK fertilizer formulation was developed using polymer coating systems and stabilizing additives to regulate nutrient release dynamics and enhance fertilizer use efficiency. The formulation aims to attenuate rapid dissolution in soil and ensure sustained nutrient availability within the root zone. Laboratory and soil incubation experiments were designed to evaluate nutrient release kinetics, granule crushing strength, water stability, and controlled-release performance. Furthermore, various coating ratios and formulation combinations will be investigated to identify the optimal release profile. Pot trials were planned to examine the effects of the developed fertilizer on plant growth parameters, nutrient uptake, and crop-water relations. The developed slow-release NPK formulation is expected to minimize nutrient losses, boost fertilizer efficacy, and contribute to sustainable agricultural production while mitigating environmental pollution risks associated with over-fertilization. This study serves as a foundational reference for biodegradable coating technologies, controlled-release nutrient delivery systems, and next-generation smart fertilizer applications.

Keywords: Slow-release fertilizer, NPK fertilizer, Controlled nutrient release, Sustainable agriculture, Polymer coating, Fertilizer efficiency

EVALUATION OF THE PRODUCTIVITY OF ORGANIC HEAD CABBAGE IN A MIXED SYSTEM WITH SPICE CROPS

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ABSTRACT

Mixed crops (growing two or more crops simultaneously on the same area) are a key tool in organic farming to achieve biological balance and influence productivity. The experimental activity was carried out during the period 2024-2025 on a certified organic field of Maritsa Vegetable Crops Research Institute, Plovdiv, Bulgaria. In the study, cabbage was used as a main crop and spice crops - savory, basil and dill were used as intercrops. The mixed crops were cultivated on a high, flat bed, in two rows according to the 100+60/40 cm scheme. Cabbage was grown as sole crops for control in the same way of growing. The experiment was conducted with fertilization with organic fertilizer vermicompost (Lumbrical), applied twice during the growing season, in rate of 12000 L ha-1. The following indicators were recorded: number of days from planting to the last harvest of the production of the main and accompanying crops; number of days of their joint growing season from planting to harvesting the production; morphological characteristics of head cabbage (leaf rosette size (cm); cabbage weight (kg); average cabbage diameter (cm); inner ear - height and width (cm); yield (t ha-1). In organic farming conditions in mixed cropping systems cabbage responds very well to co-cultivation with dill and secondly with savory. The lowest effect was found in intercropping with basil.

Keywords: organic crop production, intercropping, cabbage, dill, basil, savory, soil characteristics

THE PHENOMENON OF HEXACONAZOLE RESISTANCE IN GANODERMA BONINENSE AND THE POTENTIAL FOR CONTROL OF ACTINOMYCETES ORIGINATING FROM BASIDIOKARP ROT

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ABSTRACT

This study aimed to evaluate the resistance level of Ganoderma boninense to the fungicide hexaconazole and to assess the potential of Streptomyces isolates derived from decayed fruiting bodies of G. boninense as antagonistic agents for the biological control of basal stem rot disease in oil palm. G. boninense isolates were obtained from infected plant tissues and tested using the MIC method at hexaconazole concentrations of 5–20 µg/mL. The results showed that three isolates (A31, F23, and A33) were still able to grow at low concentrations with inhibition rates of 1.21–1.53%, but inhibition increased significantly to more than 60% at concentrations of 15–20 µg/mL. Variations in sensitivity among isolates indicate potential physiological and genetic adaptation to fungicide pressure. Isolation of actinomycetes from basidiocarps yielded 65 isolates, which were then screened based on their antagonistic activity. A total of 12 isolates exhibited strong inhibitory effects against G. boninense, with isolates GBSR1 and GBSR2 showing 100% inhibition, and GBSR4 showing 97%. Micromorphological analysis revealed that G. boninense has septate, branched, filamentous hyphae with dense mycelium, supporting its pathogenicity. Meanwhile, colony characterization of Streptomyces showed variations in color, texture, and pigmentation, indicating the potential production of bioactive secondary metabolites. Overall, the findings indicate that G. boninense exhibits tolerance to hexaconazole, which may develop into resistance due to repeated fungicide application. Streptomyces isolates from the same habitat demonstrated high antagonistic activity through the production of antibiotics, hydrolytic enzymes, and antifungal compounds, suggesting their potential development as environmentally friendly biofungicides.

Keywords: fungicide resistance, fungi, phytopathology, oil palm

INSECTICIDAL ACTIVITY OF DBD LINEAR PLASMA SOURCE ON THE BEAN WEEVIL, ACANTHOSCELIDES OBTECTUS (COLEOPTERA: CHRYSOMELIDAE)

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ABSTRACT

The bean weevil, Acanthoscelides obtectus, is one of the most important biotic factors that affect common bean crop during vegetation but especially dry beans during storage, for which non-chemical control methods are being investigated as an alternative to synthetic insecticides with toxic effects on human health and the environment. In this context, the use of plasma treatment is one promising approach to reduce the pest infestation and save bean production and quality. This study aims to evaluate the biological activity of atmospheric-pressure plasma treatment against the A. obtectus in laboratory experimental tests. The insects used in this experiment were obtained from a laboratory colony maintained at the Research Institute for Plant Protection Bucharest under laboratory conditions (26°C, 65% relative humidity and darkness); the Maura bean seeds were obtained from Vegetable Research Station Buzau; plasma treatment was performed on the mixture of 50 g of beans with 30 adult weevils at National Institute for Laser, Plasma and Radiation Physics Magurele. Experiments have been performed under different plasma environment, namely in pure Ar plasma expanding in atmosphere, or in a mixture Ar/N2 or Ar/O2 under constant ratio of 5000 sccmAr/5 sccm reactive gas. The experiments consisted in passing the plasma jet along the semi-enclosed reactor with mixture of beans and weevils, so 15% of the total exposure time (6, 9 and 12 min) the plasma is directly upon the mixture, while the rest of the time only the effluent gases are acting as treatment. Insect mortality was assessed at 1, 3, 7 and 14 days. Total mortality of insects resulted at one day after 12 min exposure in mixture Ar/O2, while at 14 days after exposure total mortality was achieved for all the other variants. Nonetheless, the extermination dynamic was depending on the gaseous mixture, namely the most rapid effect being that in Ar/O2 plasma mixture, while Ar/N2 mixture had the slowest extinction effect. Another experiment was assessing the role of direct plasma versus effluent plasma exposure, evidencing the significance of effluent gas in the process and thus indicating that the reactive oxygen species are playing a relevant role in the treatment process. The results from this study strengthen the belief that plasma technologies could be a promising alternative to chemical control of stored product insects.

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Keywords: Acanthoscelides obtectus, bean treatment, atmospheric pressure plasma

EFFECTS OF COLD ATMOSPHERIC PLASMA ON GERMINATION AND POST-GERMINATION GROWTH OF CAMELLIA SINENSIS

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ABSTRACT

Introduction: The need for sustainable food production is now urgent as the severity of climate change increases. Plasma agriculture is a promising and newly emerging low carbon technology developed to improve food production, security, and yield. Plasma is the fourth state of matter consisting of free radicals of oxygen and nitrogen, UV light, and excited atoms and molecules. Generation of plasma at atmospheric pressure and low temperature makes it safe to apply to living tissue. Cold atmospheric plasma (CAP) has been used in agriculture mainly in surface sterilization due to its bactericidal properties. In recent years, CAP has been shown to enhance seed vigour and crop development. However, there is no research on the effects of CAP on seeds of tea (Camellia sinensis). Our hypothesis is that exposure of tea seeds to CAP, using plasma generated from air and nitrogen gas, will enhance developmental events such as germination rate, uniformity, and post-germination growth, collectively called seed vigour. **Methods:** Air plasma (AP) and nitrogen plasma (NP) were applied using a plasma jet device. Before treatment, the seeds were subjected to a float test to check their viability. Seeds were kept in water overnight where viable seeds sank. The sunken seeds were collected and dried overnight at ambient temperature. Seeds were then treated with AP for up to 12 minutes and NP for up to 10 minutes. For germination tests, the seeds were sown in polystyrene boxes and incubated at 25ºC/light and germination was scored daily. To test the impact of cold stratification, the seeds were stored at 4ºC/dark for 4 months and then treated with plasma. For seedling emergence testing, after exposure to plasma, seeds were sown in soil and kept under 16/8h 22/15ºC day/night cycle. Emergence was recorded and seedling length was measured daily for 60 days. At 60 days, the seedlings were harvested and final shoot length, fresh and dry weight, and leaf number were measured. **Results:** Exposure to NP for 2, 4, and 8 minutes increased germination with 4 minutes giving the greatest increase of 15%. All AP treatments reduced final germination below the control. The maximum final germination of 86% was seen in NP 4 minutes. After 4 months of cold stratification, the patterns with NP were similar, however, 12 minutes of AP resulted in more germination than the control. AP or NP treated and control seeds reached 50% germination (T50) in 1 month, which is 2 months earlier than non-stratified seeds. No significant differences were observed in total seedling emergence from soil. All treatments except 4 minutes of air resulted in taller seedlings with the tallest at NP 8 minutes. At the 60th day, fresh and dry weight of the seedlings were bigger in 8 minutes of treatment as was the number of leaves. During 60 days, the growth pattern of the seedlings did not change as seedlings from seeds treated with AP and NP for 4 and 8 minutes consistently grew faster than the controls to produce taller seedlings. **Conclusion:** Camellia sinensis germination doesn't change significantly upon exposure of seeds to CAP, except for exposure to 4 minutes of NP. However, it is clear that prolonged cold stratification of seeds decreases dormancy level and results in quicker germination, following plasma treatment. Although the

final seedling emergence is similar across the treatments, AP and NP exposure increased post emergence seedling growth in terms of height, biomass, and leaf number. Tea seeds exposed to either air or nitrogen plasma grew more rapidly and taller in the seedling stage compared to the controls. Eight minutes of air or nitrogen plasma treatment resulted in more biomass production in the seedlings which is supported by increased fresh and dry weight and the number of leaves. This indicates that plasma treatment affects different developmental stages of a plant, be it pre- or post-germination. For Camellia sinensis, cold atmospheric plasma using air or nitrogen positively affects the post-germination developmental events.

Keywords: Plasma Agriculture, Seed Vigour

ASSESSMENT OF THE MORPHOLOGICAL AND PHYSIOLOGICAL RESPONSES OF CUCURBITACEAE ROOTSTOCK HYBRID COMBINATIONS TO WATER DEFICIT

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ABSTRACT

During the period 2024-2025, a comparative assessment of different hybrid combinations of the Cucurbitaceae family to water deficit was conducted at the Maritsa Research Institute of Vegetable Crops - Plovdiv. The aim of our study was to characterize different rootstock hybrid combinations of the Cucurbitaceae family to the abiotic stress factor drought during the seedling phase and to create a more complete characterization of their drought tolerance for breeding purposes. In order to analyze the physiological response of cucurbit crops to drought, a vegetation experiment was conducted with the following hybrid combinations of the Cucurbitaceae family: CM720 x Turban x Muskatna x CM720 (12 BC1) x NY (4-5-1); LDL (5n) x Muscatna carotinova; CM720 x Muskatna x CM720 (1-2-4, 12 BC1) x NY (4-5-1); Cucurbita moschata x NY (4-5-1) x Bolivia; CM720 x Bolivia; CM720 × Turban × Muskatna × CM720 (1-2-4, BC_2) × NY (4-5-1) . The experiment was conducted under controlled conditions in a greenhouse. The hybrid combinations were grown under three contrasting irrigation levels: control (non-stress (NS) conditions) and water deficit conditions (drought stress (DS)). The experimental plants were grown under 50% and 100% reduction in irrigation rate for a period of 12 days. Different screening approaches were used, including different morphological parameters (biomass, plant height, root length, fresh weight, dry weight of plants and leaf area) and physiological parameters (chlorophyll fluorescence induction parameters). Based on the complex assessment of morphological indicators and the analysis of chlorophyll fluorescence, the rootstock hybrid lines show clearly pronounced differences in their tolerance to water deficit. The highest tolerance to reduced irrigation rates is exhibited by the hybrid combination CM720 x Turban x Muskatna x CM720 (12 BC1) x NY (4-5-1), which preserves the morphological and physiological indicators to the greatest extent, while the hybrid combinations LDL/5n*Muscatna carotinova and CM720 x Muskatna x CM720 (1-2-4, 12 BC1) x NY (4-5-1) are the most sensitive to the abiotic stress factor water deficit.

Keywords: Cucurbitaceae, abiotic stress, drought tolerance, chlorophyll fluorescence, rootstock

PRELIMINARY SCREENING OF TRYPSIN INHIBITOR ACTIVITY IN FABA BEAN SEEDS IN RELATION TO THE BEAN BEETLE DEVELOPMENT

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ABSTRACT

The bean beetle (Acanthoscelides obtectus Say, Coleoptera: Chrysomelidae) is a significant pest of stored and field legumes and one of the most destructive post-harvest pests of faba bean. Larvae bore into seeds, consuming up to 40 - 50% of seed, which results in loss of weight, germination capability, and eventually unmarketability. Suitability and susceptibility of a certain variety strongly depends on seed qualitative traits and presence of antinutritive compounds. Protease inhibitors are one of major compounds responsible for reducing seed palatability and susceptibility to insect attacks. They are naturally occurring compounds and part of plant defense mechanisms that interfere with insect digestive biochemistry by inhibiting protease activity in insect gut. They are particularly abundant in storage tissues such as seeds. Despite extensive research on the potential use of protease inhibitors in crop protection, their practical biotechnological application in the management of stored-product pests remains largely unexplored. This work aimed to assess the activity of trypsin inhibitor (TI) in seeds of 17 faba been varieties (using spectroscopy method) and the correlation with the bean beetle progeny production after 1 ,2, 3 and 4 months (PP) and % of consumed seeds (%CS), assessed in a “no-choice” biotest. PP after 4 months ranged from 17 to 109 individuals, and %CS from 0.67 to 28.2%, with differences being statistically highly significant. The activity of TI ranged from 11.01 to 60.71% across varieties. Results revealed moderate to strong correlations between TI activity and %CS, depending on the variety. These findings indicate that, in addition to TI activity, other seed compounds and/or morphological traits contribute to faba bean susceptibility to this pest and influence faba bean - the bean beetle interactions. Moreover, the results point out that some tested varieties with very low or none seed damage, as well as very low progeny production, can serve as valuable source of resistance for breading programs. Moreover, these varieties can be recommended for cultivation in region where this pest is present in high abundance. The importance of developing alternative strategies for stored product pests’ biorational control will evidently increase the interest in protease inhibitors.

Keywords: Acanthoscelides obtectus Say, varietal difference, progeny production, consumed food

AGRONOMIC BIOFORTIFICATION WITH ZINC, SELENIUM, IRON AND BORON: HUMAN NUTRITION-ORIENTED FERTILIZER DESIGN FOR IMPROVING CROP NUTRITIONAL QUALITY AND STRESS DEFENSE

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ABSTRACT

Micronutrient deficiencies, commonly referred to as hidden hunger, remain a major global challenge at the intersection of agricultural productivity, food security, and public health. Agronomic biofortification offers a practical and scalable strategy to improve the nutritional quality of crops by increasing the concentration and bioavailability of essential micronutrients in edible plant tissues. Zinc (Zn), selenium (Se), and iron (Fe) are well-established targets in biofortification programs, while boron (B) is gaining increasing attention due to its critical roles in plant cell wall integrity, reproductive development, sugar transport, crop quality, and its potential relevance to human mineral metabolism. This review examines recent advances in Zn, Se, Fe, and B biofortification through soil and foliar fertilization, chelated formulations, controlled-release fertilizers, nanofertilizers, biostimulants, and microbial-assisted nutrient delivery systems. It highlights the key factors determining biofortification success, including nutrient form, application dose and route, crop species, soil properties, environmental conditions, and nutrient interactions. Evidence from the literature indicates that targeted micronutrient fertilization can enhance nutrient accumulation in edible plant parts while also supporting crop resilience under drought, salinity, oxidative stress, and nutrient limitation. Particular emphasis is placed on advanced fertilizer technologies that improve nutrient-use efficiency, reduce environmental losses, and enable more precise nutrient delivery. The original contribution of this review is the proposal of Human Nutrition-Oriented Fertilizer Design, a conceptual framework that redefines fertilizers not only as yield-enhancing inputs but also as functional agricultural technologies designed to improve crop nutritional density, strengthen stress resilience, enhance nutrient-use efficiency, and contribute to human nutrition and public health. By integrating Zn, Se, Fe, and B biofortification with next-generation fertilizer technologies, this framework provides a multidisciplinary roadmap for developing functional fertilizers aligned with sustainable agriculture, food quality, and nutrition-sensitive crop production.

Keywords: Agronomic biofortification, Zinc, Selenium, Iron, Boron, functional fertilizers, controlled-release fertilizer, nanofertilizer, microbial fertilizer, nutrient-use efficiency, Human Nutrition-Oriented Fertilizer Design

EVALUATION OF A MICRONUTRIENT-DOMINANT-BASED LIQUID FOLIAR FERTILIZER STUDY IN TERMS OF PLANT NUTRITION AND STRESS MANAGEMENT

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ABSTRACT

This draft evaluates the M-X micronutrient-dominant liquid fertilizer candidate developed under IGSAS R&D center project. The formulation is positioned as a foliar support product containing micronutrients and ammonium nitrogen. Although micronutrients are required in trace amounts, they are essential for chlorophyll synthesis, redox balance, nitrogen metabolism, reproductive development and cell wall function. M-X can be framed as an independent technical note or as a comparative formulation within a broader M-SYRUP efficacy study. Literature indicates that foliar micronutrient management can provide rapid nutritional support and bypass soil-related nutrient availability constraints. This study evaluates the effects of the micro-element-rich liquid fertilizer designated as M-X—developed under IGSAS R&D Center project—on plant nutrition and recovery from stress. The product is positioned as a supplementary formulation containing iron, copper, boron, molybdenum, and ammoniacal nitrogen. Although required only in small quantities for plant metabolism, micro-elements play a role in numerous critical processes, such as chlorophyll synthesis, redox balance, nitrogen metabolism, pollen viability, and cell wall stability. Consequently, the M-X product family can be the subject of a standalone research paper or serve as a comparative control formulation against more complex biostimulant products, such as M-SYRUP. Existing literature indicates that foliar micro-element applications offer the advantages of providing rapid nutrient support and overcoming limitations associated with soil-based nutrient uptake.

Keywords: micro-element, foliar fertilizer, plant nutrition, horticulture, stress management

POTENTIAL OF A MICRONUTRIENT, AMINO ACID AND PLANT SIGNALING COMPOUND-BASED LIQUID FERTILIZER FOR FROST AND POST-STRESS NUTRITION

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ABSTRACT

This manuscript evaluates a Potential of a Micronutrient, Amino Acid and Plant Signaling Compound-Based Liquid Fertilizer for Frost and Post-Stress Nutrition liquid fertilizer candidate containing micronutrients, amino acids and plant signaling compounds for frost and post-stress nutrition. The formulation concept combines Zn, Mn, Fe, Cu, B and Mo, an amino acid fraction, ammonium nitrogen and low-dose nitrophenolate/salicylate-based activators. Laboratory-scale preparation indicated that the candidate could be positioned for orchard recovery after frost, protection of chlorophyll-related functions, reduction of micronutrient limitation and mitigation of stress-induced physiological decline. Literature supports the relevance of foliar nutritional strategies in frost tolerance, the stress-regulatory role of salicylic acid and the photosynthesis-promoting effects of nitrophenolate-based biostimulants. The manuscript frames the product as a field-trial-ready formulation concept rather than a final efficacy claim. This study evaluated the post-frost and post-stress nutritional potential of a liquid fertilizer—containing micro-elements, amino acids, and plant signaling components—that was developed under a project dedicated to this specific purpose. The formulation was approached as a modular product combining trace elements (such as zinc, manganese, iron, copper, boron, and molybdenum), ammonium nitrogen, and an amino acid fraction, alongside low doses of nitrophenolate- and salicylate-based stimulating components. A homogeneous mixture was prepared at the laboratory scale, and the product was assessed for its potential use in orchards to facilitate recovery after frost, preserve chlorophyll activity, reduce the risk of micronutrient deficiencies, and mitigate stress-induced physiological decline. Existing literature indicates that potassium applications can enhance frost tolerance, salicylic acid can regulate antioxidant defense and stress signaling pathways, and nitrophenolates can support photosynthetic activity and growth parameters. Rather than asserting definitive final efficacy, the present study provides the scientific rationale and protocol framework necessary to advance the product to field trials.

Keywords: liquid fertilizer, frost stress, microelement, amino acid, sodium nitrophenolate, sodium salicylate

EVALUATION OF MODULAR LIQUID FERTILIZERS CONTAINING SNP, SA-NA, NA-NAA, CPPU AND GA3 IN TERMS OF ROOT DEVELOPMENT, STRESS MANAGEMENT AND FRUIT DEVELOPMENT

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ABSTRACT

This draft evaluates modular plant activation strategies containing sodium nitrophenolate, sodium salicylate, Na-NAA, CPPU and GA3 for rooting, stress management and fruit development. These compounds are associated with photosynthetic activation, stress signaling, adventitious rooting, cytokinin-like fruit enlargement and gibberellin-related developmental regulation. Their integration into fertilizer-related products may create high value, but this is the most regulation-sensitive product family because of dosage, phenological timing, residue and phytotoxicity concerns. Three modules are proposed: stress management, rooting and fruit enlargement/quality. This draft article examines, within the framework of existing literature, the modular applications of plant activators—evaluated under the IGSAS R&D Center Project—for rooting, stress management, and fruit development. Sodium nitrophenolate is associated with photosynthetic activity and growth regulation; sodium salicylate/salicylic acid with stress signaling and systemic resistance; Na-NAA with adventitious rooting and fruit set; CPPU with cell division and fruit enlargement via cytokinin-like activity; and GA3 with germination, shoot elongation, flowering, and fruit development. Integrating these components into liquid fertilizer formulations can yield high-value products; however, they constitute a highly sensitive product category regarding dosage, phenological stage, residues, regulations, and phytotoxicity. Therefore, rather than proposing a single product, the study suggests three modules: a stress management module, a rooting module, and a fruit enlargement/quality module. For peer-reviewed publication, each module requires support through specific dose-response trials and safety assessments.

Keywords: plant growth regulator, sodium nitrophenolate, sodium salicylate, NAA, CPPU, GA3

SUSTAINABLE WEED MANAGEMENT IN WHEAT: COMPARING CROSS-DRILL PLANTING AND CHEMICAL WEED CONTROL

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ABSTRACT

Weed infestation is one of the major constraints limiting wheat productivity in the Dera Ismail Khan, South KPK, Pakistan, due to severe competition for nutrients, moisture, light, and space. To evaluate the effectiveness of integrated weed management practices on weed dynamics, crop growth, nutrient uptake, yield attributes, yield, and economics of wheat cultivation. Weed infestation remains one of the major constraints to wheat production, reducing yield and increasing production costs. This study evaluated the effectiveness of cultural and chemical weed management practices during the 2022–2023 Rabi season at the Arid Zone Research Centre, Dera Ismail Khan, Pakistan. The experiment compared untreated control, cross-drill sowing (15 × 15 cm), hand weeding, and several herbicide treatments (Clincher, Walter Super, Buctril Super, Super Power Killer, and Ally Max). Among all treatments, cross-drill sowing produced the highest grain yield (7.59 t ha^{-1}), biomass yield (7596.7 kg ha^{-1}), spike density (512 spikes m^{-2}), grains per spike (33.3), and crop growth rate (26.97 g m^{-2} day^{-1}), while also achieving the greatest economic return. Herbicide treatments improved wheat performance compared with the untreated control but remained less effective than the cross-drill method. The untreated control recorded the lowest grain yield (6.87 t ha^{-1}), spike density (172 spikes m^{-2}), and crop growth rate (13.47 g m^{-2} day^{-1}). The findings demonstrate that cross-drill sowing effectively suppresses weed competition and enhances wheat productivity while reducing dependence on chemical herbicides. This eco-friendly and economically viable practice offers a sustainable approach to weed management and supports environmentally responsible wheat production.

Keywords: Herbicides, mechanical practices, sustainable agriculture, weed management, wheat farming

DETERMINATION OF EFFICACIES OF SOME FUNGICIDES IN CONTROL OF DAMPING-OFF (RHIZOCTONIA SOLANI + FUSARIUM SPP.) DISEASE ON THE COOL-SEASON TURFGRASSES IN AUTUMN PLANTING

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ABSTRACT

In this study, efficacy trials was conducted with some plant protection products against damping-off disease, which is common in cool-season turfgrasses in autumn planting. The material of the research consists of isolates of Rhizoctonia solani and Fusarium which is isolated and diagnosised from turfgrass, 7 cool season turfgrass species (Lolium perenne, Festuca arundinacea, Festuca ovina, Festuca rubra var. commutata, Festuca rubra var. rubra, Poa pratensis, Agrostis tenuis) and 3 preparates which one of them is plant activator (Lactobacillus acidophilus fermantation product) and 2 chemical fungicides (Tolclofos-methyl + Thiram, Hymexazol). The study was conducted on the experimental field belonging to the Department of Plant Protection, Faculty of Agriculture, Agean University. The trial was established randomized as split plot with four replications. Two factors were considered fungicide applications and turfgrass species. Determination of the trial was based on the severity of the disease and the efficacies of fungicides. As to the results of the research, the evaluations of the plant protection products and turfgrass species on disease severity were found statistically significant. The efficacies of application x species interactions on disease severity were determined significant statisticall as 1% level of probability within all measurements. As a result of the study, three fungicides as [Lactobacillus acidophilus fermantation product (Soil-Set), Tolclofos-methyl + Thiram (Sumiriz-T), Hymexazol (Tachigaren)] used in the trial resulted in promising on the disease control and it has generally been observed that Tachigaren is more effective. In general, it can be said that Festuca ovina is sensitive to diseases, whereas and Festuca rubra rubra are resistant.

Keywords: Turfgrass, damping-off, Rhizoctonia solani, Fusarium spp., fungicide, plant activator.

PRODUCTION COSTS AND CLASSIFICATION OF KEY CONSTRAINTS IN SHEEP FARMING ENTERPRISES: EVIDENCE FROM REŞADIYE DISTRICT, TÜRKIYE

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ABSTRACT

Sheep farming is an important agricultural activity due to its significant contributions to rural development, employment, and livestock production. However, rising production costs and the structural challenges faced by producers have increasingly constrained the development and economic performance of sheep farming enterprises. This study aimed to determine the socio-economic characteristics of sheep farming enterprises, evaluate their production costs, and classify the key constraints encountered by producers using exploratory factor analysis in Reşadiye District of Tokat Province, Türkiye. The primary data of the study were collected through face-to-face surveys conducted with 117 sheep farming enterprises selected using a stratified sampling method. Descriptive statistics were used to evaluate the socio-economic characteristics of the enterprises, production costs were calculated, and exploratory factor analysis was employed to identify the underlying dimensions of the constraints perceived by producers. The suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity, while the reliability of the scale was evaluated using Cronbach's Alpha coefficient. The KMO value was 0.514, Bartlett's Test of Sphericity was statistically significant ($p < 0.001$), Cronbach's Alpha coefficient was 0.807, and the four-factor solution explained 55.10% of the total variance.

The results indicated that the average age of the producers was 44 years, with an average farming experience of 19 years, and that most producers had completed primary or secondary education. Among the variable production costs, family labor represented the largest cost component (35.5%), followed by concentrate feed (31.5%) and roughage (11.7%). Veterinary and animal health expenses (4.4%) and hired labor costs (6.5%) were identified as other important variable cost components. Exploratory factor analysis revealed that the constraints perceived by producers were grouped into four major dimensions: structural and environmental constraints, institutional support and production-related constraints, technical infrastructure and farm continuity constraints, and production risk and input-related constraints. The findings indicate that production costs in sheep farming enterprises are largely driven by labor and feed expenses, while the challenges encountered by producers extend beyond economic issues to include structural, technical, and institutional constraints. Therefore, policies aimed at reducing feed costs, strengthening producer organizations, improving agricultural extension and advisory services, and implementing region-specific support programs would contribute to improving the economic performance, resilience, and competitiveness of sheep farming enterprises.

Keywords: Sheep farming, production costs, exploratory factor analysis, production constraints, Türkiye

SUSTAINABILITY, SELF-SUFFICIENCY AND MARKET POTENTIAL OF THE SUNFLOWER VALUE CHAIN IN SERBIA

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ABSTRACT

Sunflower (*Helianthus annuus* L.) is one of the most important industrial crops in Serbia, with a key role in agriculture, oil industry and export. The aim of the work is to examine the production performance, self-sufficiency, industrial transformation, market potential and foreign trade of the Serbian sunflower sector in the period 2016-2025. The analysis uses official data from the FAOSTAT, ITC TRADE MAP, and Statistical Office of the Republic of Serbia, with the application of descriptive statistics and foreign trade indicators. The results indicate the stability of domestic production. The average area was 229,474.1 ha, production 642,171.3 tons, and yield 2.8 t/ha. Serbia maintains a high degree of self-sufficiency (118.7%) and a low dependence on imports (3.5%), which confirms that production significantly exceeds domestic demand. The research reveals a high market capacity and an exceptional degree of processing rate, since on average 71% of the produced sunflower seeds are finalized in domestic capacities, while about 18% are exported. The foreign trade analysis confirms a strong export orientation, whereby export flows are significantly more stable than import flows, and average annual exports are up to six times higher than imports, which keeps high added value in the country.

Keywords: Sunflower, Processing rate, Self-sufficiency, Marketability, Foreign trade, Serbia.

EVALUATING THE IMPACT OF DIGITAL TWIN ADOPTION ON PRODUCTIVITY AND ENERGY EFFICIENCY IN ORGANIZING UZBEK DIGITAL ENTERPRISES

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ABSTRACT

This paper examines the impact of digital twin adoption strategies and their operational and economic effects on the productivity of Uzbek manufacturing enterprises. The main aim of this study is to investigate the enterprise-level reaction to digital transformation in industrial production systems which requires firms to be classified into groups high-performing, moderately performing and low-performing according to their technological maturity and energy efficiency. This study investigates the main sources of productivity differentials. By utilizing Analytic Hierarchy Process (AHP) analysis, our findings suggest that digital twins have a significant positive effect on production efficiency and energy performance. We use a sample of medium and large enterprises operating in the Uzbek manufacturing sector over the period 2015–2024 to analyze the relationship between operational risk and energy consumption risk and its impact on firm-level productivity. The results show that there is a strong positive relationship of digital twin technologies as well as their integrated application on the improvement of the overall performance of manufacturing enterprises for the sustainable development of industrial systems. The results show that the productivity effect is heterogeneous and depends on the level of the digital infrastructure, with evidence that varies across firm sizes and industrial segments. Finally, we reach important policy implications for the digital economy framework.

Keywords: Digital Twin Adoption, Enterprise Productivity, Energy Efficiency

IOT-AS-A-SERVICE BUSINESS MODELS FOR SMALL FARMS IN UZBEKISTAN

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ABSTRACT

This paper explains how IoT-as-a-Service was successfully used as part of the digital transformation process for the small farming sector in Uzbekistan. Crushed financial barriers and technical limitations among small farms are an increasingly important concern for digital agriculture adoption due to industry demands for more efficient, affordable and data-driven farm management. This study suggests that the final adoption response of the farmers is dominated by the perceived usefulness due to the various financial, technical and institutional factors. Selective correlation and regression analysis studies were performed to determine the role of the subscription-based service model as an adoption parameter for the structural equation modelling work. Statistical comparisons were made between groups of IoT users and non-users subjected to different service arrangements, including subscription-based, pay-per-use and bundled-service conditions. Analysis of the survey responses over selected regions, using structural equation modelling and regression analysis, demonstrated that the use of the updated business model can highlight the effect of different cost factors and service conditions on the adoption decisions in these farms. The results revealed that the application of subscription pricing and technical support as service components have significant influences on IoT adoption. Results showed that factors such as the affordability of the services and their accessibility, reliability and technical support and data security can influence the adoption and continued-use characteristics of the farmers. The aim of this work was to improve IoT accessibility and demonstrate the practical use of service-based business models in small farms with better affordability and technical support. It concludes that flexible pricing, reliable connectivity and continuous technical support can dramatically improve the way smart farming projects can be introduced, managed and expanded.

Keywords: IoT-as-a-Service, small farms, digital agriculture, subscription-based services

CONTROL OVER DIGITAL ACCOUNTS AND AGRICULTURAL DATA TO MONITOR AGRIBUSINESS DEVELOPMENT IN RURAL AREAS OF UZBEKISTAN

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ABSTRACT

Reducing digital exclusion and improving agricultural data control could contribute significantly to achieving the national goal of poverty reduction in rural Uzbekistan by 2030, while improving agribusiness performance and creating sustainable employment opportunities. This paper analyses digital account control during the implementation of agricultural data systems for agribusiness monitoring in Uzbekistan, focusing on digital access, data management and rural development outcomes. To obtain reliable results, an approach combining structural equation modelling and sample-selection correction has been proposed. This study examines agribusiness development under conditions of limited digital access, weak data management, financial constraints and unequal participation opportunities in agricultural markets. The aim is to provide reliable information for rural decision-makers while addressing key rural development challenges, including digital inclusion, data transparency and sustainable agribusiness growth. An integrated empirical model incorporating multiple dimensions of the rural agribusiness system was developed and estimated using structural equation modelling and the Heckman selection model. The findings indicate substantial differences and selection effects, while reducing inequalities over the study period will depend on the adoption of targeted digital control measures and improvements in agricultural data systems. The empirical results demonstrate the importance of digital account control in enhancing rural agribusiness performance, strengthening monitoring processes, improving data reliability and increasing participation in digital systems.Policy recommendations are provided to support authorities in improving the assessment of agribusiness development associated with digital participation while accounting for selection bias and rural disparities.

Keywords: Digital account control, agricultural data governance, agribusiness development

DIGITAL TWIN AS A SERVICE: AN AFFORDABLE BUSINESS MODEL FOR SMALLHOLDER DIGITALISATION IN UZBEKISTAN

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ABSTRACT

With rising technology costs and limited rural incomes, there has been an increasing demand for digitalisation of smallholder farming, which gives rise to a large number of service opportunities. The Digital Twin as a Service (DTaaS) allows in-field measurement of the performance of farms during a production cycle – that is without disrupting the operation and introducing costs such as a complete digital infrastructure. Smallholder enterprises were tested under different adoption periods to investigate the cost–performance relationship of DTaaS with particular focus on the impact of affordability and technical support quality. As a result, it is of great importance not only to ensure the affordability of the service itself but also to reduce pressure on the smallholder budget. Commonly used methods including the start–stop survival method, Weibull modelling, the Gompertz regression method and the quadratic model are described and applied. The analysis of the available panel data combined with quadratic regression enabled the study to propose non-linear relationships between the adoption intensity and the farm performance. A comprehensive literature review confirms limited attention to affordability and service models to address these constraints and therefore the potential value of the provision of digital twin services and associated technical support. The experimental results indicated that the survival prospects of farms were improved with increasing levels of adoption, and this effect became more and more pronounced with increasing service affordability. It is expected that this model can be used as a practical tool for affordable digitalisation of smallholder farms. The proposed approach is able to provide predicted survival values over time.

Keywords: Digital Twin as a Service, smallholder farming, service affordability

SWOT ANALYSIS OF AGRICULTURAL WASTE MANAGEMENT FROM A CIRCULAR ECONOMY PERSPECTIVE IN TÜRKIYE

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ABSTRACT

Türkiye generates substantial amounts of agricultural waste due to its extensive agricultural production capacity, creating significant opportunities for renewable energy production and the transition to a circular economy. However, despite the considerable biomass potential of residues from cereals, corn, cotton, sunflower, and other agricultural products, the utilization of these resources remains limited because of technological, logistical, and institutional challenges. This study aims to identify strategic priorities for the circular utilization of agricultural waste in Türkiye, with particular emphasis on renewable energy production and high value-added products through a SWOT analysis. SWOT factors were identified through a comprehensive literature review and expert evaluations, and their relative importance was assessed to support strategic decision-making. The findings reveal that Türkiye's abundant agricultural biomass resources, diversified agricultural production, and the renewable nature of biomass energy constitute its primary strengths. In contrast, dispersed agricultural waste generation, high collection and transportation costs, storage difficulties, and insufficient technological infrastructure represent the major weaknesses. The most prominent opportunities include the European Green Deal, renewable energy incentives, carbon reduction policies, and rural development programs, whereas climate change, economic instability, increasing investment costs, and regulatory uncertainties emerge as the main threats. Overall, the analysis indicates that the strengths and opportunities outweigh the identified weaknesses and threats, suggesting that agricultural waste can make a greater contribution to sustainable energy production if supported by effective incentive mechanisms, regional planning, and improved logistics infrastructure. The originality of this study lies in adopting an integrated perspective that combines climate change, the circular economy, value creation from agricultural waste, and socio-economic transformation within a single analytical framework. Beyond renewable energy production, the findings highlight the potential of agricultural waste to generate high value-added products, such as bio-based materials and cosmetic ingredients, while creating new employment opportunities for women and young people and contributing to rural development. Accordingly, the proposed framework provides both strategic guidance for policymakers and a comprehensive roadmap for advancing circular agriculture in Türkiye.

Keywords: Agricultural waste, circular economy, climate change, SWOT analysis

DIGITAL, GREEN AND TECHNICAL SKILLS GAPS IN CLIMATE-SMART AGRICULTURE: A CROSS-COUNTRY ANALYSIS FOR THE AGRINOVA SUSTAINABLE FARMING SOLUTIONS HANDBOOK

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ABSTRACT

Climate-smart agriculture increasingly depends on digital, automated, and resource-efficient technologies, yet effective adoption also requires farmers, small and medium-sized enterprises, advisers, and vocational education providers to develop the competencies needed to select, operate, and adapt these solutions. This study identifies recurrent skills gaps associated with smart and sustainable farming and examines how the findings were translated into the AGRINOVA Sustainable Farming Solutions Handbook. The analysis used a cross-country qualitative design covering Austria, Albania, Bulgaria, Greece, Romania, and Türkiye. Evidence was synthesized from 42 documented good practices, national stakeholder consultations, skills-gap reports, focus-group records, and desk research on agricultural innovation and vocational education. The practices were organized into six thematic domains covering circular economy and sustainable energy, robotics and smart machinery, precision input management, advanced cultivation and biological integration, controlled-environment agriculture, and data-driven farming systems. Across countries and stakeholder groups, recurring gaps were identified in digital literacy and agricultural data interpretation; sensor, Internet of Things, and automation use; precision irrigation and input management; equipment calibration, maintenance, and troubleshooting; sustainability and resource-efficiency assessment; and cost-benefit, innovation, and advisory skills. The findings indicate that technology availability alone does not ensure uptake: the capacity to interpret data, make operational decisions, and evaluate technical and economic feasibility remains a major implementation constraint. The resulting handbook translates these findings into practical competence areas, learning objectives, and case-based training priorities. The study supports a practice-oriented approach to agricultural vocational education that combines technical, digital, green, and entrepreneurial competencies to strengthen the adoption of climate-smart farming solutions.

Keywords: Climate-smart agriculture, skills gaps, digital agriculture, vocational education and training, technology adoption

COMMERCIAL VERMICOMPOST PRODUCTS IN EUROPE: MARKET COVERAGE, BIOLOGICAL STANDARDIZATION GAPS, AND SCIENTIFIC VALIDATION

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ABSTRACT

Vermicompost is increasingly marketed as a nutrient source, soil improver, and biologically active input for sustainable crop production. However, its agronomic effects depend on feedstock, earthworm taxon, processing conditions, maturity, microbial communities, humic fractions, and application dose. This heterogeneity raises a practical question: do commercial products provide sufficient information to support reproducible agronomic use and evidence-based product selection. A structured survey of the European vermicompost market was conducted using producer websites, online retailers, and the Enterprise Europe Network database. Products were included when a dedicated commercial description was available and the producer or verified distributor operated in Europe. Identical offers marketed through localized storefronts were counted once. Product data were documented between January 2025 and July 2026. The final dataset comprised 146 distinct products originating from or distributed across 25 European Union Member States, together with Norway, the United Kingdom, and Türkiye. Product documentation was assessed for earthworm identification, nutrient composition, pH, humic substances, microbial information, standardization status, retail price, and peer-reviewed validation of the exact commercial formulation. As main findings, an earthworm genus or species was identified for 54 of the 146 products, whereas NPK composition was declared for 15, pH for 18, quantified humic or fulvic acids for four, and any microbial information for only ten. None of the products reported microbial community composition at functional-guild level. Only one producer supplied accredited batch-specific analyses that included microbiological parameters, and independent peer-reviewed validation of the exact marketed product was identified for only one formulation. Packaged solid vermicomposts were commonly priced at approximately EUR 2.0–3.5/kg, although the full market range extended from about EUR 0.14/kg for bulk materials to EUR 8–12/kg for a highly characterized product. The survey demonstrates that geographical market expansion has not been accompanied by equivalent biological standardization. Regulation (EU) 2019/1009 addresses product safety, contaminant limits, and labelling, but does not require minimum indicators of biological efficacy. Batch-level declaration of feedstock, earthworm species, maturity, pH, electrical conductivity, nutrient and humic profiles, microbial functional groups, and standardized plant-growth and disease-suppressiveness bioassays would substantially improve product comparability, experimental reproducibility, and agronomic decision-making.

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Keywords: vermicompost, worm castings, soil improvers, biological quality, microbial characterization, product standardization

EFFECTIVE USAGE OF TECHNOLOGY IN AGRICULTURE

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ABSTRACT

Today, technology is being used increasingly widely in the field of agriculture. As technology has become more prominent and started to make a significant difference in agriculture, several important challenges have emerged. Access to up-to-date technologies is not equally easy for everyone in the agricultural sector. Advanced technologies are often expensive and also require significant investment. Therefore, in order to ensure the effective use of new technologies in agriculture and to make them accessible to broader segments of society, collective solutions and approaches that can be implemented on a large scale are needed. Accordingly, it is important to raise farmers' awareness and to establish systems through which farmers can collectively implement specific practices in an organized manner, with the support of public institutions and other relevant organizations. Such approaches can enable these practices to be implemented across larger groups and regions in a systematic and coordinated manner. In this way, rather than placing the entire economic burden on an individual farmer, institutions or groups of farmers can collectively undertake the implementation of advanced technological solutions that can benefit many farmers. Bringing farmers together and sharing the costs and responsibilities can lead to more economical, sustainable, accessible, and cost-effective solutions that are easier to implement. This study provides important analyses demonstrating that the collective and regional use of current technologies by multiple farmers, through shared solutions, can contribute to more efficient, sustainable, and accessible practices in agriculture, thereby increasing productivity and improving overall agricultural performance.

Keywords: Optimization, Technology, iot , sensors , drone , image processing

EFFECTS OF COLD ATMOSPHERIC PLASMA ON SEED GERMINATION AND SEEDLING VIGOUR IN ALLIUM AMPELOPRASUM

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ABSTRACT

The growing concern of climate change has made sustainable food production an urgent global priority. Plasma agriculture is an emerging low-carbon technology with the potential to improve crop productivity, food security and yield. Plasma, commonly described as the fourth state of matter, contains reactive oxygen and nitrogen species, ultraviolet radiation, and excited atoms and molecules. When generated at atmospheric pressure and low temperatures, plasma can be safely applied to living biological materials. Cold atmospheric plasma (CAP) treatment has been used in agriculture for surface decontamination because of its antimicrobial properties. More recently, studies have shown that CAP treatment can improve seed vigour and support crop growth and development. However, the effects of CAP on seeds of Allium ampeloprasum have not yet been widely investigated. We hypothesize that exposing A. ampeloprasum seeds to CAP generated using ambient air will enhance seed vigour, including germination rate and uniformity, as well as post-germination growth. Seeds of the leek cultivars İnegöl-92 and Kartalkalem were treated using two CAP systems. A corona discharge device was used to apply intermittent plasma–pause treatments (pulses), whereas a plasma jet system was used for continuous exposure and distance-based assays. Seeds were surface sterilized with bleach prior to treatments and then exposed to plasma for increasing durations of up to 10 minutes. Germination was assayed on water at 10°C/light. The germinated seeds were subsequently assessed for seedling vigour by transferring them to a slope test system to measure seedling root and shoot growth. Variation among experiments was explained by comparing previous results, focusing particularly on changes in the control groups' (time to reach 50% germination) as a possible indicator of seed after-ripening during cold storage. Across the tested CAP conditions, germination was not consistently improved. Corona pulse treatments were similar to the control in both a series of 3 second plasma:10 seconds pause (3:10) cycles or 16:4 cycles. Varying the distance between the nozzle of the plasma jet and the seed surface also yielded no significant results. With the plasma jet, seeds are subjected to continuous plasma exposure. Short treatments such as 0.5, 1, and 2 minutes were similar to the control, while longer exposures delayed or reduced germination, and this varied between cultivars. In contrast, certain CAP treatments were associated with increased seedling vigour. Slope tests of plasma jet treated seeds showed cultivar-dependent growth responses. Inegol displayed strong stimulation in seedling root and shoot growth after 0.5- and 1-minute plasma exposures. While Kartalkalem showed a dose-dependent pattern across treatments; durations up to 2 minutes increased root and shoot growth with a decrease observed in 4 and 6 minutes, followed by a peak in 8 minutes. In the corona plasma experiment, the 8-pulse treatment from the 16:4 s plasma:pause regime showed faster root growth compared to the 3:10 s plasma:pause setup. Comparisons among control groups from germination tests performed at different dates showed decreasing T50 values over time, suggesting that the seed lot continued to after-ripen during

storage, including at -20°C and -80°C. Overall, CAP did not consistently improve leek germination and even became inhibitory, and the seeds showed a biphasic response under stronger or longer treatments. Alternatively, certain treatments were associated with enhanced seedling vigour. These results show that plasma treatment affects seed vigour at different developmental stages, with both positive and negative impacts. For Allium ampeloprasum, cold atmospheric plasma using ambient air shows a positive impact on post-germination events and plant growth.

Keywords: Cold Plasma Application, Plasma Agriculture, Leek Seed Germination

POST-TREATMENT EMERGENCE AND DEVELOPMENT OF MAIZE EXPOSED TO COLD PLASMA FOR GRAIN MOTH MANAGEMENT

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ABSTRACT

The non-chemical protection of maize stored in silos remains particularly challenging because treatments must limit the substantial quantitative and qualitative losses caused during storage by insects and fungal deterioration while maintaining food and feed safety, including control of the risks associated with mycotoxigenic fungi and mycotoxin contamination. Stored-product protection treatments must control insect pests without compromising the biological quality of grains intended for sowing. This requirement is particularly important for maize (Zea mays L.) infested by the grain moth, Sitotroga cerealella (Olivier), whose larvae develop inside the kernels and may affect seed quality. Cold plasma is being investigated as a non-chemical technology for stored-product protection, but its effects on germination and subsequent plant development depend on the plasma source, treatment atmosphere and exposure time. Within the ADER 2.1.7 project, this study evaluated whether cold-plasma treatments applied to maize kernels for S. cerealella management affected seed emergence, plant establishment and growth through reproductive development. Four plasma treatments were compared with an untreated control. V1 and V2 represented argon treatments applied for 6 and 9 min, respectively. V3 and V4 represented cold-plasma treatments performed in an argon atmosphere for 3 and 6 min, respectively. Each treatment and the control comprised 104 kernels, sown individually in eight plug trays containing 13 cells each. Plants were monitored from sowing through the milk stage. The results showed that, by 1 June, V1 produced the highest proportion of established plants (62.5%), compared with 51.0% in the untreated control. The other treatments produced establishment rates of 44.2% for V2, 49.0% for V3 and 48.1% for V4. By 1 August, when the surviving plants had reached the milk stage and formed one or two ears, the final proportion of surviving plants was 51.9% in V1, compared with 46.2% in the control. The remaining three treatments produced final values slightly below that of the control. Among the four plasma treatments, only V1 resulted in numerically higher proportions of both established plants and plants reaching the reproductive stage than the untreated control. These findings demonstrate a protocol-dependent response of maize seeds and indicate that cold-plasma treatments developed for S. cerealella management should be evaluated jointly for insect-control efficacy and the preservation of seed germination and subsequent plant development.

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products and evaluation of its effects on seeds and plants, for sustainable and quality productions".

Keywords: maize, cold plasma, Sitotroga cerealella, seed treatment, plant germination and growth, stored-product protection

DEFINING THE AGRITECH MANAGER: EUROPEAN MULTI-STAKEHOLDER EVIDENCE FOR DIGITAL AGRICULTURE, AKIS AND RURAL DEVELOPMENT

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ABSTRACT

European agriculture is adopting automation, artificial intelligence, and data-intensive technologies faster than many education and advisory systems can adapt. This study identifies competence priorities for the emerging AgriTech Manager and examines implications for Agricultural Knowledge and Innovation Systems (AKIS) and rural development. A multilingual SurveyMonkey questionnaire produced 1,080 entries across six survey instances, of which 820 were complete. Descriptive frequency analysis was verified against exported response counts; SurveyMonkey's integrated AI-assisted functionality was used only for exploratory summarization. Findings were triangulated with 12 national HEI/VET reports from Cyprus, the Czech Republic, Greece, Hungary, Italy, and Romania. Among 850 valid responses to technology questions, automation (75.9%) and artificial intelligence (69.2%) were expected to have the greatest impact, while high investment costs (87.3%) and lack of farmers' digital skills (71.9%) were the dominant adoption barriers. Among 820 complete responses, precision farming (72.0%), sustainable agricultural practices (67.1%), and AI/data analysis (56.8%) were leading technical priorities; 66.8% reported a moderate or large skills gap, and 85.9% favored hands-on training. National evidence shows fragmented provision, uneven rural access, and a recurring need to connect education, farms, technology providers, and advisory actors. AGRITECH, therefore, offers a practical basis for advisor upskilling and AKIS capacity-building, while rural-development impacts remain prospective. Identifiers were removed before analysis, and data handling followed GDPR-aligned project protocols requiring minimization, secure storage, restricted access, and encryption.

Keywords: AgriTech Manager, artificial intelligence, AKIS, agricultural advisory services, rural development

ALTERNATIVE ROOTSTOCK POTENTIAL AND GRAFT COMPATIBILITY OF COTONEASTER NUMMULARIA FOR POME FRUITS

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ABSTRACT

Environmental stresses associated with climate change, including drought, high soil pH, calcareous conditions, and low soil fertility, have increased the importance of developing new rootstocks capable of adapting to diverse ecological conditions in fruit production. Türkiye possesses rich plant genetic resources and numerous naturally distributed wild Rosaceae species, providing considerable potential for the identification of alternative rootstock materials. This study aimed to evaluate the potential of Cotoneaster nummularia a species naturally distributed in Anatolia, as an alternative rootstock for pome fruits and to determine graft compatibility among different rootstock-scion combinations. The study was conducted during 2025-2026 at the experimental area of Gaziantep University İslâhiye Vocational School and the laboratories of the East Mediterranean Transitional Zone Agricultural Research Institute. Healthy C. nummularia genotypes selected from natural populations were budded with Golden Delicious apple, Deveci pear, Eşme quince, and Polat Efe hawthorn. Approximately 11 months after grafting, samples collected from the graft union were examined for anatomical structure, cambial and vascular continuity, necrotic tissue formation, and parenchymatic differentiation. Starch distribution within the tissues was also evaluated using iodine-potassium iodide (IKI) staining. In the Golden Delicious/C. nummularia combination, vascular discontinuity, necrotic areas, irregular orientation of xylem bundles, insufficient xylem differentiation, and extensive parenchymatic tissue formation indicated pronounced anatomical incompatibility. In the Deveci/C. nummularia combination, cambial and vascular continuity was largely established; however, the anatomical trace of the graft union did not completely disappear. In contrast, Polat Efe/C. nummularia showed continuous vascular connections, regular cambial development, and an almost indistinguishable graft union, closely resembling the self-grafted C. nummularia/C. nummularia control. These findings demonstrate that graft compatibility is highly dependent on the specific rootstock-scion combination and indicate that C. nummularia may represent a promising alternative rootstock, particularly for hawthorn genotypes. Further long-term studies evaluating graft compatibility together with environmental stress tolerance, dwarfing potential, yield, and fruit quality are required to determine its practical value in sustainable fruit production.

Keywords: Cotoneaster nummularia, wild genetic resources, alternative rootstock, graft compatibility, histology

CHANGES IN PHYSICAL PROPERTIES OF A CLAY LOAM SOIL BY AGRICULTURAL WASTE APPLICATION

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ABSTRACT

Agricultural sustainability and environmental protection mostly depend on soil management practices. Loss of soil organic matter due to intensive or inappropriate agricultural management systems can destroy soil physical properties and reduce availability of soil nutrients. Hazelnut husk (HH) is one of the most important agricultural waste in Black Sea Region of Türkiye. In this study, the effect of HH application on some physical properties such as, bulk density (BD), total porosity (F), aggregate stability (AS) and saturated hydraulic conductivity (Ks) were investigated in a clay loam soil. After incorporating 5% of HH into the soil, soil samples were incubated for 4 months under field moisture contents in a greenhouse. When soil properties obtained from control treatment compared to HH treatment at the end of 160 days incubation period, HH application significantly increased AS from 17,89% to 25,50%, F from 55,48% to 60,77%, Ks from 1,20 cm/h to 3,55 cm/h and decreased BD from 1,15 g/cm3 to 1,01 g/cm3. AS values had a negative correlation with BD (-0,831**), and positive correlations with F (0,831**) and Ks (0,426*). The Ks values had a significant postive correlation with F (0,580**) values. It was determined that recycling HH as an organic residue helps to improve soil physical properties.

Keywords: Hazelnut husk, aggregate stability, hydraulic conductivity

DIFFERENTIAL RESPONSES OF DURUM WHEAT GENOTYPES TO WATER DEFICIT: PERSPECTIVES FOR THE SELECTION OF RESILIENT VARIETIES

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ABSTRACT

Limited water availability is one of the major factors affecting cereal production in regions exposed to challenging climatic conditions. In this context, improving durum wheat resilience relies particularly on the identification of genotypes exhibiting differential adaptive capacities under water deficit. The present study evaluated seven durum wheat genotypes grown under semi-controlled conditions and subjected to three water regimes: a well-irrigated control treatment and two levels of water deficit. Genotypic responses were characterized using a combination of agronomic, physiological, and morphological parameters, including yield components, cell turgor, and root system characteristics. The results revealed significant variability in genotype performance according to the water regime. Guemgoum Rkhem exhibited a greater capacity to maintain its performance under water deficit, whereas Mohamed Ben Bachir and Fassi showed greater sensitivity. The reduction observed in the studied parameters under water stress nevertheless reflected differential responses among genotypes, indicating the existence of distinct adaptive strategies. These findings highlight the value of combining agronomic, physiological, and morphological traits to identify genotypes with high resilience potential. They also provide perspectives for integrating molecular approaches to characterize the genetic determinants underlying water-deficit tolerance. Such an integrated approach could contribute to guiding breeding programs toward the selection of genotypes better adapted to water constraints and future production conditions.

Keywords: Durum wheat, water deficit, climate adaptation, varietal selection, sustainable agriculture

EFFECT OF ORGANIC WASTE ON SOIL MECHANICAL PROPERTIES AND WORKABILITY

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ABSTRACT

Soil mechanical properties are useful to people interested in land planning, construction and maintenance projects, along with agricultural soil management. Atterberg limits describe the soil consistency under the different soil moisture contents. The objective of this study was to determine the effects of tobacco waste (TOW) application on Atterberg limits of a clay soil. Tobacco waste was incorporated to a clay field at four different doses (0, 2, 4, and 6 %) with three replications. After eight months, soil samples were taken from field and analyzed for liquid limit (LL), plastic limit (PL) and plasticity index (PI). The index of consistency (Ic) was calculated to evaluate optimum soil moisture contents for soil workability. Increasing the application doses of TOW increased LL and PL values and decreased PI value in the field. According to control treatment, while the highest increments for liquid and plastic limits were statistically determined with the highest application rate. Increasing TOW application doses increased soil moisture levels at 0,75, 1,00 and 1,30 of Ic values. It was determined that clay soil can be cultivated at higher soil moisture contents without structural damage compare with the control treatment. Using agricultural waste as a soil conditioner helps to soil structural development and allow soil workability at higher soil moisture contents.

Keywords: Soil cultivation, Atterberg limits, consitency index, clay soil

VEGETATIVE AND PRODUCTIVE CHARACTERISTICS OF LEGUMES IN MIXED CROPS OF SOLANACEAE UNDER ORGANIC FARMING CONDITIONS

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ABSTRACT

Intercropping in organic farming in Bulgaria is beginning to gain increasing importance in open field cultivation technologies and is used as a practice for enriching the species composition on farms. Legume crops garden peas and garden beans can be successfully used in mixed systems in areas for early and medium-early field production in the climatic conditions of Bulgaria. The aim of the study is to establish the influence of mixed cultivation on the vegetative manifestations, biometric indicators and productivity of legume crops peas and beans in mixed crops with representatives of the Solanaceae family (potatoes, tomatoes and pepper) in order to optimize plant biodiversity and increase yields per unit area. The yield structure of legume crops from mixed crops is compared with single-species cultivation (monocultures). The experiment was conducted in 2023-2024 in the certified organic field of the Maritsa Research Institute of Vegetable Crops, with varieties selected at the institute, characterized by fine adaptive and productive indicators in organic farming conditions. Garden peas are a new breeding line, with very good quality indicators for organic production. It was found that the most suitable is the relay cultivation of peas with tomatoes and peppers. Mixed cultivation with potatoes is an unsuitable combination that negatively affects the growth and productive manifestations of peas. In the bean variants, its use as a suitable accompanying crop for the three types of vegetables was found to be appropriate. Relay cultivation was applied, which allows for different periods of sowing/planting of the species and the creation of favorable conditions for their development. After harvesting the seeds, the bean plants are left as living mulch. They do not have a negative impact on the main crop. Single crop farming of legumes in organic field conditions facilitates soil cultivation during the growing season and increases yield due to the greater number of plants per unit area. In systems with two crops, the difference in their biological requirements involve more specific treatments, but has a positive effect on increasing biodiversity per unit area.

Keywords: intercropping, organic farming, garden peas, garden beans, potatoes, tomatoes, pepper, alluvial-meadow soil

MACHINE LEARNING APPLICATIONS IN PRECISION LIVESTOCK FARMING: CURRENT ADVANCES AND FUTURE PERSPECTIVES

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ABSTRACT

The continuous growth of the global population, increasing demand for animal-derived protein, and the necessity for sustainable food production have accelerated the adoption of precision livestock farming technologies. Modern livestock systems generate vast amounts of data through sensors, automated recording systems, imaging technologies, environmental monitoring, and production records. However, transforming these complex datasets into practical management decisions remains a major challenge. In this context, machine learning has emerged as one of the most promising technologies for improving productivity, animal welfare, health monitoring, and farm management through data-driven decision support. This review summarizes recent advances in machine learning applications across precision livestock farming. Current studies demonstrate that supervised learning algorithms, including Random Forest, Extreme Gradient Boosting (XGBoost), Support Vector Machines, and Artificial Neural Networks, have been successfully applied to disease diagnosis, production forecasting, reproductive performance, precision feeding, behavior monitoring, and genetic improvement. Furthermore, recent developments in deep learning, computer vision, wearable sensor technologies, and explainable artificial intelligence have considerably expanded the practical implementation of machine learning under commercial farming conditions. These approaches enable continuous monitoring of individual animals, early detection of health disorders, optimization of resource utilization, and enhancement of production efficiency. Recent research also indicates a gradual transition from conventional statistical analyses toward intelligent decision-support systems capable of integrating heterogeneous biological and environmental data. Future developments are expected to focus on multimodal data integration, digital twin technologies, edge computing, foundation AI models, and explainable machine learning frameworks to improve model transparency, reliability, and practical adoption. Overall, machine learning is expected to become an indispensable component of precision livestock farming by supporting sustainable production systems, improving animal welfare, and increasing the resilience of livestock production under future environmental and economic challenges.

Keywords: Precision livestock farming, machine learning, artificial intelligence, animal welfare, sustainable livestock production

LAND USE AND LAND COVER CHANGE AND BIOMASS DENSITY ESTIMATION IN ACARLAR FLOODPLAIN FOREST

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ABSTRACT

In this study, it is aimed to determine the changes in Land Use and Land Cover (LULC) and Aboveground Biomass Density (AGBD) between the years 2020-2024 in and around Acarlar Floodplain Forest. Land Use and Land Cover (LULC) maps were created using Sentinel-1 and Sentinel-2 data in six classes: floodplain forest (FF), other forest (OF), agriculture (A), settlement (ST), sand (S), and water (W). The areas covered by the aforementioned classes were calculated as 21.78; 19.90; 72.93; 0.46; 14.72; and 0.78 km² in 2020, and as 22.94; 19.06; 74.57; 0.73; 12.35; and 0.94 km² in 2024, respectively. The overall accuracy of the maps for the years 2020 and 2024 was found to be 94.25% and 93.08%, respectively; the Macro-F1 values were 0.935 and 0.911; and the Micro-F1 values were 0.942 and 0.931. AGBD was modeled using Sentinel-1 and Sentinel-2 data along with GEDI products, and the model's performance was evaluated on independent test data, yielding R^2= 0.82 and RMSE=25.24 Mg/ha for 2020, and R^2= 0.88 and RMSE=16.41 Mg/ha for 2024. As a result of the LULC change analysis, it was observed that approximately 2.48 km² of A and 0.71 km² of OF areas were converted to FF between 2020 and 2024, while 1.38 km² of FF was converted to A and 0.64 km² to OF. When examining the AGBD change, it was found that the total area converted from OF to FF decreased by 5.81 Mg/ha, while the areas converted from FF to OF increased by 0.12 Mg/ha, and the areas maintaining their FF characteristics increased by an average of 6.04 Mg/ha. It is expected that the obtained results will contribute to the integrated monitoring of LULC and AGBD changes in Acarlar Floodplain Forest, the understanding of temporal and spatial changes in carbon storage capacity, and management efforts aimed at the conservation of the area. Without allowing the uncontrolled growth and reduction of FF areas, efforts should be initiated to prepare the Acarlar Floodplain Forest management plan as soon as possible.

Keywords: Floodplain Forest, Biomass, Carbon Sequestration, GEDI, AGBD

INTEGRATING GEDI, SENTINEL-5P AND ERA5 DATA FOR THE SPATIAL ASSESSMENT OF WILDFIRE-INDUCED BIOMASS AND CARBON LOSS: A ÇANAKKALE WILDFIRE CASE STUDY

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ABSTRACT

In this study, it is aimed to evaluate the biomass loss and carbon emissions (CO2) estimates generated by forest fires in Canakkale as well as the spatial evaluation on fire-induced atmospheric vhanges using multi-source remote sensing and meteorological data. In this context, a Random Forest (RF) based multilayer biomass prediction model was realized by integrating the GEDI L4A Aboveground Biomass Density (AGBD), GEDI L2A height and L2B canopy products from the Global Ecosystem Dynamic Investigation (GEDI) mission located on the Internal Spae Station (ISS) with Sentinel-1 and Sentinel-2 data (R2=0.846, RMSE=31.9 Mg/ha). Pre-fire carbon stocks were determined using the estimated AGBD map. To observe the spatial impact and intensity of the fire, the nNBR index derived from Sentinel-2 images was used to classify the affected areas in four different burn severity Low-Severity Burn (0.1 dNBRlsb < 0.27), Moderate - Low Severity Burn (0.27 dNBRmsb 0.44), Moderate–High Severity Burn (0.44 dNBRmhsb < 0.66) and High Severity Burn (dNBRhsb 0.66). The areas affected by the fire were calculated as 3.405 ha (dNBRlsb), 1.540 ha (dNBRmsb), 875 ha(dNBRmhsb) ve dNBRhsb (827 ha) in terms of area, according to each intensity of the fire. By overlaying the fire intensity map with biomass, carbon dioxide emissions (CO2) and carbon stock maps at the pixel level the amounts of biomass, carbon and CO2 for the fire – affected areas. In the study the wind direction and speed obtained from the ERA5 meteorological dataset the Absorbing Aerosol Index (AII) obtained from the Sentinel-5P TROPOspheric Monitoring Instrument (TROPOMI) sensor and the atmospheric behavior of carbon monoxide (CO) and nitrogen dioxide (NO2) gases were synthesized for the fire area and its surroundings. Future studies will spatially determine the losses in AGBD and CO2 levels due to fire intensity and address the distribution of fire-induced atmospheric pollutants in conjunction with meteorological conditions, thereby integrating the impacts of forest fires on ecosystems and carbon cycles for urban planning purposes.

Keywords: GEDI, Biomass, Wildfire, Sentinel-5P, CO2 emission

THE IMPACT OF URBAN DEVELOPMENT AND AGRICULTURAL LAND CONVERSION ON SOIL ORGANIC CARBON STOCKS: THE CASE OF BURSA ULUDAĞ UNIVERSITY

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ABSTRACT

The purpose of this study is to examine changes in land use and land cover (LULC) in relation to the establishment and development of Bursa Uludağ University and to assess changes in soil organic carbon (SOC) stocks resulting from the conversion of agricultural land into residential areas. In this context, changes in LULC that occurred during the periods of 1985, 2016, 2025 were analyzed; SOC stocks at risk of being lost due to the conversion of agricultural lands into residential areas were calculated using SOC data provided by ISRIC - World Soil Information. According to the analysis results, it was determined that the total area converted from agricultural land to residential land during the 1985-2016 period was 7,652.21 ha. The average SOC stock at a soil depth of 0-30 cm in these areas was calculated to be 94.80 t C /ha, and the total SOC stock affected by LULC was found to be 719,888.28 t C. For the 2016-2025 period, the total area converted from agricultural land to residential land was calculated to be 2,057.11 ha. The average SOC stock at a soil depth of 0-30 cm in the areas undergoing transformation during this period was determined to be 94.90 t C/ha. Although a smaller amount of agricultural land was converted to residential areas compared to the 1985-2016 period, the average SOC stock per unit area was found to be slightly higher. Accordingly, the total SOC stock affected by the transformation during the 2016-2025 period was calculated to be 195,220.73 t C. The findings indicate that the conversion of agricultural land into residential areas, particularly during the 1985-2016 period, resulted in a significant reduction in SOC stocks. Although the loss of agricultural land and the associated loss of SOC decreased during the second period, the rapid expansion of urban development poses a risk to the preservation of agricultural lands' carbon storage capacity. For this reason, it is important to monitor the pressure exerted by urban growth around the University on agricultural lands and to develop strategies for the protection of agricultural soils with high SOC stocks in land- use planning.

Keywords: Land Use Land Cover (LULC), Soil Organic Carbon (SOC), Urban Expansion, University

A SPATIAL ASSESSMENT OF THE CASCADING EFFECTS OF AGRICULTURAL LAND LOSS IN TÜRKIYE'S GEOGRAPHICAL REGIONS ON AIR POLLUTION AND NIGHTTIME LIGHTS

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ABSTRACT

The aim of this study is to examine the relationship between changes in agricultural land resulting from shifts in land use across Türkiye and air pollutants and nighttime lighting (NTL), as well as the distribution of these spatial changes across different geographical regions. Agricultural land changes were identified using the Dynamic World Land Use Land Cover (LULC) dataset for the periods 2019-2022 and 2022-2025. Environmental variables included remote sensing based NTL data from NASA's Black Marble dataset and NO_2, CO, SO_2 and HCHO data derived from the Sentinel-5P/TROPOMI satellite. The relationship between changes in agricultural land in hotspots and environmental variables were examined using Pearson correlation analysis. The study compared the periods 2019-2022 and 2022-2025 and found that losses of agricultural land had increased by 29.2 per cent, rising from 36,830 km² to 47,584 km². In 2019 - 2022, significant associations with increasing NTL ($p < 0.001$) included CO, NO_2, and SO_2 in the Black Sea; NO_2, HCHO, SO_2 and CO in Southeastern Anatolia; NO_2 and HCHO in the Mediterranean; HCHO and CO in Central Anatolia; SO_2 and CO in Marmara; and CO, SO_2 and NO_2 and in the Eastern Anatolia. In 2022 - 2025, significant associations included CO, NO_2, and SO_2 in the Black Sea; NO_2, SO_2 and CO in Southeastern Anatolia and the Mediterranean; NO_2 in Central Anatolia, Marmara, and Eastern Anatolia; and NO_2 and SO_2 in the Aegean. The results of this study indicate that the declines in agricultural land observed across Türkiye on a regional basis could trigger environmental changes and, consequently, have an impact on air quality. In future studies, it is planned to prepare a comprehensive series of assessment maps on a national scale by also examining the relationships among other LULC classes.

Keywords: Agricultural land-use change, Nighttime light (NTL), Air Pollution, Hotspot analysis, Türkiye

SPECIFIC FEATURES OF HAZELNUT (CORYLUS AVELLANA L.) DECLINE IN WESTERN GEORGIA: PRELIMINARY RESULTS

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ABSTRACT

Since 2021, a progressive spread of hazelnut decline syndrome has been observed in the major hazelnut-growing regions of Western Georgia. Phytopathological and anatomical-morphological analyses revealed a heterogeneous symptom complex, suggesting the possible involvement of both biotic and abiotic factors. Affected hazelnut plants were examined using phytopathological, microbiological, and anatomical-morphological approaches. Symptomatic tissues were analyzed for associated microorganisms, and skeletal branches were examined for alterations in vascular tissues. Bacterial isolates were evaluated using a hypersensitive response (HR) assay on Pelargonium zonale. Meteorological data were retrospectively analyzed to identify potentially relevant environmental stress factors. Fungal microorganisms belonging to the family Botryosphaeriaceae and the genus Cytospora were detected in symptomatic tissues, while bacterial agents, including Xanthomonas arboricola and Pseudomonas spp., were isolated separately. Additionally, Klebsiella grimontii was isolated from symptomatic hazelnut tissues and its identity was confirmed by sequencing. The isolate induced a strong HR in Pelargonium zonale, indicating potential phytopathogenic significance. In several surveyed orchards, extensive leaf scorch and tissue deterioration occurred despite the apparent preservation of vascular tissue structure. Cross-sections of skeletal branches showed no macroscopic evidence of necrosis, discoloration, or degradation of the xylem or cambium. Preliminary retrospective analysis of meteorological data suggests that late-spring frosts and prolonged periods of exceptionally high nighttime temperatures (“tropical nights”) may have contributed to plant stress and decline. The findings suggest that hazelnut decline in Western Georgia may represent a complex syndrome involving interactions between abiotic stress and opportunistic microorganisms. The detection of K. grimontii in symptomatic tissues, together with its strong HR response, highlights its potential phytopathogenic significance. Further studies are required to establish causal relationships, determine the pathogenic roles of the isolated microorganisms, and clarify the contribution of hydrothermal stress to disease development.

Keywords: Hazelnut decline syndrome, Pseudomonas spp., Xanthomonas arboricola, Klebsiella grimontii, hypersensitive response, hydrothermal stress, Western Georgia

THE IMPACT OF CARBON MARKETS ON AGRICULTURAL PRODUCTION DECISIONS: AN ASSESSMENT OF FARMER BEHAVIOR AND THE TURKISH CARBON MARKET

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ABSTRACT

Carbon markets are important market-based policy instruments with the potential to reduce greenhouse gas emissions and enhance carbon sequestration in the fight against climate change. The agricultural sector is at the heart of these markets, serving as both an emission source and a significant carbon sink through soil, biomass, and waste management. Prominent carbon sequestration practices in agriculture include conservation tillage, no-till farming, cover cropping, integrated nutrient management, and the utilization of agricultural waste. The adoption of these practices is closely linked to farmers' decision-making mechanisms, which are based on various factors such as financial incentives, risk perception, knowledge level, institutional trust, and the ease of integrating practices into existing farm systems. When evaluating new practices, farmers consider not only potential carbon income but also their effects on yield, costs, labor requirements, and environmental benefits like soil health. This study aims to comprehensively evaluate the impact of carbon markets on agricultural production decisions within the context of farmer behavior and carbon market regulations in Türkiye. It examines the potential of agricultural carbon practices and the factors influencing farmers' participation in these practices. The main findings of the study indicate that farmers' participation in carbon markets depends not only on financial incentives but also on behavioral and institutional factors such as risk perception, knowledge level, institutional trust, and the ease of integrating practices into the production system. Specifically for Türkiye, despite the legislation providing a national framework, there are significant shortcomings such as agricultural methodologies, local advisory mechanisms, and collective application models suitable for small producers not yet being sufficiently defined, high monitoring, reporting, and verification (MRV) costs, and policy uncertainties. This situation limits the potential for carbon income to be transformed into additional finance through sustainable practices.

Keywords: carbon markets, farmer behaviour, agricultural production decisions, perception of risk

METHODS FOR COMBATING DROUGHT STRESS IN SUNFLOWER

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ABSTRACT

Drought has become one of the most critical abiotic stress factors threatening agricultural production under the influence of global climate change. Sunflower (*Helianthus annuus* L.), which holds a significant place among oilseed crops, can tolerate drought to a certain extent; however, it is substantially affected by water scarcity, particularly during the flowering and seed-filling periods. In this seminar study, the effects of drought stress on plant growth, development, physiology, biochemical processes, yield, and oil quality in sunflower were examined; furthermore, agronomic, physiological, and biotechnological approaches utilized to combat drought were evaluated. The study determined that drought stress restricts root and shoot development, reduces photosynthetic efficiency, induces oxidative damage, and consequently leads to significant losses in yield and oil quality in sunflower. It was observed that under drought conditions, the plant develops various adaptation mechanisms, such as deep root development, stomatal closure, osmotic adjustment, and the activation of antioxidant defense systems. Additionally, it was demonstrated that adjustments in sowing time, soil and moisture management, drip irrigation practices, biostimulants, plant growth regulators, and protective mineral applications are effective in mitigating the adverse effects of drought. Besides these, modern biotechnological approaches—such as markerassisted selection, genomic selection, quantitative trait locus (QTL) mapping, and iv CRISPR/Cas9-based genome editing technologies—were evaluated to provide significant advantages in developing drought-tolerant sunflower cultivars. In conclusion, it was determined that integrated strategies combining agronomic practices with molecular and biotechnological methods must be developed to mitigate the effects of drought stress in sunflower. In today's world, where the impacts of climate change are increasingly intensifying, developing drought-tolerant and high-yielding sunflower cultivars is of great importance for sustainable agricultural production.

Keywords: Sunflower, drought stress, drought tolerance, biotechnology, genome editing, genomic selection, biostimulants, water management, yield, climate change

PLASMA AGRICULTURE: INNOVATIVE, GREEN AND SUSTAINABLE TECHNOLOGY

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ABSTRACT

Plasma is the fourth state of matter along solid, liquid, and gas, and it is ionized gas which splits into positive and negative ions, neutral atoms, and electrons. Plasmas can be classified as low, atmospheric and high pressure plasma in terms of pressure; and according to the thermal equilibrium, they are divided into two categories: thermal (hot) and non-thermal (cold) plasma. The utilization of cold atmospheric plasma (CAP) technology in the field of agriculture is called plasma agriculture. Conventional agriculture faces mounting pressures from climate change, soil degradation, and the compelling need to reduce chemical inputs. Cold plasma (CP) technology presents a promising, eco-friendly physical solution. By exposing seeds, irrigation water, or growing crops to CP, this green technology modifies key biological processes without leaving toxic chemical residues. It enhances seed germination, strengthens seedling establishment, and boosts stress tolerance by increasing seed vigour, and reducing dormancy period. In this talk, the effects of cold plasma technology on seed germination and seedling growth will be presented. The mechanism of action of direct plasma exposure, and indirect plasma activated water treatment will be discussed. Some results of ongoing project will be shown.

Keywords: Plasma technology, Agricultural Innovations, green technology, seed germination

EXPLAINABLE MACHINE LEARNING-BASED 24-HOUR EARLY WARNING OF FROST AND EXTREME HEAT RISKS FOR VITICULTURE USING LOCAL HOURLY METEOROLOGICAL DATA

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ABSTRACT

Temperature-related extreme weather events can have important impacts on agriculture, public safety, and local economic activities. Therefore, practical early warning systems are needed to predict these events before they occur. This study proposes an explainable machine learning-based 24-hour early warning framework for frost and extreme heat risks using local hourly meteorological data. Hourly temperature, rainfall, relative humidity, wind speed, and wind direction data collected from two meteorological stations between 2021 and 2025 were used. Frost risk was defined as the occurrence of a minimum temperature of 0 °C or below within the next 24 h, while heat risk was defined as the occurrence of a maximum temperature of 35 °C or above within the next 24 h. Lagged and rolling statistical features were extracted from the time series data. Several machine learning models were compared using a temporal train-test strategy. The Extra Trees model achieved the best performance for frost risk prediction, with an F1-score of 0.820 and a PR-AUC of 0.929. For heat risk prediction, Logistic Regression achieved high recall of 0.942 and a PR-AUC of 0.739. Feature importance analysis showed that recent temperature dynamics and seasonal time variables were the most influential predictors. These findings show that explainable machine learning models may provide practical support for local short-term warning systems for frost and extreme heat risks. Both frost and extreme heat are becoming more frequent and intense under climate change, and they can cause severe damage to vineyards, including late spring-frost injury to young shoots and heat-related damage to grapevine development. By signalling these risks one day in advance, the proposed framework may therefore support timely protective decisions in viticulture and other high-value perennial cropping systems exposed to both temperature extremes.

Keywords: Explainable artificial intelligence, machine learning, extreme temperature prediction, early warning system, grapevine, vineyard, digital agriculture technologies, climate change

DETERMINATION OF POMOLOGICAL AND CHEMICAL CHARACTERISTICS OF NATURALLY GROWING GILABURU (VIBURNUM OPULUS L.) FRUITS IN TUŞBA DISTRICT OF VAN PROVINCE

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ABSTRACT

Gilaburu (Viburnum opulus L.) is a multifunctional shrub species belonging to the Adoxaceae family and has potential value as a fruit, ornamental, medicinal and functional food plant. Although the species is generally associated with humid habitats, stream banks, forest edges and soils rich in organic matter, its cultivation under high-altitude semi-arid conditions may provide important information for alternative fruit production, climate-adapted plant selection and edible landscape design. This study was carried out to determine some pomological and chemical characteristics of gilaburu fruits grown in Tuşba district of Van Province, Türkiye, and to evaluate the fruit quality potential of the species under high-altitude semi-arid conditions outside its typical natural habitat. Fruit weight, fruit length, fruit width, skin thickness, cluster weight, flesh ratio, seed characteristics, fruit skin colour parameters (L*, a*, b*, Chroma and Hue), total soluble solids (TSS), pH and titratable acidity were determined. The mean fruit weight was 0.57 g, while fruit length and fruit width were 9.30 mm and 10.19 mm, respectively. The mean cluster weight was 34.96 g. The fruit flesh ratio was 87.04%, and the mean seed weight was 0.07 g. Colour measurements showed L*, a*, b*, Chroma and Hue values of 27.32, 35.20, 26.68, 44.24 and 36.86°, respectively. Chemical analyses revealed 13.3% TSS, 2.00% titratable acidity and a pH value of 3.51. The findings indicate that gilaburu fruits grown under Van/Tuşba conditions have a high flesh ratio, attractive red colour, suitable soluble solid content and a pronounced acidic character. These properties suggest that the fruits may be suitable especially for processed products such as juice, vinegar, fermented beverages, jam, marmalade and functional food ingredients. In addition, due to its showy flowers, red fruit clusters and autumn foliage, V. opulus may be considered a promising multifunctional shrub for edible landscape practices in high-altitude semi-arid regions.

Keywords: Edible landscapes, functional food, gilaburu, pomological traits, semi-arid area, Viburnum opulus.

COMPARISON OF THE VOLATILE AROMA PROFILES OF NATURALLY GROWING DAFFODIL (NARCISSUS TAZETTA L.) FLOWERS FROM ADANA AND MERSIN PROVINCES

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ABSTRACT

Daffodil (Narcissus tazetta L.) is an important geophyte species widely utilized in cut flower production, landscape design, potted ornamental plant cultivation, perfumery, and cosmetic industries due to its Mediterranean origin, attractive flower clusters, and distinctive fragrance. The presence of natural and naturalized daffodil taxa in Türkiye highlights this species not only as an ornamental plant of economic importance but also as a valuable plant genetic resource characterized by rich genetic diversity and cultural heritage. Its characteristic scent and long history of traditional use have enabled daffodils to occupy a special place in the cultural memory of society. Therefore, this study aimed to identify and compare the volatile organic compounds responsible for the characteristic fragrance of naturally growing N. tazetta flowers collected from the Adana and Mersin regions. The results revealed significant differences in volatile compound composition between the two regions. In the Adana samples, ketones (56.26%) were the predominant compound group, followed by alcohols (25.51%), esters (11.32%), terpenes (6.45%), and acids (0.46%). In the Mersin samples, ketones (37.90%) and alcohols (33.47%) were the major groups, followed by terpenes (15.56%), esters (12.17%), acids (0.50%), and aldehydes (0.40%). Among the identified compounds, 1-(2-Methylphenyl)-ethanone was the dominant ketone in both regions, accounting for 56.26% and 37.71% of the total volatile compounds in Adana and Mersin, respectively. Within the alcohol group, linalool was identified as the most abundant compound, representing 11.33% in Adana and 21.15% in Mersin. Among esters, benzyl acetate was the principal compound, occurring at 3.08% and 2.76% in Adana and Mersin, respectively. In the terpene group, (E)-β-ocimene was the predominant compound, accounting for 2.77% in Adana and 9.65% in Mersin. The findings demonstrated substantial regional variation in the volatile aroma profiles of naturally growing N. tazetta flowers. The higher concentrations of linalool and (E)-β-ocimene detected in the Mersin population may contribute to a richer and more distinctive floral aroma. In contrast, the Adana population was characterized by a markedly higher ketone content. These results indicate that natural N. tazetta populations should be evaluated as valuable resources for aromatic genotype selection, ornamental plant breeding, perfumery and cosmetic applications, and the conservation of plant genetic resources.

Keywords: Daffodil, Narcissus tazetta, HS-SPME/GC-MS, Volatile organic compounds, natural population

COWTECH: AN INTELLIGENT INFORMATION SYSTEM FOR MODERNIZING LIVESTOCK PRODUCTION

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ABSTRACT

The rapid development of information and communication technologies has made digitalization an increasingly important factor in the modernization of all industrial sectors, including agriculture. In this context, the implementation of modern information systems in livestock production is becoming increasingly necessary, particularly on dairy farms, where timely access to and processing of data can significantly contribute to improving animal health and welfare, increasing productivity, and enhancing overall farm management. The aim of this paper is to propose and elaborate a practical implementation of an information system for monitoring the welfare of cows. The system is intended to enable the centralized collection, storage, and analysis of data related to the health status, nutrition, and daily activities of the animals. Through such a system, data for each individual animal would be available in real time, allowing timely monitoring of changes in behavior, activity, and health condition. The proposed information system aims to provide relevant information to farmers and veterinary services, thereby facilitating the decision-making process, enabling the generation of reports and diagrams, and improving control over production processes. In addition, the system may contribute to the early detection of potential diseases, the reduction of diagnostic and treatment costs, and the improvement of the overall organization of the farm. The implementation of such an information system represents an important step toward replacing traditional farm management practices with a modern digital model based on accurate, reliable, and timely available data. In this way, the digitalization of livestock production processes enables greater efficiency, improved traceability, enhanced animal welfare, and the modernization of dairy farms.

Keywords: digitalization, information system, dairy farm, animal welfare, livestock production, real-time data.

IMPACT OF ENVIRONMENTAL EXPOSURE TO PESTICIDES ON SPERM FUNCTIONS ANS MALE HORMONAL PROFILE: A CASE STADY OF THE SETIF REGION, ALGERIA

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ABSTRACT

A plethora of epidemiological studies conducted by researchers across the globe have demonstrated that exposure to pesticides has a significant impact on the increased incidence of cancer, particularly among reproductive system disorders, in exposed populations. This association is evident in both occupational exposure and unintentional exposure scenarios. Chlorpyrifos (CPF) is an organophosphate (OP) insecticide that is used extensively in the Setif region, located in northeastern Algeria, as well as worldwide. It is evident that recurrent exposure to low doses of CPF exerts a considerable detrimental effect on human health and the environment. Moreover, there is a manifest manifestation of toxicity in humans. Observations have been made of the deterioration of biochemical parameters in rats, accompanied by pathological changes in the reproductive system. In addition, it has been observed that pathological changes to the rodents' reproductive system have taken place in the course of this experiment. The chemical compound under scrutiny has been demonstrated to be associated with a decline in sperm concentration in human subjects, in addition to a reduction in sperm motility and viability. Histological examination of the samples revealed progressive degeneration and atrophy of the tubules, leading to oligospermia and azoospermia, likely due to dysfunction of the seminiferous tubules.

Keywords: chlorpyrifos (CPF), Pestide exposure, Semen parameters, Hormonal profile, Testicular histopathology

A PORTABLE EMBEDDED SYSTEM FOR ON-SITE DETECTION OF ADULTERATED DIAMMONIUM PHOSPHATE VIA DENSITY ANALYSIS

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ABSTRACT

The widespread adulteration of Diammonium Phosphate (DAP) fertilizer severely undermines agricultural productivity and inflicts significant economic losses on farmers, who lack access to costly and centralized laboratory verification methods. This paper presents the design and implementation of a novel, low-cost, and portable electronic device for the on-site detection of DAP adulteration. The core detection principle is based on a precise density measurement, leveraging the standard density of pure DAP (1379 kg/m³). The system hardware integrates a custom 3D-printed conical frustum vessel of fixed volume with a high-precision load cell for mass measurement, a microcontroller for data processing, and an LCD for user-friendly result display. Additionally, a green LED indicates purity, whereas a buzzer generates an alert when adulteration is detected. The embedded firmware calculates the density and classifies the sample's purity. Extensive testing validated the system's performance, demonstrating a 95% accuracy in identifying adulterated samples when benchmarked against standard density values. This proves the effectiveness of the developed system to assess the quality of DAP fertilizer on-site. This consumer-grade electronic solution empowers farmers with immediate, in-field quality control. Future work will focus on enhancing the system through IoT connectivity for data logging and the integration of multi-sensor fusion for a more robust analysis.

Keywords: Adulteration Detection, Smart Sensor, Precision Agriculture, Embedded Systems, Di-ammonium Phosphate, Fertilizer Quality

THE ENVIRONMENTAL AND HEALTH RISKS ASSOCIATED WITH EXPIRED PESTICIDES: A STUDY BASED ON A SURVEY AND FIELD OBSERVATIONS CONDUCTED IN THE SÉTIF REGION

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ABSTRACT

Agriculture is a fundamental pillar of the regional economy in Algeria. To optimize agricultural yields, the Setif region is seeing increasing use of pesticides. While high-income countries are moving toward stricter regulations, nations such as Algeria continue to use older and potentially more dangerous compounds. This problem is exacerbated by the lack of adequate systems for collecting and disposing of chemical waste. Based on a practical methodological approach, this study draws on field surveys and direct observations to document the reality of the risks involved. The data collected reveal that this intensive use is often accompanied by the improper storage of expired products. These obsolete substances degrade into byproducts whose toxicity is sometimes greater than that of the original compounds. In the absence of regulated disposal channels, the informal storage and misuse of these expired stocks pose major and immediate risks to human health, biodiversity, and the balance of local ecosystems. More specifically, exposure to these compounds poses serious physiological threats, including proven effects of neurotoxicity, carcinogenicity, and endocrine disruption. Furthermore, the specific physicochemical properties of these molecules facilitate their dispersion in aquatic resources; even in trace amounts, they cause complex ecotoxicological impacts that are still poorly understood. To mitigate these threats, it is crucial to implement structured programs for the disposal of abandoned packaging while systematically promoting alternative crop protection strategies. This article thus offers a critical analysis based on factual observations, highlighting the urgency of implementing safe management measures in Algeria.

Keywords: Expired pesticides, Setif, Algeria, Field surveys, Observations, Health risks, Ecotoxicity.

MALACHITE GREEN REMOVAL FROM AQUEOUS SOLUTION USING AN AGRICULTURAL WASTE-BASED ADSORBENT: ISOTHERM, KINETIC, THERMODYNAMIC AND RSM STUDY

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ABSTRACT

An agricultural waste-derived precursor was evaluated as a low-cost adsorbent for removing the cationic dye malachite green (MG) from synthetic wastewater. The material's surface functional groups and morphology were characterized by Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). X-ray diffraction (XRD) provided information on crystallinity and phase composition, while thermogravimetric analysis/differential thermal analysis (TGA/DTA) assessed thermal stability and decomposition behavior; collectively these techniques confirmed the presence of oxygenated functional groups, partial amorphous structure and thermally stable porous framework favorable for adsorption. Batch experiments investigated the effects of contact time, adsorbent dosage, solution pH, initial dye concentration, stirring speed and temperature on removal efficiency. Equilibrium data were analyzed with Langmuir, Freundlich and Temkin models, with Freundlich and Langmuir giving the best fits under tested conditions, indicating heterogeneous adsorption sites and possible monolayer coverage. Kinetic analyses showed the pseudo-second-order model described the process most accurately, implying rate dependence on available adsorption sites. Thermodynamic parameters ($\Delta G°$, $\Delta H°$, $\Delta S°$ and Ea) indicated a spontaneous, predominantly exothermic process with reduced randomness at the solid–solution interface. Multiple error functions (SSE, SAE, ARE, HYBRID, MPSD, $\chi 2$ and RMSE) validated model applicability. Response Surface Methodology (RSM) with ANOVA produced a high correlation ($R2 = 0.9978$), demonstrating robust optimization of operating variables. Overall, this agricultural waste-based adsorbent is an effective and sustainable candidate for MG remediation in aqueous systems.

Keywords: Agricultural waste, Adsorbent, Cationic dye, Adsorption isotherms, Kinetics, Thermodynamics, RSM.

PHYSICOCHEMICAL CHARACTERIZATION AND ADSORPTION PERFORMANCE OF MODIFIED LIGNOCELLULOSIC RESIDUE FOR THE REMOVAL OF AN ANIONIC DYE

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ABSTRACT

Water pollution resulting from industrial effluents remains a major environmental challenge, requiring efficient and sustainable remediation strategies. In this context, the present study investigates the physicochemical characteristics and adsorption performance of a cationic surfactant-functionalized lignocellulosic residue for the selective removal of an anionic dye from aqueous solutions. The modified biosorbent was characterized by Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), X-ray diffraction (XRD), and point-of-zero-charge (pHPZC) analysis. Characterization results confirmed successful surface functionalization, evidenced by significant changes in surface chemistry, morphology, crystallinity, and surface charge, leading to improved adsorption performance. Batch adsorption experiments were performed to investigate the effects of solution pH, contact time, initial dye concentration, adsorbent dosage, and temperature. Under optimized conditions, the modified biosorbent exhibited high dye removal efficiency within a short contact time. Equilibrium data were best described by the Dubinin–Radushkevich and Sips isotherm models, whereas the adsorption kinetics followed the pseudo-second-order model. Thermodynamic analysis revealed that the adsorption process was exothermic. Furthermore, binary adsorption experiments demonstrated the selective adsorption behavior of the modified biosorbent toward the target anionic dye under competitive conditions. These findings highlight the potential of this sustainable biosorbent for the highly efficient and sustainable treatment of dye contaminated industrial wastewater.

Keywords: Lignocellulosic residue, Cationic surfactant modification, Anionic dye, Biosorption

NON-DESTRUCTIVE QUALITY CHARACTERIZATION OF PEACH FRUIT USING VIS / NIR SPECTROSCOPY AND MULTIVARIATE ANALYSING

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ABSTRACT

Research Aim: In this study, the capability of the Vis / NIR method for non-destructive evaluation of quality and detection of some peach varieties including Zaferani, Makhmali and Javadi was investigated. **Research method:** In this regard, a capacitive array (CCD) spectroradiometer with a range of 350 to 1150 nm was used to predict pH, titrable acid (TA), soluble solid-state (SSC), total phenol (TP), extract anthocyanin (Prance and Nesbitt) nondestructively. Multivariate partial least squares (PLS) regression models were used based on reference and degradation measurements. Spectral data processed with Savitsky-Goley smoothing (SG), first derivative (D1), incremental diffusivity correction (MSC), standard normal distribution (SNV) and Baseline correction was performed individually and in combination (SG + MSC + D1) and (SG + Baseline) to predict peach quality characteristics. The models were evaluated by the root mean square error of prediction (RMSEP), correlation coefficient (rp) and standard deviation ratio (SDR). **Findings:** The results showed that the Vis / NIR spectroscopy method had different capabilities in predicting some qualitative parameters of the peach cultivars. The best prediction accuracy was related to pH parameter, which could make saffron cultivar with moderate accuracy (SDR >1/5), velvet cultivar with acceptable accuracy (SDR >2) and velvet cultivar with high accuracy (SDR >2.5). The velvet peach's TA was not predictable using spectroscopy, but in the rest of cultivars, this parameter was predicted in the range of 1/51/5) and saffron cultivar with high accuracy (rp>0/90 and SDR>2/5). The amount of total phenol and anthocyanin in Javadi cultivar was not predictable for any pretreatments and these parameters were predicted in two cultivars of Saffron and Velvet with moderate accuracy (rp >0/75 and SDR >1/5).

Keywords: Spectroscopy, Peach, Multivariate Analysing, Fruit quality

PROTEASE-ASSISTED ENZYMATIC AMINO ACID HYDROLYSATE PRODUCTION FROM ANIMAL LEATHER SHAVINGS AND ITS AGRICULTURAL BIOSTIMULANT POTENTIAL

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ABSTRACT

This study evaluated the production of an amino acid hydrolysate with potential for agricultural use from a protein-rich side stream—specifically leather shavings—via protease-assisted hydrolysis. At the laboratory scale, the leather shavings underwent size reduction, were softened in warm water, pre-treated with dilute acid, and subsequently hydrolyzed using a protease enzyme. Following the process, solid particles were removed by filtration, yielding a liquid phase characterized as an amino acid concentrate. Protein hydrolysates—comprising peptides, oligopeptides, and free amino acids—are considered biostimulant materials capable of influencing plant growth, nutrient use efficiency, and stress tolerance. This study demonstrates circular economy potential regarding the conversion of leather and similar proteinaceous wastes into value-added fertilizer inputs. However, to meet publication standards, further analyses—including free amino acid profiling, total nitrogen, organic matter, heavy metal content, microbial safety, phytotoxicity, and plant germination tests—are required. This manuscript evaluates protease-assisted enzymatic hydrolysis of animal leather shavings to produce an amino acid-rich agricultural biostimulant candidate. Laboratory-scale processing involved size reduction, warm-water softening, dilute acid pretreatment, protease addition and filtration to remove residual solids. The resulting liquid phase was considered an amino acid hydrolysate concentrate. Protein hydrolysates containing peptides, oligopeptides and free amino acids are widely discussed as biostimulants that can improve plant growth, nutrient-use efficiency and stress tolerance. The approach also provides a circular-economy route for valorizing protein-rich by-products.

Keywords: protein hydrolysate, amino acid, protease, leather waste, circular economy, biostimulant

ASSESSMENT OF CROP WATER STRESS UNDER PREVAILING IRRIGATION PRACTICE ON A FARM BY HYPERSPECTRAL REMOTE SENSING

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ABSTRACT

Improper irrigation management adopted during the prevailing irrigation practice causing crop water stress affects crop yield significantly. Remote sensing (RS) based monitoring of crops can detect water stress in crops prior to the appearance of its visual symptoms (leaf wilting or curling) of permanent damage. This study assessed the conditions of crop water stress occurring in maize and spinach crops growing under prevailing irrigation practice by using hyperspectral RS. A hyperspectral reflectance spectrum of maize and spinach crops arranged in randomized complete block design with two replications subjected to water treatments of 0, 33, 66, 100 and 133 % of field capacity (FC) moisture and those undergoing prevailing irrigation practice, through initial, developing, mid-season and late-season stages was obtained by a spectroradiometer (325-1075 nm) and thirty spectral vegetation indices (SVIs) related to crop water stress were then calculated. Two physical parameters related to crop water stress of soil moisture content and crop yield were also measured. Analysis of RS data indicated that crop water stress affects spectral reflectance of leaves in both crops and statistical analysis showed that many SVIs were strongly correlated with soil moisture content, but response varied across different growth stages. Determination coefficients (R2) were generally higher in spinach as compared to maize and a greater number of SVIs had strong correlations in the former compared to the later. Among all SVIs investigated, normalized photochemical reflectance index (PRInorm) has been found to be consistently having strong correlation with soil moisture, and is recommended to be used for prediction of soil moisture for all stages of maize and spinach crops except for their developing stages. Analysis of irrigation schedule followed during prevailing irrigation practice based on deviation of selected indices belonging to rows undergoing prevailing irrigation practice from their reference values, revealed that it causes mild to moderate stress in under-irrigation as well as mild to severe stress in over irrigation throughout different growth stages of maize and spinach. Using these results, a future irrigation schedule was proposed for both crops to avoid mild stress from becoming severe stress grown under similar site-specific, plant-specific and meteorological conditions. This research has shown that hyperspectral RS has the capability to develop a proper irrigation scheduling method ensuring optimum irrigation.

Keywords: Crop water stress, Hyperspectral remote sensing, Irrigation scheduling, water management

INVESTIGATION OF THE EFFECT OF PARTICLE SIZE VARIATION ON QUALITY PARAMETERS IN PELLETS PRODUCED FROM SAFFLOWER WASTE

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ABSTRACT

Production residues derived from oilseed crops are among the significant biomass materials that can be considered as renewable energy sources. In particular, the conversion of lignocellulosic residues remaining after the harvest and processing of the safflower plant into pellet fuel is of interest from both waste management and energy recovery perspectives. The pelletization process increases the energy density per unit volume of the raw material and improves storage and transportation conditions. In this study, the effect of die diameter on the quality characteristics of pellets produced from safflower biomass was investigated. Within the scope of the study, sunflower material was prepared under constant moisture content and grinding conditions, and pellets were produced with die diameters of 6 mm, 8 mm, and 10 mm. To determine the quality characteristics of the produced pellets, parameters such as diameter, length, weight, bulk density, breaking strength, mechanical durability, and other physico-mechanical properties were evaluated. The findings indicate that pellet diameter has a significant impact on product quality. It was determined that pellets with smaller diameters exhibit a more compact and homogeneous structure, whereas an increase in diameter leads to changes in certain physical and mechanical properties. In particular, pellet diameter was found to be a critical production parameter in terms of density, durability, and structural integrity. Additionally, it was determined that changes in diameter also affect the length and weight distribution of the pellets. The results demonstrate that selecting the appropriate die diameter is crucial for improving product quality in the production of pellets from safflower biomass. This study contributes to the assessment of safflower biomass as a pellet fuel and provides foundational data for determining optimal production conditions.

Keywords: Renewable energy, biomass, agricultural waste, safflower, pellet diameter

STATISTICAL MODELING OF THE QUALITY CHARACTERISTICS OF PELLETS PRODUCED FROM PINE SAWDUST

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ABSTRACT

The growing demand for energy and the shift toward renewable sources have made the use of woody biomass as pellet fuel increasingly important. In this study, the effect of pellet diameter on the quality characteristics of pellets produced from pine sawdust was investigated using multivariate statistical methods. For this study, pine sawdust raw material was prepared with a moisture content of 8–10%, ground to a particle size of 7–10 mm, and pelletized with die diameters of 6 and 8 mm. The bulk density, mechanical strength, breaking strength, moisture absorption resistance, and flue gas emission values of the produced pellets were evaluated. According to the results, the bulk density of 8 mm diameter pellets was found to be higher at 597.48 kg m^{-3}, while 6 mm diameter pellets exhibited higher moisture absorption resistance at 95.32%. Significant differences in mechanical and physical quality parameters were observed depending on pellet diameter. Principal Component Analysis (PCA) and heatmap analyses will be applied to comprehensively evaluate the obtained data. The aim is to identify the primary variables influencing quality parameters using PCA and to visualize the similarities between samples and parameter relationships using heatmap analysis. In conclusion, under constant production conditions, pellet diameter is found to be a determining factor in the quality performance of pine sawdust pellets. Multivariate analysis methods provide effective decision-support tools for determining the optimal pellet diameter.

Keywords: Renewable energy, biomass, agricultural waste, pellet, pine sawdust, principal component analysis

A HYBRID LSTM–AUTOENCODER–ISOLATION FOREST APPROACH FOR EARLY FAULT DETECTION IN SOIL MOISTURE SENSORS

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ABSTRACT

Reliable soil moisture monitoring is a fundamental requirement for precision agriculture and intelligent irrigation management. However, long-term deployment of soil moisture sensors frequently introduces measurement errors caused by sensor disconnection, signal saturation, drift, environmental interference, and hardware degradation. Conventional threshold-based monitoring systems often struggle to distinguish genuine soil moisture variations from sensor-related faults, resulting in unreliable irrigation decisions and increased maintenance costs. This study proposes a framework integrating Long Short-Term Memory (LSTM), Autoencoder (AE), and Isolation Forest (IF) algorithms for the early detection of soil moisture sensor faults. Due to the limited availability of labeled fault data from real deployments, a synthetic multivariate time-series dataset was generated to represent soil moisture, ambient temperature, relative humidity, and light intensity measurements under normal and faulty operating conditions, including sensor disconnection, signal saturation, gradual drift, and abnormal noise spikes. The LSTM network predicts future soil moisture behavior, while the Autoencoder reconstructs normal operational patterns. A Composite Error score is derived from the discrepancy between prediction and reconstruction outputs and serves as the primary anomaly indicator. A statistical threshold based on the 99th percentile of normal operating conditions forms the first validation layer. An Isolation Forest model then analyzes a multidimensional error space consisting of the Composite Error, LSTM Error, and Autoencoder Reconstruction Error. An alarm is triggered only when both validation stages jointly indicate abnormal behavior, reducing false-positive detections. The proposed framework is evaluated against individual LSTM and Autoencoder models using Precision, Recall, F1-Score, and accuracy. By combining temporal prediction, reconstruction-based learning, and non-parametric anomaly validation, the architecture aims to provide a reliable and scalable solution for agricultural sensor quality assurance, offering a foundation for future validation on real-world sensor data and deployment on low-power IoT platforms.

Keywords: Soil Moisture Sensor Fault Detection, LSTM, Autoencoder, Isolation Forest, Smart Agriculture, Anomaly Detection, Precision Irrigation

ANALYSIS OF CAN-BUS BASED TRACTOR OPERATION DATA: EXTRACTION OF LOAD CYCLES FOR AGRICULTURAL MACHINERY ELECTRIFICATION

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ABSTRACT

Electrification of agricultural machinery has become a critical research domain to reduce greenhouse gas emissions and enhance the utilization of renewable energy in agricultural production. However, unlike the automotive sector, standardized load cycles for agricultural machinery are currently lacking. In this study, it was aimed to determine the required electric motor power and battery capacity for an electric tractor based on real-world field operations. To achieve this, an open-access dataset obtained from high-resolution GNSS and CAN-bus (J1939/ISOBUS) recording systems deployed on five tractors (77–240 kW) on a farm in Germany over one year was analyzed from an electrical and mechanical engineering perspective, focusing on the Fendt 211 model (44.25 hours, 10 Hz sampling). Instantaneous mechanical power derived from engine speed and torque data was compared across different operation types (power harrowing, precision seeding, transport). The power harrowing operation demonstrated a significantly higher power demand (average 30.4 kW, maximum 85.4 kW) compared to other operations. A strong linear correlation ($r = 0.97$) was identified between power output and fuel consumption. Using the derived load profile, an electric motor and battery sizing analysis was conducted: the RMS value (29.97 kW) was referenced for continuous motor power, the peak value (85.42 kW) for peak motor power, and a battery capacity requirement of approximately 90.6 kWh was calculated for a typical work session. The findings highlight the necessity of operation-specific motor designs with high peak-to-continuous power ratios for agricultural machinery electrification.

Keywords: agricultural machinery electrification, CAN-bus, load cycle extraction, electric motor sizing, precision agriculture, power electronics

GENOMIC PREDICTION OF HEAD DIAMETER IN SUNFLOWER: COMPARING GWAS-DERIVED AND GENOME-WIDE FEATURE SETS ACROSS MACHINE LEARNING MODELS

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ABSTRACT

Head diameter is a key yield component in sunflower, yet most genomic studies of the trait stop at association mapping and rarely move toward predictive modeling. This gap matters because breeders care less about which SNP sits where and more about whether a genotype's future performance can be forecast before it ever reaches the field. Here we compared genomic prediction accuracy for head diameter across three feature representations, a compact GWAS-derived SNP set, a principal component set summarizing genome-wide variation, and a correlation-based LD-pruned set, using data from 274 sunflower accessions genotyped at 226,779 SNPs. Five models spanning linear and nonlinear families, Ridge, Lasso, Random Forest, XGBoost, and a multilayer perceptron, were evaluated under five-fold cross-validation. The best combination paired XGBoost with the GWAS-SNP feature set, reaching a mean R^2 of 0.632, consistently outperforming both larger genome-wide feature sets. A marker count analysis further showed that predictive accuracy plateaus once the number of markers approaches the size of the significant GWAS pool, around 112 SNPs; beyond that point, additional markers add little. These results indicate that a compact, association-informed marker panel can rival or exceed genome-wide predictors, offering a genotyping strategy that is both cheaper and more interpretable for sunflower breeding programs.

Keywords: Sunflower, Genomic prediction, GWAS, Machine learning, Head diameter, Marker economy

STUDY OF A BRACHYURAN DECAPOD, CRUSTACEAN, THE BLEU CRABCALLINECTES SAPIDUS (RATHBUN,1896): STUDY OF SOME MORPHOMETRIC PARAMETERS IN THE FOR EAST OF ALGERIA

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ABSTRACT

The blue crab is a Brachyourean Decapod and Crustacean destructive invader originating from the American coasts and migrating towards the Algerian coasts where it was interesting to study its biology and ecology. The biology of the blue crab Callinectes sapidus (Rathbun, 1896) in the extreme east of Algeria, more precisely at the Mafrag and Mellah sites, was studied in order to make up for the lack of data concerning the exploitation of this species. During the period from January 2025 to April 2025, we analysed a total of 20 individuals, including 5 females and 15 males. The various measurements taken were as follows: For the Mafrag site: ($5.8 \leq LC \leq 16.1$ cm, $7 \leq lC \leq 16.1$ cm and $90.69 \leq Pt \leq 457.01$ g). For the Mellah site: ($4.8 \leq LC \leq 7.7$ cm, $11.4 \leq lC \leq 16.9$ cm and $65.11 \leq Pt \leq 241.78$ g). Most of the crabs caught were at mature stages. The results obtained in our study revealed a length-weight relationship at Oued Mafrag with a minor growth pattern. We noted that weight increased more slowly than the cube of length ($b = 3$). We observed isometry between carapace width and length measurements, as well as between left leg length and carapace length. The speed of these parameters is considered to be equal. At the Mellah site, we observed a minor allometry, with carapace width increasing more slowly than carapace length. We also deduced a growth isometry between the length of the leg and the posterior and anterior lateral lengths. These results obtained in this study revealed that the growth of these linear parameters occurs at an equal rate. We observed a major allometry between the length of the left leg and the length of the carapace, which showed that the measured length grew faster than the length of the carapace

Keywords: Callinectes sapidus, sex ratio,morphometric parameters,relative growth, Maphrag and Mallah sites

EFFECTS OF LUNAR PHASE ON BODY CHEMICAL COMPOSITION OF MUD CRAB (SCYLLA OLIVACEA) REARED IN SUSTAINABLE SILVOFISHERY SYSTEMS

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ABSTRACT

Natural environmental factors have received increasing attention as environmentally friendly and low-cost approaches for improving aquaculture productivity. Among these factors, lunar phase alters nocturnal light intensity and influences the behavioral rhythms of aquatic organisms, potentially affecting feeding activity and nutrient utilization. However, information regarding the influence of lunar phase on the body chemical composition of mud crab (*Scylla olivacea*) cultured in silvofishery systems remains limited. Therefore, this study evaluated the effects of different lunar phases on the body chemical composition of mud crab reared under sustainable silvofishery conditions. A completely randomized design was employed using four lunar phase treatments (new moon, first quarter, full moon, and third quarter), each with three replicates. A total of 120 male mud crabs weighing 146–168 g was cultured in bamboo enclosures established within a mangrove ecosystem and fed chopped tilapia once daily at 10% of biomass. Body chemical composition, including crude protein, crude lipid, and energy content, was determined using standard proximate analysis. Water quality parameters were monitored throughout the experimental period. Data were analyzed using the Kruskal–Walli's test followed by the Mann–Whitney U test. Lunar phase significantly affected the body chemical composition of mud crab ($p < 0.05$). Crabs cultured during the new moon phase exhibited the highest crude protein (48.11%), crude lipid (12.95%), and energy content (3.892 kcal g^{-1}), whereas the lowest values were observed during the full moon phase. These findings suggest that reduced nocturnal illumination during the new moon phase may enhance feeding activity and nutrient deposition, consistent with the negative phototactic behavior of mud crab. Throughout the experiment, water quality remained within acceptable ranges for mud crab culture. This study demonstrates that lunar phase is an important natural environmental factor influencing the nutritional quality of mud crab cultured in silvofishery systems. Integrating lunar phase information into culture scheduling may provide a practical, low-cost, and environmentally sustainable management strategy for improving mud crab production.

Keywords: Mud crab, Lunar phase, Body chemical composition, Silvofishery, Sustainable aquaculture.

SPATIAL AND DEPTH-RELATED ASSESSMENT OF BIOFOULING IN SEABASS MARICULTURE (DICENTRARCHUS LABRAX LINNAEUS, 1758)

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ABSTRACT

Since the advent of mariculture, biofouling has posed a major challenge by impairing the biological and physiological condition of cultured organisms through net fouling, reducing operational efficiency, and consequently decreasing the profitability and economic sustainability of the industry. This study assessed spatial and depth-related variation in biofouling within cage nets used for European seabass (Dicentrarchus labrax) cultivation. In situ sampling was performed using an underwater camera. Samples were collected from all four sides of the cage at three depths (1 m, 4 m, and 8 m). A control net located at the edge of the mariculture concession was also included in the analysis. All cage sides exhibited a significant reduction in mesh opening, indicating progressive biofouling development over the study period. The results of the Bonferroni post hoc analysis of the side effect revealed significant differences in the surface area of net mesh free of biofouling between most cage sides. The northern side did not differ significantly from the western side; however, it showed significant differences compared to the remaining sides. The control net was significantly different ($p < 0.001$) from all examined cage sides (north, west, south, and east). The results of the Bonferroni post hoc analysis of the main effect of depth (1 m, 4 m, and 8 m) revealed statistically significant differences among all examined depths in the surface area of net mesh free of biofouling ($p < 0.001$). These findings suggest that variations in light penetration with depth influence both the composition and abundance of biofouling communities.

Keywords: biofouling, mariculture, Dicentrachus labrax, Adriatic

ANTIOXIDANT POTENTIAL OF ROSMARINUS OFFICINALIS ESSENTIAL OIL IN PRESERVING SEA URCHIN SPERM QUALITY

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ABSTRACT

The preservation of sperm quality is a key challenge in marine reproductive biology, where oxidative stress is recognized as a major factor affecting gamete functionality. Natural antioxidants have attracted increasing interest as environmentally friendly alternatives for limiting oxidative damage and improving reproductive performance. In this context, the present study investigated the potential of Rosmarinus officinalis essential oil (ROEO) as a natural antioxidant for maintaining sperm quality in the Mediterranean Sea urchin Paracentrotus lividus. The antioxidant activity of ROEO was evaluated using the DPPH assay, while its phytochemical composition was determined by GC-MS analysis. The biological response of sea urchin sperm exposed to ROEO was then evaluated through Computer-Assisted Sperm Analysis (CASA) together with the assessment of lipid peroxidation using the TBARS assay.
ROEO exhibited high free radical scavenging activity, consistent with its richness in bioactive compounds identified by GC-MS. CASA analysis showed that appropriate ROEO concentrations significantly enhanced sperm quality ($p < 0.001$), whereas TBARS analysis demonstrated a significant reduction in oxidative damage ($p < 0.05$). In contrast, higher concentrations significantly impaired sperm function despite their greater antioxidant capacity ($p < 0.05$). This study highlights the potential application of Rosmarinus officinalis essential oil as a natural antioxidant for the preservation of sea urchin sperm quality and contributes to the development of sustainable approaches for marine reproductive biotechnology and aquatic resource conservation.

Keywords: Rosmarinus officinalis, Sea urchin, Sperm quality, Antioxidant activity, Oxidative stress CASA

INFLUENCE OF ROSMARINUS OFFICINALIS ESSENTIAL OIL AND A-TOCOPHEROL ON OXIDATIVE STATUS DURING EMBRYONIC AND LARVAL DEVELOPMENT OF PARACENTROTUS LIVIDUS

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ABSTRACT

Oxidative stress is a major factor affecting embryonic development in marine invertebrates by disrupting redox homeostasis and increasing lipid peroxidation. Natural antioxidants have emerged as promising alternatives for protecting early developmental stages against oxidative damage. This study evaluated the effects of *Rosmarinus officinalis* essential oil (EO) and α-tocopherol (VE) on the embryonic and larval development of the Mediterranean Sea urchin *Paracentrotus lividus* in comparison with untreated controls. Embryonic development was monitored from the cleavage stage to the four-arm pluteus stage. Oxidative status was assessed by measuring lipid peroxidation using the TBARS assay, while antioxidant capacity was evaluated using the ABTS assay. EO significantly reduced lipid peroxidation during key developmental stages, exhibiting lower malondialdehyde (MDA) levels than the control at 4 h ($p < 0.05$) and maintaining reduced oxidative damage at 72 h ($p < 0.05$). VE also decreased MDA levels during embryogenesis, particularly at 19 h ($p < 0.05$), although this protective effect declined during the late larval stage. Antioxidant activity varied according to developmental stage, with EO showing the highest ABTS activity at 48 h, whereas VE exhibited enhanced antioxidant capacity at 24 h. Developmental observations revealed that EO accelerated embryonic progression, with a greater proportion of blastulae during early development and a predominance of four-arm pluteus larvae at 48 h. In contrast, VE promoted gastrulation but showed reduced protection during the final larval stage, when degeneration increased. These findings demonstrate that *Rosmarinus officinalis* essential oil provides more consistent protection against oxidative stress than α-tocopherol alone while supporting normal embryonic and larval development. EO therefore represents a promising natural antioxidant for improving early developmental success in marine invertebrates and may contribute to sustainable strategies for marine reproductive biotechnology and aquatic resource conservation.

Keywords: Paracentrotus lividus, Rosmarinus officinalis essential oil, α-tocopherol, oxidative stress, embryonic development, lipid peroxidation

THE EFFECTS OF REARING SYSTEM ON CALVES BEHAVIOUR

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ABSTRACT

The aim of the current study was to assess the effects of the usual rearing systems on calves' behavioral patterns. In this respect, 166 Simmental calves were separated from their dams immediately after birth (within first 60 minutes), being housed either individually (n=52), in pair (n=27 pairs) or in 6-calves groups (n=60). The feed intake, habitat explore, agonistic and playing behavioral patterns were recorded on days 5th, 10th, and the 15th after birth, data being expressed as mean and ± SD. Individually housed calves spent significant less time ($p \leq 0.005$) for feeding (5.7±0.39 bouts/day compared to pair housed calves (6.9±1.1 bouts/day) and grouped ones (9.17±2.01 bouts/day). Also, the individually housed calves highlighted significant prolonged intervals ($p \leq 0.003$) for feeding bouts. The agonistic behavior proved to be the prerogative of large groups of calves, higher frequency (6.36±1.19 vs. 1.18±0.03 bouts/day, $p \leq 0.001$) and significant more time (11.9±0.54 vs. 9.32±0.08 sec./bout, $p \leq 0.024$) being spending for this particularly pattern. The playing behavior was more evident in grouped housed calves (9.3±0.29 bouts/day, $p \leq 0.01$), paired housing allowing the externalization of this behavior pattern for an extended amount of time ($p \leq 0.001$). These outcomes highlighted that individually housed allow the pairs housing increase benefits for calves with respect for welfare condition, the social opportunities and expression of desired behaviors patterns. Individual housing provides the calm state requires, whereas the paired provides the required safety. Accommodation in larger groups enhances social contacts, but diminishes the safety state, due to the interactions that build the group hierarchy, which are significantly more intensive.

Keywords: behaviour, calves, housing, Simmental, welfare

CORTISOL AS A BIOMARKER FOR HEAT STRESS IN CATTLE: A REVIEW

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ABSTRACT

Heat stress triggered by spikes in the temperature–humidity index (THI) poses a serious threat to the modern cattle industry because it triggers physiological disturbances and decreases metabolic efficiency. To maintain homeostasis during thermal stress exposure, the body activates the hypothalamic–pituitary–adrenal (HPA) axis, which drives cortisol secretion to regulate energy mobilization and modulate immune response. This review article aims to comprehensively evaluate the role of cortisol as a key endocrine biomarker of heat stress in cattle, explore its neuroendocrine pathways, review the feasibility of various biological testing matrices, and highlight variability in responses across cattle breeds. This literature review was compiled following the PRISMA guidelines through a systematic search of major academic databases, including Scopus, Web of Science, PubMed, and Google Scholar, to synthesize high-quality data related to heat load and cortisol metrics in cattle. The literature synthesis results indicate that heat exposure significantly increases circulating cortisol levels, which are directly correlated with increased rectal temperature and respiration rate and decreased feed intake. At the molecular level, this hormonal surge is accompanied by the upregulation of heat shock protein 70 (HSP70). While highly sensitive for detecting acute stress, conventional blood sampling is invasive and susceptible to spurious increases due to stress from handling. As a solution, non-invasive matrices offer a stable and stress-free alternative: fecal cortisol metabolites (FCM) effectively reflect daily heat load with a physiological time lag, while hair cortisol successfully quantifies the accumulation of chronic seasonal stress. Furthermore, cortisol dynamics are breed-dependent; Bos indicus and local Indonesian breeds exhibit more stable basal cortisol profiles and better heat tolerance than Bos taurus. In Conclusion, Cortisol is a highly sensitive and biologically relevant biomarker for monitoring heat stress in cattle. The transition to non-invasive testing matrices provides an accurate method for monitoring animal welfare and a critical foundation for modern precision farming systems and climate-adaptive cattle genetic selection programs.

Keywords: Cortisol, Cattle, Heat stress, HPA axis, Non-invasive biomarker

COMPARATIVE METABOLOMIC PROFILING REVEALS UNIQUE BREED-SPECIFIC METABOLITE SIGNATURES ASSOCIATED WITH PRODUCTION POTENTIAL IN SAANEN AND ETAWA CROSSBRED GOATS

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ABSTRACT

Breed-specific metabolomic profiling is important for understanding the biochemical mechanisms underlying production traits in goats. Saanen goats are recognized as specialized dairy goats with high milk yield capacity, whereas Etawa crossbred goats are considered dual-purpose animals contributing to milk and meat production. However, the metabolic basis supporting these different production orientations remains limited. This study aimed to identify unique breed-specific metabolites and evaluate their relationship with production characteristics. A Gas Chromatography–Mass Spectrometry-based metabolomic profiling approach was applied to six goats, consisting of three Saanen and three Etawa crossbred goats. Detected metabolites were annotated using KEGG IDs and analyzed through MetaboAnalyst pathway analysis to identify biologically relevant pathways. A total of 76 metabolites were identified across both breeds. Venn diagram analysis showed 22 unique metabolites in Saanen goats, 21 unique metabolites in Etawa crossbred goats, and 33 shared metabolites, representing 28.9%, 27.6%, and 43.4%, respectively. From these unique metabolites, pathway impact analysis was used to prioritize biologically influential metabolites, allowing interpretation of metabolites most relevant to production-related metabolic pathways. Saanen goats were characterized by impactful metabolites associated with carbohydrate utilization, mitochondrial energy metabolism, glucose oxidation, and redox regulation. D-Sorbitol, alpha-D-Glucose, succinate, D-Gluconic acid, and 5-Oxoproline indicate active glucose metabolism and antioxidant balance, supporting high energy requirements for milk synthesis. In contrast, Etawa crossbred goats exhibited impactful metabolites related to amino acid metabolism, nitrogen regulation, gluconeogenesis, nucleotide metabolism, and biosynthetic activity, suggesting metabolic flexibility for dual-purpose production. These preliminary findings indicate that impactful metabolite signatures may serve as exploratory biochemical indicators for breed-specific productivity in goats.

Keywords: Breed metabolomics, metabolic biomarkers, production traits, unique metabolites

CHARACTERISTICS AND PHYSICAL QUALITY OF BRAHMAN CROSS STEER MEAT AT DIFFERENT AGE GROUPS

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ABSTRACT

The purpose of this research was to determine the characteristics and physical quality of Brahman Cross steer meat at different age groups. The materials used in this research were 313 heads of Brahman Cross steers, consisting of PI0 (34 heads), PI2 (80 heads), PI4 (113 heads), and PI6 (86 heads), with average slaughter weights of 496.00±32.94 kg, 492.28±43.34 kg, 519.68±51.63 kg, and 537.36±48.64 kg, respectively. The age range was 1.5–3.5 years old. The method used in this research was a case study. Data were collected randomly, and the locations were selected using purposive sampling. The obtained data were analyzed using one-way classification analysis followed by the Least Significant Difference (LSD) test. The results of this research showed that age groups had a highly significant effect (P

Keywords: carcass, Brahman Cross steer, age groups

PRODUCTION PERFORMANCE COMPARISON OF LACTATING DOES WITH SUCKLING KIDS: SIVOPASTURE VERSUS OPEN PASTURE GRAZING SYSTEMS

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ABSTRACT

The objective of this study was to evaluate silvopasture (SP) and open pasture (OP) biomass productivity, nutrients, and goats' production performance comparison for grazing systems. Forty mixed breeds does (Spanish, Kiko, and Boer crosses) with their 77 suckling kids were randomly allocated between silvopasture (n=20 does, 39 kids) and open pasture (n=20 does, 38 kids) grazing systems. Animals were grazed in allotted paddocks rotationally over 6 weeks. Measurements included forage biomass production (kg/hectare) and nutrient contents. Pasture plant samples were analyzed for acid detergent fiber (ADF), neutral detergent fiber (NDF), crude protein (CP), and in-vitro digestibility (IVD) using ANKOM system. Animal production performance traits, including body weight, condition scoring, ultrasound measurements, FAMACHA assessment, and fecal egg count analysis were conducted. Plant communities differed markedly, where silvopasture showed high plant diversity (18+ species) compared in open pasture that was dominated by tall fescue-white clover combinations. There were significant differences in ADF (20–25% in SP and 35–45% in OP), NDF contents (45–55% in SP and 55 –65% OP), and IVD of the first samplings, whereas SP increase in ADF and CP during the second year. Silvopasture recorded less biomass dry matter yield than OP. Metabolomic assays showed plant metabolites, such as phenolic acids, flavonoids, terpenoids and epicatechin were found to be higher in SP plant than OP forages. Open pasture demonstrated substantial high productivity with advantage over SP which produced 137.5% higher fresh weight, 106.7% higher dry matter production, and 12.3% higher crude protein (16.39% vs 14.60%), and 9.2% lower acid detergent fiber (better digestibility) compared to silvopasture. Despite lower biomass, silvopasture met NRC nutritional nutrient requirement standards and supported doe kid rearing and lactation. Blood parameter monitoring in does indicate that hemoglobin declined from baseline (~10 g/dL) to anemic levels (5.28 g/dL SP; 6.58 g/dL OP grazing). Silvopasture grazed animals showed a lower muscle deposit compared to forage pasture group (loin eye area: 4.95 vs 5.90 cm², P

Keywords: silvopasture, biomass, dry matter, metabolite, hemoglobin, crude protein, fiber

GASTROINTESTINAL NEMATODE PARASITE RESISTANT SELECTION INITIATIVE FOR HAIR SHEEP BREED

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ABSTRACT

Gastrointestinal nematode (GIN) parasite poses serious health risks and economic losses for the small ruminants worldwide. GIN infection causes severe weight loss, diarrhea, protein deficiency, bottle jaw, and anemia in small ruminant animals. This research initiative is to evaluate GIN resistant selection efficiency in hair sheep breed - Katahdin. The objective is to establish a GIN resistant selective breeding group and random control group by prescreening production performance records and identifying phenotypic and genomic markers, as well as single-nucleotide polymorphism (SNPs) that are associated with GIN resistance. The preliminary data from breeding ewes and first crop progeny lambs were analyzed. Six breeding sires and 72 mixed age ewes were selected from 50 rams and 280 ewes, respectively. Three six-month-old rams containing a pedigree of GIN resistance were assigned for the selection group (SG), whereas three randomly selected rams from the experimental station flock served as control group (CG) sires. Each sire was mated to 12 ewes for two estrus cycles (35d) during fall season of 2024. Ewes were recorded for breeding, post gestation, post lactation liveweight (LW, kg), body condition score (BCS 1-5 scale), Famacha score (FAM, 1-5 scale), hematocrit (HCT%) and fecal egg count (FEC/g) at four intervals, correspondingly. Lambs were recorded for the ID, birth weight (BW), sex, birth rearing ranks (BRR), weaning (WW) and post weaning weight (PW), average daily gain (ADG), and fecal egg count (FEC). Sire and progeny pedigrees were validated using Ovine-Global-Parentage test kit (Neogen[X]). ®). Data was analyzed and presented with R-statistics for both breeding ewes and progeny. FEC measured was at 1600/g for rams and 732/g for ewes in SG compared to 5600/g for rams and 1114/g for ewes in CG at breeding (P = 0.10). BCS (2.9 vs. 3.0), FAM (1.4 vs. 1.5) and HCT (34.7% vs. 34.3%) in progeny lamb between control and selection. The GIN resistant selection resulted in culling high GIN carriers and parasite egg shaders, then retaining GIN resistant animals while cumulating resistant genotypes in the flock. As a result, finding postulated genetic markers, SNPs, and genomic breeding values for sheep breeding may significantly improve selection efficiency for disease resistance and production sustainability.

Keywords: Gastrointestinal parasite, Katahdin, selection efficiency, breeding value, genomic marker

RESEARCH ON THE INFLUENCE OF THE MANAGEMENT SYSTEM ON MILK PRODUCTION IN SAANEN GOATS

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ABSTRACT

Dairy goat farming represents an important sector of modern animal production, and improving productive performance has become a major concern in the context of resource optimization and increased sustainability in livestock systems. Saanen goats, a specialized dairy breed, are characterized by high milk production potential and good adaptability to different management conditions. The aim of the present study was to evaluate milk production in two Saanen goat farms included in a purebred breeding program over a three-year period, according to the production system used: traditional (pasture-based) and intensive (permanent indoor housing). Milk yield was estimated using the Fleischmann formula, including the suckling period of the kids, while statistical analysis was performed using the Paired Two-Sample t-Test for Means.
The average milk yield of goats raised under the traditional pasture-based system showed significant differences among the three lactations analysed ($p < 0.001$), increasing progressively from 737.31 ± 186.11 kg in the first lactation to 856.07 ± 180.90 kg in the second lactation and 929.44 ± 224.89 kg in the third lactation. At the same time, the average lactation length decreased from 315.6 days to 307.3 days. Therefore, the increase in total milk production was mainly attributable to the enhanced productive capacity of the goats, with average daily milk yields of 2.34 kg/day, 2.79 kg/day, and 3.02 kg/day in the first, second, and third lactations, respectively. Milk production in the intensively managed herd increased significantly from one lactation to the next, accompanied by both an increase in lactation length and a higher average daily milk yield. Goats raised under the intensive system achieved higher production levels than those observed under the traditional system from the first lactation onward (836.4 kg vs. 737.3 kg), with differences becoming even more pronounced in subsequent lactations (1198.6 kg and 1236.2 kg vs. 856.1 kg and 929.4 kg, respectively). These findings suggest that intensive management, through improved nutritional control and housing conditions, promotes a more complete expression of the genetic potential of Saanen goats.

Keywords: Saanen goats, milk production, management system

POMEGRANATE PEELS OR PISTACHIO HULLS AS ADDIDIVE IN CONCENTRATE FEEDS TO FEED D'MAN MEAT LAMBS.

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ABSTRACT

Exploring alternative feed stuffs like agriculture by-products may partially improve livestock productivity, avoid environmental contamination and enhance product quality. The purpose of this work was to investigate the effects pomegranate peels and pistachio hulls incorporated at the level of 20% in two concentrate feed composition, on growth performances and carcass quality of D'Man lambs reared in south Tunisia. The experiment dealt with 21 male D'Man lambs with an average initial body weight of 24.3 Kg. They were divided into 3 groups of 7 lambs each. The three groups received the same amount of oat hay 800 g/d and the same amount of concentrate feed 600 g/d. The groups defined by the type of concentrated feed, the first group (CC) received a commercial concentrated, the second group (PGD) received a concentrated containing 20% of the pomegranate peels and the third lot (PST) received a concentrated containing 20% of the pistachio hulls. They were fattened for 98 days. During this period the growth of the lambs was monitored. At the end of the trial, lambs were slaughtered and carcass quality was studied. The results showed that the slaughter body weights were similar between groups. However, the GMQ was higher for CC and PGD groups compared to the PST group (138 and 134 vs. 110 g /d). The hot and cold carcass weights, the commercial and the real yields were not affected by the type of concentrate. Overall, the regional and tissular quality of the carcasses differed between groups; the fattiest cuts (Ribs and breast) were more developed for the CC and PGD lambs (P=0.002; P=0.05) and the PGD lambs had leaner shoulders (P=0.05) in comparison to both other groups. The recorded results revealed that pomegranate peels' concentrate improved D'Man lambs' growth and carcass quality; however pistachio hulls' concentrate had contrary effects.

Keywords: Pistacia hulls., pomegrenate peels, lambs, carcass quality

INFLUENCE OF THE MALE EFFECT ON ESTRUS RESPONSE IN CARPATHIAN GOATS RAISED IN TWO CONTRASTING CLIMATIC AREAS OF ROMANIA

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ABSTRACT

The male effect is considered one of the most efficient natural methods for stimulating ovarian activity and synchronizing estrus in goats, representing a practical alternative to hormonal protocols in extensive and semi-extensive production systems. The present study was conducted to evaluate the influence of the male effect on estrus response in Carpathian goats raised under two contrasting climatic conditions in Romania. A total of 100 clinically healthy adult females were equally distributed between a dry and a humid climatic area and assigned to control and experimental groups. In the experimental groups, females were completely isolated from bucks for 60 days before the breeding season, after which one buck was introduced for every 25 females. Estrus was monitored daily for 15 days following buck introduction, and both the proportion of females exhibiting estrus and the interval between buck introduction and estrus onset were recorded. The application of the male effect significantly improved reproductive performance in both climatic areas. In the dry area, the proportion of females exhibiting estrus increased from 68% in the control group to 92% in the experimental group, while in the humid area it increased from 72% to 96%. In addition, a considerably higher proportion of females expressed estrus within the first five days after buck introduction, demonstrating a more synchronized reproductive response. Although reproductive performance was slightly higher in the humid area, the male effect proved highly effective under both environmental conditions, indicating that climatic factors may influence the intensity, but not the efficiency, of the reproductive response. The results demonstrate that the male effect is a simple, low-cost and hormone-free reproductive management strategy capable of improving estrus synchronization in Carpathian goats and can be successfully applied under different climatic conditions to increase the efficiency of breeding management.

Keywords: goats, estrus, male, effect, reproductive

NECROPHAGOUS ACTIVITY OF SILPHA RUGOSA (LINNAEUS, 1758) ON MAMMAL CADAVER AT DIFFERENT STAGES OF DECOMPOSITION

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ABSTRACT

Forensic entomology is a discipline that is interested in the study of insects that colonize and consume nourishing substrates, called necrophagous insects. In Algeria, works on forensic entomology is fragmentary and limited. especially for both Diptera and Coleoptera on which only a few works have been done. That is why we have chosen to deal with this subject, by choosing an important necrophagous species of Coleoptera represented by Silpha rugosa.
For our investigation we used as substrate a rabbit corpse, this latter has been put in a cage specially designed to protect it from any predators. The cage is installed in an open space, located near by the laboratory of Biosystematics and Ecology of Arthropods, that is situated in Chaabat Erssas, Constantine, Algeria. According to the results of the present study, Silpha rugosa belonging to the family Silphidae, was the most abundant beetle species collected on the rabbit carcass, with a total of 21 individuals recorded during the decomposition process. It represented one of the dominant necrophagous Coleoptera associated with carrion decomposition. The species was detected from the fresh stage of decomposition and remained present throughout the successive stages of carcass degradation. Its abundance increased markedly during the bloated and putrefaction stages, where it became the dominant beetle species. Silpha rugosa continued to colonize the carcass during the advanced decay stage and persisted in lower numbers at the beginning of the dry-remains stage. The study revealed that the bloated and advanced decomposition stages were characterized by an increase in both dipteran and coleopteran diversity and abundance. Within this necrophagous community, S. rugosa showed a strong association with decomposing tissues and was one of the principal beetle species involved in the carrion degradation process. The dominance and persistence of S. rugosa throughout several decomposition stages indicate its important role in the necrophagous succession of insects colonizing animal remains. Its occurrence may therefore provide useful information for understanding decomposition dynamics and the temporal succession of carrion-associated beetles.

Keywords: Forensic entomology, Necrophagous Coleoptera, Silpha rugosa, mammal cadaver

INVESTIGATION POTENTIAL RESISTANCE OF CULEX PIPIENS LARVAE (LINNAEUS, 1759) TO CYMBOPOGON CITRATUS(DC.) STAPF ESSENTIAL OIL

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ABSTRACT

Mosquitoes represent a major public health concern due to their role in the transmission of numerous pathogens. Among them, Culex pipiens is a widely distributed mosquito species commonly found in stagnant water bodies, particularly those rich in organic matter. Given the increasing limitations of synthetic insecticides, including the emergence of insecticide resistance and their adverse environmental effects, plant-derived products have gained considerable attention as promising alternatives for mosquito vector control. The present study aimed to evaluate the larvicidal activity of Cymbopogon citratus essential oil against third- and fourth-instar (L3 and L4) larvae of Culex pipiens. Larvae were collected from the vicinity of the Beni Haroun Dam (Mila Province, Algeria) and maintained under laboratory conditions. Bioassays were performed using three concentrations (50, 75, and 100 mg/L), with three replicates per concentration and 25 larvae per replicate. Two control groups were included: one containing distilled water only and another containing distilled water supplemented with Tween 80. The results demonstrated that Cymbopogon citratus essential oil exhibited weak larvicidal activity against Culex pipiens larvae, with a mean mortality rate of 8% after 24 h and a cumulative mortality of 24% after 48 h at the highest tested concentration (100 mg/L). One-way ANOVA revealed no statistically significant larvicidal effect. Consequently, the LC_{50} and LC_{95} values could not be reliably estimated because mortality remained below 50% at all tested concentrations. The limited larvicidal efficacy observed may indicate a potential tolerance or emerging resistance of Culex pipiens larvae to the bioactive compounds of Cymbopogon citratus essential oil, although this hypothesis requires further experimental confirmation. Future investigations should evaluate higher concentrations, identify the major bioactive constituents, and explore the biochemical and molecular mechanisms responsible for the observed reduced susceptibility. These studies will contribute to a better understanding of larval responses to botanical insecticides and support the development of more effective and sustainable mosquito control strategies.

Keywords: Culex pipiens, Cymbopogon citratus, essential oil, larvicidal activity, resistance, LC50, LC95

CHARACTERIZATION OF THE ESRTOUS CYCLE AND CYCLIC CHANGES IN THE VAGINA OF THE LIBYAN JIRD (MERIONES LIBYCUS, RODENTIA: MURIDAE) DURING THE BREEDING SEASON

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ABSTRACT

Meriones libycus is a seasonal breeder exhibiting an active reproductive period (spring and early summer) and a quiescent period (late summer, autumn, and winter). Vaginal morphofunctional changes are mainly regulated by ovarian steroid hormones, whose circulating levels fluctuate throughout the estrous cycle. This study aimed to characterize the estrous cycle and correlate vaginal cytology with histological changes in the vagina during the breeding season. Vaginal smear analysis identified four distinct stages of the estrous cycle. Proestrus lasted 0.5–2 days and was characterized by a predominance of small and large nucleated epithelial cells with a few cornified cells. Estrus lasted from 3 hours to 1.5 days and was characterized by 100% cornified epithelial cells. Metestrus lasted 0.5–1.5 days and showed large nucleated epithelial cells, a few cornified cells, and numerous leukocytes. Diestrus, the longest stage (7–15 days), was characterized mainly by leukocytes associated with variable numbers of nucleated epithelial cells and a few cornified cells. Histological examination revealed marked cyclic modifications of the vaginal mucosa. During estrus, the vaginal epithelium was thick, stratified, squamous, and heavily keratinized. During metestrus, the epithelial structure remained relatively unchanged, whereas leukocyte infiltration first appeared in the connective tissue before extending into the epithelium. During diestrus, the vaginal epithelium became thinner and showed abundant leukocyte infiltration. In proestrus, epithelial proliferation resulted in a marked increase in epithelial thickness, accompanied by the disappearance of leukocyte infiltration from the mucosa. These findings demonstrate that the vagina of M. libycus undergoes well-defined cyclic histological changes that closely parallel the cytological stages of the estrous cycle. Vaginal cytology therefore represents a reliable and non-invasive method for monitoring reproductive status in this seasonal rodent.

Keywords: Meriones libycus, estrous cycle, cyclic changes, histology, vagina.

THE IMPACT OF ENDOPARASITES OF WILD QUAIL COTURNIX COTURNIX , BY SEX, AND ON CERTAIN BIOCHEMICAL PARAMETERS (CHOLESTEROL AND CALCIUM)

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ABSTRACT

Parasitic diseases represent a major health concern for a wide range of wild animals, including migratory birds. The present study investigated the Common Quail (Coturnix coturnix coturnix) as a representative migratory game bird. This small species, belonging to the order Galliformes and the family Phasianidae, serves as a host for a diverse assemblage of parasites. In wild populations, parasitic infections constitute one of the main causes of disease, with coccidiosis being among the most prevalent parasitic disorders affecting game birds. Therefore, the present study was conducted on Common Quails collected from three regions of Algeria—Bouira, Tizi Ouzou, and Chlef—with approximately thirty individuals sampled from each region. Parasitological investigations were performed by analyzing fecal samples collected from birds kept in cages. Two complementary diagnostic methods were employed: a qualitative technique based on the flotation method and a quantitative technique using the McMaster method. In addition, blood smears stained with May–Grünwald–Giemsa (MGG) were examined for the detection and identification of blood parasites. Biochemical analyses were carried out on two groups of birds: one naturally infected with coccidia and the other free of coccidial infection.
Coprological examination revealed that Eimeria spp. were the predominant endoparasites detected in quails from all three study regions, while a Strongyloides egg was identified only in samples from Bouira. The prevalence of parasitic infections was highest in Chlef (78.6%), followed by Bouira (19.5%) and Tizi Ouzou (2.0%). Analysis of variance showed no significant difference in Eimeria oocyst counts between male and female birds ($p > 0.05$), indicating a similar susceptibility to coccidial infection in both sexes. In contrast, microscopic examination of May–Grünwald–Giemsa-stained blood smears did not reveal the presence of any blood parasites. Biochemical analyses of serum samples from coccidia-infected and non-infected birds were performed to evaluate the effects of coccidiosis on calcium and cholesterol concentrations. The mean serum calcium concentrations were 3.24 and 6.017 mmol/L in infected and non-infected birds, respectively, whereas the corresponding mean serum cholesterol concentrations were 0.011 and 0.013 mmol/L. Coccidial infection was therefore associated with a decrease in both serum calcium and cholesterol concentrations, with the reduction being more pronounced for calcium.

Keywords: Common quail (Coturnix coturnix), endoparasites, Eimeria, blood smears, biochemical parameters

PARTIAL REPLACEMENT OF BARLEY WITH ALMOND HULLS IN LAMBS DIETS: EFFECTS ON GROWTH PERFORMANCE AND MEAT QUALITY

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ABSTRACT

The present study evaluated the effects of partially replacing barley with almond hulls, an abundant agro-industrial by-product, on the growth performance, carcass characteristics, and meat quality of Barbarine lambs. Twenty-seven male lambs (20.7 ± 4 kg) were randomly assigned to one of three dietary treatments: a control diet (T), a diet containing 10% almond hulls (AM10), and a diet containing 20% almond hulls (AM20) as a partial replacement for barley. Animals were fed 600 g of oat hay and 600 g of concentrate daily for 110 days before slaughter. Dry matter intake was not affected by dietary treatment, remaining stable across the three groups (1065–1073 g/day). Likewise, growth performance, including final body weight and average daily gain (ADG), did not differ significantly among treatments ($P > 0.05$). Carcass tissue composition was also unaffected, averaging approximately 58% muscle, 19 % fat, and 22 % bone ($P > 0.05$). Regarding meat quality, the chemical composition of the meat, including cooking loss, dry matter, ash, and protein content, remained unchanged with almond hull inclusion ($P > 0.05$). Ultimate pH exhibited the expected post-mortem decline (6.37 to 5.54) and was not influenced by the dietary treatments. Almond hull inclusion slightly reduced meat redness (a*) (14.53, 13.33, and 13.01 for T, AM10, and AM20, respectively; $P < 0.05$), whereas the other colour parameters remained unaffected. Lipid oxidation, assessed by TBARS, increased in the almond hull groups, reaching the highest value in AM20 (0.79 mg MDA/kg meat). **In conclusion**, almond hulls can successfully replace barley at inclusion levels of up to 20% in finishing diets for Barbarine lambs without compromising feed intake, growth performance, carcass characteristics, or the physicochemical quality of the meat.

Keywords: Almond hulls, Barbarine lambs, growth, carcass composition, meat quality.

IDENTIFICATION OF CANDIDATE GENES AND BIOLOGICAL PATHWAYS ASSOCIATED WITH GENETIC SHEEP RESISTOME TO GASTROINTESTINAL NEMATODES IN SHEEP: AN INTEGRATED MICROARRAY DATA MINING APPROACH

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ABSTRACT

Background: Intestinal nematode (GIN) infections are one of the biggest health and financial challenges to sheep production systems worldwide. Although anthelmintic medications have been the primary method of control for decades, the global emergence of drug-resistant nematode populations and increasing consumer demand for animal products free of chemicals has led to increasing interest in breeding sheep with innate genetic resistance to GIN. However, conventional phenotype-based selection is complicated by the polygenic architecture and moderate heritability (h^2 = 0.22–0.63) of resistance traits. **Objectives:** The current study was designed with the following goals in mind: (i) to identify differentially expressed genes (DEGs) shared by several independent microarray datasets; (ii) to characterize the functional categories and biological pathways enriched among these DEGs; (iii) to build protein-protein interaction (PPI) networks and identify hub genes essential to the resistance phenotype; (iv) to interpret the results in the context of host-parasite immunobiology; and (v) to suggest workable, farm-level marker-assisted selection. **Methods:** The NCBI Gene Expression Omnibus database was used to obtain 48 raw microarray samples from three platforms (GPL4077, GPL4076, and GPL4072). 45 high-quality samples were left after thorough quality control using boxplots, MA-plots, heatmap clustering, and principal component analysis. The limma package was used to conduct differential expression analysis with empirical Bayes moderation (FDR < 0.05, $|\log_2 FC| \geq 1.0$). DAVID, clusterProfiler, and GSEA were used for gene ontology enrichment, KEGG pathway analysis, and gene set enrichment analysis. Hub genes were found using the Maximal Clique Centrality (MCC) algorithm; PPI networks were built with STRING and displayed in Cytoscape. **Results:** Among the 1,247 DEGs, 558 were downregulated and 689 were upregulated in resistant animals. The key upregulated genes included IFNG ($\log_2 FC$ = 2.34), IL4 (2.21), TLR4 (1.98), TNF (1.87), Ovar-DRB1 (1.76), and NRAMP1 (1.45); the downregulated genes included MUC7 (−1.45) and MUC15 (−1.05) from the mucin family. GO enrichment showed significant enrichment for immune response, inflammatory response, chemotaxis, and cytokine-mediated signaling; KEGG pathways highlighted Th1/Th2 differentiation, chemokine signaling, and toll-like receptor signaling; and GSEA confirmed strong Th2-related gene set enrichment in resistant animals. PPI network analysis identified 10 hub genes (IFNG, TNF, TLR4, IL4, Ovar-DRB1, CCL5, IL6, STAT6, IL13, and NRAMP1) that were involved in three functional modules related to Th2 polarization, antigen presentation, and inflammatory regulation. **Conclusions:** This integrated bioinformatics analysis provides a strong molecular signature of genetic resistance to GIN infection in sheep. The identified hub genes, especially those related to Th2 immunity and MHC class II antigen presentation, are promising targets for marker-assisted selection and genomic breeding programs. The downregulation of mucin genes in resistant animals suggests that pathological mucus hypersecretion is averted by rapid parasite expulsion, challenging the

conventional wisdom. These results can be used to rationally design breeding programs aimed at reducing anthelmintic dependence and developing sustainable sheep production.

Keywords: Gastrointestinal nematodes, Sheep, Genetic resistance, Microarray, Differential gene expression, Hub genes, Th2 immunity, MHC, Bioinformatics, Marker-assisted selection

EVALUATION OF AMINO ACID DIGESTIBILITY AND PROTEIN QUALITY OF MEALWORM (TENEBRIO MOLITOR) MEAL IN BROILER CHICKENS

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ABSTRACT

The increasing global demand for sustainable protein sources has directed attention toward edible insects as alternatives to conventional feed ingredients. This study was conducted to determine the standardized ileal digestibility (SID) of amino acids and protein quality of mealworm (Tenebrio molitor) meal compared to soybean meal in broiler chickens. A total of 70 male Ross 308 broiler chickens at 34 days of age were used in a completely randomized design with 7 treatments and 5 replicates. Experimental diets included: 1) corn-soybean meal basal diet, 2) nitrogen-free diet, 3) purified diet containing mealworm meal as the sole protein source, 4) purified diet containing soybean meal, and 5-7) mixture diets (50:50). All diets contained 0.5% chromic oxide as an indigestible marker. Birds were fed experimental diets from 34 to 38 days of age, and ileal digesta was collected at day 38. Chemical composition analysis revealed that mealworm meal contained significantly higher crude protein (61.55%) compared to soybean meal (43.45%). The SID of protein in mealworm meal (90.90%) was significantly higher than soybean meal (81.75%). Digestibility of methionine in mealworm meal (94.66%) was substantially higher than soybean meal (75.17%), while lysine digestibility was 91.95% versus 88.52%, respectively. The Digestible Indispensable Amino Acid Score (DIAAS) for mealworm meal (75.3%) was significantly higher than soybean meal (59.6%). Methionine + cystine was identified as the first-limiting amino acid for both sources, but the severity was much greater in soybean meal. The standardized digestible protein content in mealworm meal (55.96 g/100g) was approximately 1.6 times higher than soybean meal (35.51 g/100g). In conclusion, mealworm meal possesses superior protein quality, exceptional digestibility, and high concentrations of digestible amino acids, particularly methionine, making it a strategic protein source to reduce reliance on synthetic amino acid supplements and imported soybean meal in poultry nutrition

Keywords: Mealworm, Tenebrio molitor, Amino acid digestibility, Protein quality, DIAAS, Broiler chickens

EVALUATION OF AMINO ACID DIGESTIBILITY AND PROTEIN QUALITY OF BLACK SOLDIER FLY LARVAE (HERMETIA ILLUCENS) MEAL IN BROILER CHICKENS

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ABSTRACT

The search for sustainable protein alternatives has intensified due to increasing global population and environmental concerns associated with conventional protein sources. This study evaluated the standardized ileal digestibility (SID) of amino acids and protein quality of black soldier fly larvae (BSFL) (Hermetia illucens) meal compared to soybean meal in broiler chickens. A total of 70 male Ross 308 broiler chickens at 34 days of age were used in a completely randomized design with 7 treatments and 5 replicates. Experimental diets included purified diets containing BSFL meal or soybean meal as the sole protein source, a basal corn-soybean meal diet, mixture diets (50:50), and a nitrogen-free diet for measuring endogenous losses. All diets contained 0.5% chromic oxide. Birds were fed experimental diets from 34 to 38 days, and ileal digesta was collected at day 38. Chemical composition analysis showed BSFL meal contained 36.21% crude protein, significantly lower than soybean meal (43.45%). However, the SID of protein in BSFL meal (89.86%) was significantly higher than soybean meal (81.75%). Methionine digestibility in BSFL meal (91.93%) was substantially higher than soybean meal (75.17%), while lysine digestibility was 92.25% versus 88.52%, respectively. However, valine digestibility in BSFL meal (75.85%) was significantly lower than soybean meal (94.79%), and cystine digestibility (82.86%) was also lower than soybean meal (101.53%). The DIAAS value for BSFL meal (72.6%) was significantly higher than soybean meal (59.6%). Methionine + cystine was identified as the first-limiting amino acid for both sources. In conclusion, despite its lower protein concentration, BSFL meal exhibits high protein quality and digestibility, particularly for lysine and methionine, making it a viable alternative protein source. However, the lower digestibility of valine and cystine requires attention in diet formulation, and a synergistic combination with soybean meal is recommended for optimal results.

Keywords: Black soldier fly larvae, Hermetia illucens, Amino acid digestibility, Protein quality, DIAAS, Broiler chickens

FROM SEA COASTS TO URBAN ROOFTOPS: INLAND EXPANSION OF THE YELLOW-LEGGED GULL (LARUS MICHAHELLIS) IN BULGARIA

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ABSTRACT

The Yellow-legged Gull (Larus michahellis) is one of the most successful examples of avian adaptation to anthropogenic environments in Bulgaria. Originally associated predominantly with marine and coastal habitats, the species has undergone a remarkable range expansion and synanthropization over the last century. This study reviews and synthesizes historical and contemporary data on the expansion of the Yellow-legged Gull from the Bulgarian Black Sea coast towards inland regions and urban environments. Based on published ornithological records spanning the nineteenth century to the present, four major stages of expansion were identified. The first stage, lasting until the mid-twentieth century, was characterized by predominantly coastal distribution and the earliest documented cases of rooftop nesting in Black Sea towns. Between 1950 and 1980, the species gradually expanded inland, apparently using major river valleys, wetlands, reservoirs, and other water bodies as ecological corridors and feeding habitats. After 1980, the expansion accelerated considerably, accompanied by the establishment of breeding populations in numerous inland cities. By the early 1990s, 63.3% of the breeding pairs in Bulgaria nested on buildings, demonstrating a pronounced shift towards synanthropic breeding. Since 2000, urban populations have become dominant, while the national breeding population has been estimated at 5,000–7,000 pairs. The expansion of Yellow-legged Gull illustrates the species' high ecological plasticity and its ability to exploit artificial nesting sites and anthropogenic food resources. At the same time, the growing urban populations increase the potential for human–wildlife conflicts and ecological impacts, highlighting the need for systematic monitoring and evidence-based population management.

Keywords: Larus michahellis, Yellow-legged Gull, range expansion, synanthropization, urban ecology, Bulgaria

SYNERGISTIC EFFECTS OF ORGANIC CHROMIUM AND SELENIUM SUPPLEMENTATION IN TRANSITION DAIRY COWS: HEALTH, PRODUCTION, AND MOLECULAR RESPONSES

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ABSTRACT

Transition period in dairy cows, spanning approximately three weeks before calving to three weeks after parturition, is a critical physiological phase characterized by marked metabolic, oxidative, and immune challenges. During this period, the sudden increase in nutrient demand for fetal growth and milk synthesis often coincides with reduced dry matter intake, resulting in negative energy balance, mobilization of body reserves, impaired liver function, and greater susceptibility to inflammatory and metabolic disorders. In parallel, the elevation of pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF−α)(TNF-\alpha)(TNF−α) and interleukin-6 (IL−6)(IL-6)(IL−6) may further exacerbate appetite suppression, metabolic instability, and immune dysfunction. For this reason, nutritional strategies aimed at supporting metabolic adaptation and immune resilience during the transition period are of considerable interest in dairy science. Chromium and selenium are two trace elements that may play complementary roles in alleviating transition-related stress. Chromium is known to contribute to improved insulin sensitivity and glucose metabolism, thereby supporting energy homeostasis under conditions of metabolic strain. Selenium, on the other hand, is an essential component of selenoproteins and antioxidant enzymes such as glutathione peroxidase, which are involved in protecting tissues against oxidative damage and maintaining immune competence. Despite the recognized biological importance of each element, evidence regarding their combined or synergistic effects in transition dairy cows remains limited. Accordingly, the present research was designed to examine whether supplementation with organic chromium and selenium, alone or in combination, could improve productive performance, reproductive efficiency, blood metabolites, antioxidant status, and inflammatory gene expression in Holstein dairy cows during the transition period. The proposed study involves Holstein dairy cows assigned to four experimental groups: a control group receiving no supplementation, a chromium-supplemented group, a selenium-supplemented group, and a combined chromium-plus-selenium group. Blood and milk samples are collected before calving, immediately after parturition, and during the first three weeks postpartum. The study evaluates a wide range of variables, including daily milk yield, fat-corrected milk, milk composition, dry matter intake, reproductive indices such as days open, retained placenta, and conception rate after first insemination, as well as metabolic markers including non-esterified fatty acids (NEFA)(NEFA)(NEFA), beta-hydroxybutyrate (BHBA)(BHBA)(BHBA), glucose, insulin, and indicators of liver function. In

addition, antioxidant and immune-related parameters such as glutathione peroxidase (GPx)(GPx)(GPx), superoxide dismutase (SOD)(SOD)(SOD), ferric reducing antioxidant power (FRAP)(FRAP)(FRAP), neutrophil chemotaxis, and somatic cell count in milk are assessed. The concentrations of chromium and selenium in blood and milk are measured using inductively coupled plasma mass spectrometry (ICP−MS)(ICP-MS)(ICP−MS). To evaluate inflammatory responses at the molecular level, gene expression analysis of TNF−αTNF-\alphaTNF−α and IL−6IL-6IL−6 is performed using real-time PCR, with relative expression calculated by the 2−ΔΔCt2^{-\Delta\Delta Ct}2−ΔΔCt method. The experimental design is intended to determine the main effects of chromium and selenium and, more importantly, their interaction effect. Statistical analysis is planned using repeated-measures analysis of variance, followed by post hoc comparisons at a significance level of p≤0.05p \le 0.05p≤0.05. Although the file primarily presents a research framework rather than finalized experimental results, the expected outcome is that the combined supplementation may produce greater benefits than either element alone. Such benefits may include improved milk production, better energy balance, reduced mobilization of body fat, enhanced antioxidant defense, lower inflammatory gene expression, and improved reproductive performance. If confirmed, these findings could support the use of organic chromium and selenium as a practical nutritional intervention to improve health and productivity in transition dairy cows. In summary, this study addresses an important gap in dairy nutrition by investigating the possible synergistic effects of chromium and selenium supplementation during one of the most vulnerable stages of lactation. The proposed framework is biologically grounded and methodologically comprehensive, but because the available file does not provide numerical outcomes, definitive conclusions about efficacy cannot yet be drawn. Final interpretation will require access to the actual data tables, statistical outputs, and completed results section.

Keywords: Transition period, dairy cows, organic chromium, selenium, synergistic effect, oxidative stress, immune response, inflammatory cytokines, milk production, reproduction, TNF−αTNF-alphaTNF−α, IL−6IL-6IL−6

MARKETING MIX FACTORS INFLUENCING CONSUMERS' PURCHASE DECISIONS FOR PASTEURIZED MILK: A CASE STUDY OF LOMILK, INDONESIA

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ABSTRACT

The marketing mix plays a crucial role in influencing consumers' purchasing behavior, particularly in the increasingly competitive dairy industry. This study aimed to examine the influence of marketing mix elements on consumers' purchase decisions for pasteurized milk products, using Lomilk, a local pasteurized milk brand in Makassar, Indonesia, as a case study. A quantitative descriptive approach was employed, involving 42 respondents consisting of one business owner and 41 consumers selected through purposive and accidental sampling techniques. Primary data were collected through questionnaires, interviews, observations, and documentation, while multiple linear regression analysis was performed using IBM SPSS Statistics 25. Prior to regression analysis, classical assumption tests, including normality, multicollinearity, and heteroscedasticity tests, confirmed that the regression model met the required statistical assumptions. The results revealed that, among the four marketing mix variables, only promotion had a positive and statistically significant effect on consumers' purchase decisions ($\beta = 0.429$; $p = 0.005$). In contrast, product ($p = 0.725$), price ($p = 0.960$), and place ($p = 0.064$) did not significantly influence purchase decisions. Simultaneously, the four marketing mix variables significantly affected purchase decisions ($p = 0.032$). These findings indicate that promotional activities, particularly through social media and promotional campaigns, play the most influential role in encouraging consumers to purchase pasteurized milk products. The study suggests that local dairy enterprises should strengthen their promotional strategies while maintaining product quality, competitive pricing, and distribution accessibility to enhance market competitiveness and sustain consumer purchasing behavior.

Keywords: marketing mix, purchase decision, pasteurized milk, promotion, consumer behavior, Indonesia

SUSTAINABLE MANAGEMENT OF SMALL RUMINANTS: FROM THE CRISIS OF DECLINING NUMBERS TO GENETIC AND ECONOMIC IMPROVEMENT

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ABSTRACT

The small ruminant sector in Albania, a traditional pillar of the rural economy and pastoral culture, is undergoing one of its most challenging periods. Sheep and goats remain a primary income source for over 40% of families in mountainous and hilly areas, contributing to milk, meat, and traditional high-value products while preserving genetic biodiversity and pastoral heritage. Yet the last decade shows a steady population decline: according to INSTAT, the combined sheep and goat flock fell by 2.9% in 2024 alone, from 1,846,000 to 1,792,000 head, with sheep down 3.8% (to ~968,000) and goats down 3.9% (to ~500,000). Economic pressures (rising feed costs, labor shortages, and unstable product prices) have weakened family flocks, which make up 85% of all farms, while a lack of secure markets and investment in modern technology compounds the problem. Meanwhile, rural-to-urban migration and emigration have eroded the next generation of shepherds and weakened efforts to preserve local breeds such as Bardhoka, Ruda, Shkodranja, Lara e Polisit, Dhija e Hasit, Velipojës, and Dukatit — a rare genetic heritage now threatened by uncontrolled crossbreeding and the disappearance of family farms. This decline is mirrored in production: total milk output dropped from 900,569 to 876,688 tonnes (-2.7%) between 2023 and 2024, with cow's milk still dominant (84.9%) over goat's (7.7%) and sheep's (7.4%). Dairy-collected volumes fell 6.6% overall, with sheep's milk down 9.7% and goat's milk down 3.1%; cheese output dropped 9.9%, hit hardest in goat's-milk cheese (-16.8%). Live-weight meat production fell 3.8%, from 135,483 to 130,334 tonnes. Production is geographically concentrated, with Vlorë and Gjirokastër together accounting for roughly 40-45% of the national sheep and goat flock. The resulting supply gap has deepened import dependence, while pasture abandonment and biodiversity loss further threaten food security and the sustainability of national production. Genetic improvement is therefore a strategic necessity. Modern tools: artificial insemination, genomic (SNP) analysis, gene banks, and systematic data recording can raise productivity, cut costs, and safeguard local breeds. A national program supporting nucleus farms, identifying elite individuals, and integrating farm-level digital technology could restore competitiveness and product quality. Supporting policies should strengthen infrastructure, farm cooperatives, and international partnerships, notably with European genetic networks like EUGENA. Only an integrated approach linking science, farming practice, policy, and market can move the sector from survival toward long-term sustainability, preserving Albanian identity and tradition.

Keywords: Small ruminants, Population dynamics, Genetic improvement, Technology transfer, Sustainable management

MOLECULAR CHARACTERIZATION OF ALBANIAN SHEEP AND GOAT BREEDS: A REVIEW OF GENETIC DIVERSITY AND POPULATION STRUCTURE

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ABSTRACT

Albanian sheep and goat breeds represent an important component of the country's animal genetic resources and have been the subject of several molecular investigations over the last two decades. These studies have provided valuable information on the genetic diversity and population structure of indigenous breeds using different molecular marker systems. This review brings together the available evidence to provide an integrated overview of the current knowledge and to highlight its relevance for the conservation and sustainable management of Albanian small ruminant genetic resources. The published studies employed microsatellites (SSR), AFLP, mitochondrial DNA (mtDNA), and SNP markers to investigate the genetic diversity of sheep and goat breeds, although SNP-based studies remain comparatively limited compared to microsatellite-based research. Sheep breeds studied included Bardhoka, Ruda, Shkodrane, and Recka, together with several local goat populations. Although different approaches and sampling strategies were used, the studies reached similar conclusions: Albanian sheep and goat populations were consistently characterized by high genetic diversity, reflected in high allelic richness and heterozygosity. Most variation was observed within breeds, whereas differentiation among breeds was generally low to moderate, indicating preserved genetic variability. Population structure analyses also identified varying degrees of clustering and admixture, improving understanding of relationships among local breeds and their evolutionary history. These studies have established an important scientific foundation for the genetic characterization of Albanian sheep and goat breeds and have contributed significantly to the documentation of the country's animal genetic resources. Recent advances in genomic technologies provide new opportunities to complement the existing knowledge through genome-wide analyses, allowing a more detailed investigation of genetic diversity, population structure, inbreeding, admixture, and signatures of selection. The integration of these approaches with previous molecular studies will further support conservation programmes, sustainable breeding strategies, and the long-term preservation of Albania's indigenous sheep and goat breeds.

Keywords: Sheep, Goat, Breeds, Genetic diversity, Population structure, Molecular markers, Microsatellites.

AN EVALUATION ON SUSTAINABLE WATER MANAGEMENT IN DAIRY CATTLE ENTERPRISES FROM GLOBAL WATER SECURITY

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ABSTRACT

Water is one of the indispensable natural resources for the continuity of life, the protection of ecosystems, and the sustainability of agricultural production. However, population growth, climate change, water pollution, and increasing water demand are progressively increasing the pressure on water resources on a global scale. The agricultural sector is one of the areas where freshwater resources are most intensively used. Within the agricultural sector, intensive water use is carried out in dairy cattle enterprises. In these enterprises, water stands out as one of the fundamental inputs of production due to the drinking water requirements of animals, feed production, milking systems, and the cleaning of equipment and housing. In this review, the current status of global water resources and water security, the causes of water pollution, and current approaches toward the protection of water resources are evaluated; subsequently, sustainable water management practices in dairy cattle enterprises and current studies regarding water resources and water management in dairy cattle enterprises in Turkey are discussed in detail. Literature findings show that regular monitoring of water use in enterprises, reduction of water losses, evaluation of alternative water resources, dissemination of practices for water reuse, and the adoption of appropriate management strategies can increase water use efficiency. Furthermore, ensuring continuous access for animals to an adequate amount and appropriate quality of drinking water is of great importance as a fundamental necessity for protecting animal health, welfare, and production performance. In conclusion, the dissemination of sustainable water management in dairy cattle enterprises will provide significant long-term contributions to the protection of water resources, the support of environmental sustainability, and the development of sustainable milk production.

Keywords: Water security, water pollution, sustainable water management, dairy farming, water resources, water use efficiency.

THE IMPORTANCE OF BEHAVIORAL INDICATORS FOR ANIMAL WELFARE AND HERD MANAGEMENT IN DAIRY CATTLE

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ABSTRACT

Cattle behaviors are among the important biological indicators used in evaluating the physiological state, health level, adaptation to environmental conditions, and welfare of animals. Regular monitoring of behaviors such as feeding, rumination, resting, movement, social interaction, estrus, water consumption, and defecation contributes to the early diagnosis of diseases, the evaluation of management practices, and the improvement of production performance. In this review, first, the basic approaches used in the evaluation of cattle behaviors and the relationship between behavior and animal welfare are discussed; then, behavioral indicators such as body condition, feed intake, heat stress, estrus behaviors, rumen fill, housing hygiene, resting behavior, bunk and stall design, foot health, fecal consistency, and water consumption are evaluated in line with the current literature. In addition, the contributions of behavioral indicators to animal health, welfare, his decision-making processes in herd management, and the applicability of these indicators in field conditions are also addressed. Furthermore, the importance of behavioral observations in monitoring herd management, animal health, and welfare is emphasized. Literature findings show that the use of behavior-based evaluations together with appropriate feeding and housing practices can provide significant contributions to improving animal welfare, identifying diseases at an early stage, and increasing production performance. Additionally, regular and systematic monitoring of behaviors can contribute to making more accurate and timely decisions in herd management. In conclusion, systematic monitoring and evaluation of cattle behaviors are considered a fundamental management tool for sustainable production, effective herd management, and the development of animal welfare in modern dairy cattle enterprises.

Keywords: Cattle behavior, animal welfare, ethology, behavioral indicators, dairy farming, herd management

MITIGATING ANTIMICROBIAL RESISTANCE THROUGH ANIMAL WELFARE STANDARDS: A ONE HEALTH FRAMEWORK

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ABSTRACT

Antimicrobial resistance represents a major global health challenge that requires integrative solutions beyond conventional medical stewardship. This study investigates the role of animal welfare as a determinant in reducing resistance development, focusing on how stress-related immunosuppression influences infection rates and antimicrobial use. A systematic meta-analysis was conducted using a sample of 45 peer-reviewed studies published between 2020 and 2025, comparing resistance prevalence and antimicrobial consumption across intensive and welfare-oriented production systems. The methodology included measurement of cortisol levels as indicators of stress and genomic characterization of resistant Escherichia coli and Campylobacter isolates. Results revealed a significant correlation ($r = 0.68$, $p < 0.01$) between elevated stress markers and increased shedding of resistant pathogens. Livestock raised under intensive conditions showed a 35 percent higher incidence of opportunistic infections, which led to greater reliance on metaphylactic antimicrobial administration. In contrast, farms that implemented environmental enrichment and improved air quality achieved a 22 percent reduction in antimicrobial use. Genetic analysis further demonstrated that stressed hosts serve as reservoirs for the transfer of resistance traits. The findings highlight that improving animal welfare is a novel, non-pharmacological strategy to mitigate resistance, reducing the need for chemical interventions and strengthening biosecurity. This contribution underscores the importance of embedding welfare standards into veterinary policy frameworks to preserve the long-term effectiveness of existing antimicrobials.

Keywords: livestock stress, host immunity, resistant pathogens, biosecurity strategies, sustainable farming.

CARCASS CHARACTERISTICS AND SECONDARY CUTS OF BRAHMAN CROSS STEERS AT DIFFERENT AGE LEVELS

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ABSTRACT

This study aimed to evaluate the effect of age on carcass yield and secondary cuts in Brahman Cross (BX) steers. The research was conducted from September 2 to 22, 2015, at PT Cianjur Arta Makmur slaughterhouse, Cianjur Regency, West Java. A total of 68 Brahman Cross steers were used, divided into four age groups based on permanent incisor eruption: PI0 (24–36 months, n=21), and PI6 (>36–42 months, n=13). Measured variables included slaughter weight, hot carcass weight, cold carcass weight, carcass percentage, and secondary cut weights consisting of blade, chuck tender, shank, chuck, brisket, rump, topside, knuckle, and silverside. Data were analyzed using one-way ANOVA. The results showed no significant differences (P>0.05) among age groups in terms of slaughter weight (507.07 ± 44.58 kg), hot carcass weight (287.97 ± 23.85 kg), cold carcass weight (273.31 ± 23.57 kg), carcass percentage (53.95 ± 1.92%), and secondary cut weights: blade (17.92 ± 1.84 kg), chuck tender (2.56 ± 0.29 kg), shank (15.90 ± 1.64 kg), chuck (25.20 ± 3.28 kg), brisket (15.43 ± 1.48 kg), rump (12.55 ± 1.53 kg), topside (16.56 ± 1.32 kg), knuckle (10.66 ± 1.81 kg), and silverside (14.99 ± 1.19 kg). These findings suggest that age level doesnot significantly influence carcass characteristics or secondary cut weights in Brahman Cross steers.

Keywords: Brahman Cross steers, carcass characteristics, secondary cuts, age groups

IMPACT OF EXPERIMENTAL HYPOGONADISM ON ENERGY METABOLISM IN TWO RODENT MODELS: A COMPARATIVE STUDY IN MUS MUSCULUS AND MERIONES LIBYCUS

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ABSTRACT

Growing evidence has established a strong association between hypogonadism and metabolic dysfunction, particularly in patients undergoing androgen deprivation therapy. Although androgen deficiency has been linked to obesity, insulin resistance, dyslipidemia, and an increased risk of metabolic syndrome, the cellular and molecular mechanisms responsible for these metabolic alterations remain poorly understood. To further investigate the effects of hypogonadism on energy homeostasis, we performed experimental gonadectomy in two adult male rodent models: the laboratory mouse (Mus musculus) and the desert rodent Meriones libycus. Metabolic profiling was conducted by measuring key biochemical parameters, including blood glucose, total cholesterol, and circulating triglyceride concentrations. Our results demonstrated that gonadectomy predominantly disrupted lipid metabolism, as evidenced by a significant increase in circulating triglyceride levels in both species. In contrast, blood glucose and total cholesterol concentrations remained unchanged following gonadectomy, suggesting that androgen deprivation selectively affects specific metabolic pathways rather than inducing generalized metabolic impairment. These findings support the hypothesis that androgen deficiency preferentially alters lipid metabolic regulation, potentially through enhanced insulin secretion and the activation of lipogenic pathways, leading to increased triglyceride synthesis and storage. Further mechanistic studies are required to clarify the endocrine and molecular pathways linking hypogonadism to dysregulated lipid homeostasis and to identify potential therapeutic targets for preventing metabolic complications associated with androgen deficiency.

Keywords: Hypogonadism, Gonadectomy, Biochemical parameters, Meriones libycus, Mus musculus

IN VITRO COMPARISON OF DIET-ADAPTED AND NON-ADAPTED RUMEN FLUID: EFFECTS ON FERMENTATION KINETICS, CO_2 AND CH_4 PRODUCTION, AND MICROBIAL COMMUNITY

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ABSTRACT

Techniques for assessing gas production in vitro, such as the Gas Endeavour system, are extensively used to investigate rumen fermentation dynamics and represent a valuable approach for evaluating rumen function and potential methane mitigation strategies. However, the composition and metabolic activity of the microbial inoculum are strongly influenced by the donor animals' diet. This study investigated the influence of adapted and non-adapted rumen fluid (RF) on the fermentation characteristics of four experimental diets previously tested in vivo. All diets were formulated to provide comparable neutral detergent fiber (NDF) and net energy contents and included 2000 g/head/day of hay, while differing in the replacement of concentrate with prickly pear peel silage. The control diet (CTR) contained 450 g/head/day of concentrate, whereas diets (PP500, PP1000 and PP1500 progressively replaced concentrate with 500, 1000 and 1500 g/head/day of prickly pear peel silage, respectively. Each diet was incubated in triplicate for 24 h using the Gas Endeavour system with two different inocula collected by oro-esophageal probe: adapted rumen fluid (ARF), obtained from sheep receiving the corresponding experimental diets, and common rumen fluid (CRF), collected from donor sheep fed with hay diet under the same management conditions. In parallel, whole-metagenome sequencing was performed on rumen fluid samples to characterize the taxonomic composition and functional potential of the microbial communities. Fermentation data were analysed using a two-way ANOVA, considering diet and inoculum type as fixed effects. Total methane production after 24 h was not affected by dietary treatment, whereas cumulative gas production differed according to both diet and inoculum. The CTR diet showed the greatest gas production, while ARF generated a higher cumulative gas volume than CRF (276 vs. 267 mL/3 g incubated feed). Nevertheless, the type of inoculum markedly affected the early stages of fermentation. During the first 7 h of incubation, ARF consistently produced lower amounts of total gas and methane than CRF, with the greatest reductions observed in diets B and C, characterized by the highest inclusion of prickly pear peel silage. Thereafter, fermentation profiles gradually converged, resulting in similar methane production after 24 h. Overall, these results demonstrate that prior microbial adaptation to the substrate substantially influences the initial kinetics of in vitro fermentation. The whole-metagenome analysis provided complementary evidence of diet-related differences in microbial community composition and functional potential, reinforcing the importance of using diet-adapted rumen inoculum to obtain biologically meaningful and reliable in vitro fermentation data.

Keywords: Rumen fermentation, Adapted rumen fluid, In vitro gas production, Methane production, Whole-metagenome sequencing

EFFECTS OF FIBROLYTIC ENZYME SUPPLEMENTATION ON FIBER DIGESTIBILITY AND GROWTH PERFORMANCE OF BEETAL BUCKS FED A SOYBEAN-HULL-BASED TOTAL MIXED RATION

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ABSTRACT

Efficient utilization of fibrous feed resources can enhance livestock productivity, particularly in production systems where conventional forages are limited in availability and costly. Therefore, the present study was carried out to assess the performance of Beetal bucks fed a total mixed ration (TMR) of soybean hulls and the effect of fibrolytic enzyme supplementation on growth performance, feed intake, nutrient digestibility, fiber utilization, feed efficiency, and fecal characteristics. The experiment was performed in the Goat Research and Development Farm, Punjab feeds (Ltd), Sheikhupura, Punjab, Pakistan. The total of 12 healthy Beetal bucks (approx. 45 ± 5 kg) were randomly distributed among three dietary treatments in a completely randomized design. The experiment lasted 50 days, consisting of a 7-day adaptation period and a 43-day data-collection period. Individual housing was used to precisely measure feed intake and fecal output. The basal TMR was made of 70% soybean hulls and 30% commercial concentrate. The basal TMR was fed to the control group T1. However, T2 and T3, 0.2 and 0.4 g of a commercial fibrolytic enzyme per kg of feed, respectively. The ingredients of the experimental concentrate fed were corn, rice polish, wheat bran, palm kernel cake, 30% gluten, mineral mixture, salt, and vitamin premix. The enzyme product provided cellulase, xylanase and β-glucanase activities specific to the structural carbohydrates of soybean hulls. Growth performance, dry matter intake (DMI), feed intake (FI), average daily gain (ADG), feed efficiency ratio (FER), feed conversion ratio (FCR), nutrient digestibility, fiber digestibility, body condition score (BCS) and fecal score were measured. The supplementation of fibrolytic enzyme had a highly beneficial effect on the growth performance and fiber utilization in Beetal bucks. The treatment of diet had a significant effect on average daily gain ($P = 0.022$). The ADG for T1, T2 and T3, respectively, were 0.075, 0.157, and 0.153 kg/day, which showed that animals receiving enzyme had better growth performance. There were no significant differences ($P = 0.212$) between treatments in terms of T3, which had the largest numerical feed intake and DMI. Feed intake was 1590.45, 1727.34 and 1928.32 g/day, while DMI was 1426.16, 1548.91 and 1729.12 g/day for T1, T2 and T3, respectively. There was a numerical trend for the feed efficiency ratio to improve with enzyme supplementation ($P = 0.091$) but not for FCR ($P = 0.872$). These results indicate that the growth improvements were more related to greater utilization of nutrients and fiber in the diet, rather than to statistically validated improvements in feed conversion efficiency. Enzyme supplementation had the greatest impact on fiber digestibility. The digestibility of total fiber significantly ($P < 0.05$) decreased in the control group compared to T2 and T3, which were 56.69% and 59.50%, respectively. Similarly, digestible NDF increased from 49.43% in T1 to 64.44% in T2 and 67.77% in T3, while digestible ADF increased from 53.27% in the control to 60.40% and 63.10% in the 0.2 and 0.4 g/kg enzyme groups, respectively ($P < 0.05$). However, the digestible

crude protein and ether extract were not significantly different with enzyme supplementation (P = 0.664 and P = 0.638, respectively). Digestible crude protein values were 50.56%, 52.37% and 51.81% in T1, T2 and T3, respectively, while ether extract digestibility was 48.50%, 46.74% and 45.89%. Although significant effects were observed on these parameters, the lack of effects suggests that the effects of the fibrolytic enzyme preparation in the present study were mainly due to degradation and utilization of fibrous dietary components rather than to a general improvement in protein or lipid digestion. The results showed that supplementation of a soybean-hull based TMR with fibrolytic enzymes can significantly increase the digestibility of fiber and growth performance in Beetal bucks. Enzymes combined with locally available non-forage fiber resources could be put forward as a viable option for nutrient utilization and production efficiency in livestock production and minimizing reliance on traditional forage resources.

Keywords: Beetal bucks, soybean hulls, fibrolytic enzymes, fiber digestibility, sustainable livestock production

EFFECTS OF PHYTASE, MULTI-CARBOHYDRASE AND CITRIC ACID SUPPLEMENTATION ON PERFORMANCE, NUTRIENT UTILIZATION AND SKELETAL HEALTH OF BROILERS FED LOW-ENERGY DIETS

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ABSTRACT

The poultry industry is under increasing pressure to improve production efficiency while reducing feed costs and optimizing nutrient utilization. Dietary energy is a major contributor to feed costs in broiler production, and reducing dietary energy density may offer an opportunity to lower production costs. The present study was therefore conducted to evaluate the individual and combined effects of phytase, multi-carbohydrase (MX; β-mannanase and xylanase), and citric acid supplementation on growth performance, immune response, ileal nutrient digestibility, bone mineralization, and carcass characteristics of broilers fed a low-energy diet. The experiment was carried out at Animal Nutrition Research Center, Raja Muhammad Akram, University of Agriculture, Faisalabad. 216-day-old broiler chicks were randomly assigned to 9 diets, with 3 replications of 8 birds per treatment. The experimental period was 35 days. The feed of the positive control (PC) was a standard broiler diet balanced to meet the nutrient requirements of the broiler, while the feed of negative control (NC; T0) was formulated by decreasing the metabolizable energy by 100 kcal/kg. NC + phytase was given to T1 at 0.120 g/kg feed (which provided about 3000 FTU/kg); NC + MX was given to T2 at 0.1 g/kg feed; NC + citric acid was given to T3 at 5 g/kg feed; NC + phytase + MX was given to T4 at 0.1 g/kg feed; NC + phytase + citric acid was given to T5 at 5 g/kg feed; NC + MX + citric acid was given to T6 at 0.1 g/kg feed; and NC + phytase + MX + citric acid was given to T7 at 0.1 g/kg feed. In the 35-day experimental period, dietary treatments were provided ad libitum. BWG, FI and FCR were measured every week. Blood samples, ileal digesta, tibia bones and carcass samples were taken at day 35 to assess immune response, nutrient digestibility, bone mineralization and carcass characteristics. Immune response was determined by measuring antibody levels against Newcastle disease virus (NDV) and infectious bronchitis virus (IBV). Meanwhile, ileal digestibility of dry matter, ether extract, crude protein, calcium, phosphorus and crude fiber were measured. One-way analysis of variance, under a completely randomized design, was used to analyze data and means of treatments were compared using Tukey's test at $P < 0.05$. The results showed that the enzyme and citric acid were effective when applied in the low-energy diet to reduce the negative effects. The results also showed that Phytase supplementation alone resulted in better improvements in body weight gain than negative control, while Phytase in combination with MX resulted in better growth performance and feed efficiency. In particular, the interaction between phytase and MX was significant for feed conversion efficiency, while no clear interaction was seen between citric acid and MX for growth performance. The results indicate that enzyme supplementation cannot only enhance growth but also support proper immune function under nutrient-deficient feeding conditions.

The higher digestibility is in line with the complementary actions of the additives, phytase physically cleaves the phytate and releases bound nutrients, while β-mannanase and xylanase break down NSP fractions which could otherwise restrict nutrient accessibility and utilization. Increased bone mineralization was also observed with dietary supplementation. The better skeletal mineralization could be attributed to an increase in phosphorus release due to increased phytase activity, an increase in mineral availability due to the breakdown of NSP and perhaps an increase in mineral solubility due to dietary acidification. The combined supplementation method also resulted in favorable effects on the carcass characteristics. The dressing percentage, breast meat yield and thigh meat yield for the phytase + MX + citric acid treatment were highest reported (72.41%, 31.10% and 17.93% respectively), similar to the positive control. In conclusion, the use of the combined action of phytase, multi-carbohydrase and citric acid in the diets of broilers offers the potential to enhance nutrient digestibility, immune response, skeletal mineralization, carcass performance and growth performance with low-energy diets.

Keywords: Broiler chickens, low-energy diets, phytase, multi-carbohydrase, citric acid

DIVERSITY AND PREVALENCE OF ECTOPARASITES AND ENDOPARASITES IN SHEEP AND GOATS IN BISKRA PROVINCE, ALGERIA

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ABSTRACT

This study aimed to assess the prevalence of ectoparasites and endoparasites in sheep and goats and to identify the major parasitic species affecting the examined flock. The investigation was conducted between 15 February and 23 March 2024 at the Ben Aissa Brothers Industrial Slaughterhouse in Chetma, Biskra Province, Algeria. A total of 296 animals were examined, including 207 sheep and 89 goats. Ectoparasites were collected through careful visual inspection of the skin, wool, and hair, whereas endoparasites were recovered from the gastrointestinal tract and selected internal organs following slaughter. All specimens were preserved and identified using standard morphological taxonomic keys. Associations between parasite prevalence and selected host factors were evaluated using the Chi-square (χ^2) test, with statistical significance set at $p < 0.05$. The overall prevalence of ectoparasitic infestation was 10.14%. The identified ectoparasites consisted mainly of the lice Damalinia ovis and Linognathus africanus, together with fleas belonging to the family Pulicidae. Among these, Damalinia ovis was the most prevalent ectoparasite. Statistical analysis revealed significant associations between ectoparasite infestation and both animal age ($\chi^2 = 4.769$, $p = 0.029$) and sex ($\chi^2 = 4.608$, $p = 0.032$). The overall prevalence of endoparasitic infection was 9.80%. The predominant endoparasites identified were Echinococcus granulosus and Taenia spp. Endoparasitic infection varied significantly according to age, with a strong statistical association between age and infection rate ($\chi^2 = 30.719$, $p < 0.001$). These findings highlight the occurrence of both ectoparasitic and endoparasitic infections in small ruminants slaughtered in the Biskra region and emphasize the importance of continuous veterinary surveillance and effective parasite control programs. Particular attention should be given to zoonotic parasites such as Echinococcus granulosus because of their significant veterinary, economic, and public health implications.

Keywords: Sheep, Goats, Ectoparasites, Endoparasites, Damalinia ovis, Echinococcus granulosus, Biskra.

THE PREVALENCE OF ECTOPARASITES IN COLUMBIDS (PIGEONS AND TURTLEDOVES), AND NEW DATA ON LICE (INSECTA : PHTHIRAPTERA) IN THESE BIRDS IN ALGERIA

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ABSTRACT

Columbids (family Columbidae) represented by six species (Columba livia, Streptopelia decaocto, Streptopelia turtur, Streptopelia risoria, Streptopelia roseogrisea, and Spilopelia senegalensis) are widely distributed in Algeria and play important ecological and cultural roles. They are also recognized as hosts to various ectoparasites capable of affecting bird health and acting as potential reservoirs for zoonotic pathogens. This study aimed to compile a comprehensive inventory of ectoparasites infesting domestic and wild columbids in northern Algeria. During the outings conducted between 2020 and 2023 in three regions of northern Algeria (Blida, Algiers, Tipaza), a total of 321 individuals from six columbid species were examined using standardized capture, handling, and parasite collection protocols. Ectoparasites were carefully removed, preserved, and identified through morphological keys under stereomicroscopy, supplemented by taxonomic descriptions from the literature. A total of 11,294 ectoparasites were recovered, belonging to 16 species across different groups: 13 lice, one mite, one tick, and one dipteran fly. Notably, three lice (Colpocephalum turbinatum, Bonomeilla columbae, and Coloceras hilli) were recorded for the first time in Algeria, while Columbicola joudiae was documented for only the second time worldwide and the first time in the country. Lice were the most abundant group and exhibited host-specificity, with distinct lice assemblages associated with each columbid species. The mite Falculifer sp., the tick Argas reflexus, and the hippoboscid fly Pseudolychia canariensis were less frequent but indicate a broad spectrum of ectoparasitic taxa infesting columbids. This study provides the first integrative account of columbid ectoparasites in Algeria, revealing high diversity and novel distributional records. The findings highlight both the ecological importance and potential veterinary relevance of these associations. Future research should focus on molecular confirmation of parasite taxa, host–parasite coevolutionary dynamics, and the role of ectoparasites in pathogen transmission among columbids and other bird species.

Keywords: Columbidae, ectoparasites, lice, host-specificity, Algeria, avian parasites, pathogen transmission

INTEGRATING AI, GENOMICS, AND SENSOR-BASED TECHNOLOGIES FOR SUSTAINABLE ANIMAL REPRODUCTION

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ABSTRACT

Precision theriogenology is an emerging discipline that integrates artificial intelligence (AI), genomic science, and sensor-based technologies to transform reproductive management in animals. This chapter provides a comprehensive overview of how these innovations converge to enhance fertility prediction, optimize breeding strategies, and ensure sustainable livestock production. AI-driven analytics enable predictive modeling of reproductive cycles, while genomic tools refine selection for fertility-associated traits. Sensor-based monitoring facilitates real-time detection of physiological changes, improving estrus detection, semen evaluation, and pregnancy diagnosis. Together, these technologies advance reproductive efficiency, animal welfare, and environmental sustainability, positioning precision theriogenology as a cornerstone of modern veterinary practice and livestock extension. Traditional theriogenology has relied heavily on clinical observation, manual palpation, and empirical decision-making. However, the increasing demand for food security, climate resilience, and ethical animal production necessitates a paradigm shift toward precision-based approaches. Precision theriogenology, by integrating AI, genomics, and sensor technologies, offers individualized, data-driven reproductive management that aligns with global sustainability goals. Precision theriogenology represents a transformative approach to animal reproduction. Artificial intelligence is reshaping reproductive management by enhancing estrus detection, embryo assessment, semen evaluation, and pregnancy prediction. By integrating AI, genomics, and sensor-based technologies, it enables sustainable, efficient, and welfare-oriented reproductive management. Its adoption will be central to addressing global challenges in food security, climate resilience, and ethical animal production.

Keywords: AI, Genomics, Theriogenology, Precision

FARMING PRACTICES EFFECT ON THE QUALITY OF THE MONTBELIARDE BREED MILK FROM THE WILAYA OF MOSTAGANEM

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ABSTRACT

As demonstrated by several studies, livestock farming practices are synonymous with yield and quality for farmers. They influence the quality of animal products as well as the zootechnical parameters of the animals themselves. However, dairy cattle are not exempted from this equation; where farming practices play a limiting role in mastering the quality of milk and dairy products. For this purpose, a study was conducted in this context on three farms in the wilaya of Mostaganem; it is a Mediterranean region located in the northwest of Algeria. These farms were characterized by raising only one breed of imported cows, belonging to the French breed 'the Montbéliarde'. Therefore, the experimental approach was structured around two axes; the first axis included a prospecting (survey) and the second axis an analytical part. First, the survey was carried out using a questionnaire that primarily gathered information on farming practices. Second, the sampling process consisted of six 250ml samples collected from each farm. They were collected in sterile vials after the morning mixed milking from several Montbéliarde cows. Then, the samples underwent physicochemical analysis and lactic acid bacteria enumeration to link the effects of farming practices to milk quality. The physicochemical analysis performed by using a lactoscan allowed for the determination of pH, density, conductivity, ash, protein content, fat content, and lactose content. The enumeration of lactic acid bacteria was carried out on MRS medium incubated at 30°C for 24 hours. A total of 18 milk samples were analyzed and showed a minimal fat content and a moderate protein content estimated at approximately 3%. The lactic acid bacteria count was approximately 260 x 10^6 UFC.

Keywords: Farming practices, Quality, Dairy cattle, Montbéliarde, Questionnaire.

MOLECULAR INVESTIGATION OF COXIELLOSIS IN CAMEL AND TICKS

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ABSTRACT

Coxiella burnetii, the etiological agent of coxiellosis (Q fever), is a globally distributed zoonotic pathogen with significant public health and veterinary importance. Despite increasing recognition of camels as potential reservoirs, limited molecular data exist on their role in pathogen maintenance and transmission, particularly in relation to tick vectors. This study aimed to investigate the molecular prevalence and genetic characterization of C. burnetii in dromedary camels and associated ticks. Blood and milk samples from camels, along with ticks collected from the same hosts, were subjected to DNA extraction followed by polymerase chain reaction (PCR) targeting the IS1111 transposon element. Positive samples were further analyzed through sequencing of the com1 gene to determine genetic diversity. The results revealed the presence of C. burnetii DNA in both camel and tick samples, confirming active circulation of the pathogen in the study population. Phylogenetic analysis demonstrated close genetic relatedness between camel- and tick-derived isolates, supporting the hypothesis of vector-mediated transmission. These findings highlight the epidemiological significance of camels and their ectoparasites in sustaining C. burnetii infection cycles, with implications for One Health surveillance and control strategies in endemic regions. Enhanced molecular monitoring of camel populations and tick vectors is recommended to mitigate zoonotic risks and improve public health preparedness.

Keywords: coxillosis, ticks, camel

MOLECULAR IDENTIFICATION, TECHNOLOGICAL PROPERTIES AND CHARACTERIZATION OF VIRULENCE FACTORS IN ENTEROCOCCI ISOLATED FROM FISHERY PRODUCTS

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ABSTRACT

Marine lactic acid bacteria (LAB) are promising alternative food sources due to their ability to survive under atypical conditions and produce bioactive compounds with potential applications in food preservation. Their use in biopreservation can reduce chemical preservatives, extend shelf life, improve sensory quality, and provide antibacterial activity.
This study focused on the technological and safety characterization of Enterococcus strains isolated from the gastrointestinal tract of fresh fish collected along the Algerian coast. The technological properties investigated included antibacterial, acidifying, proteolytic, lipolytic, and exopolysaccharide-producing activities. Safety was assessed through the detection of virulence-related factors, including antibiotic resistance, hemolysin production, decarboxylase activity, gelatin hydrolysis, hydrophobicity, and aggregation properties. The isolates produced only trace amounts of exopolysaccharides and showed low acidifying, proteolytic, and lipolytic activities. However, three strains, Enterococcus sp. C2, C3, and C4, demonstrated direct antibacterial activity against several pathogenic and spoilage bacteria, including Staphylococcus aureus, Bacillus cereus, Bacillus subtilis, Escherichia coli, and Salmonella abony. Their cell-free supernatants also showed indirect antibacterial activity against B. cereus. Phenotypic screening indicated that the selected strains were safe, with no detectable hemolysin or biogenic amine production. They also exhibited significant hydrophobicity, with adhesion percentages ranging from 57.9% to 73%, as well as self- and co-aggregation abilities. The highest co-aggregation was observed for strain C3 with B. cereus (47.65%) and S. abony (53.6%) after 24 hours.

Keywords: Bio-preservation, Enterococcus sp., technological characterization, safety, virulence.

DIAGNOSTIC ACCURACY OF DRAIN FLUID AMYLASE IN PREDICTING POST-OPERATIVE PANCREATIC FISTULA

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ABSTRACT

Introduction: Postoperative pancreatic fistula (POPF) is one of the most serious complications after pancreatic surgery, with an incidence of up to 30% following cephalic duodenopancreatectomy (CDP). Since 2016, the International Study Group of Pancreatic Surgery (ISGPS) has defined POPF as a drain fluid amylase level greater than three times the upper limit of serum amylase from postoperative day 3 onwards. **Objective:** To assess the diagnostic performance of drain fluid amylase measurement on postoperative day 1 (D1) in predicting POPF. **Materials and Methods:** We conducted a retrospective study of 55 patients, predominantly with pancreatic cancer, who underwent pancreatic surgery at the EHS Centre Pierre et Marie Curie. Serum and drain fluid amylase levels were measured on postoperative days 1, 3, and 5 using the Cobas 6000 analyzer (Roche Diagnostics). POPF was defined as a drain/serum amylase ratio > 3 on D3 or D5. Statistical analyses were performed with SPSS 21. **Results:** The cohort included 54.55% women and 45.45% men (sex ratio M/F = 0.83), with a mean age of 54 years (range: 20–86). Pancreatic involvement was present in 81.82% of patients, with histological subtypes including adenocarcinoma (45.24%), IPMN (14.29%), mucinous cystadenoma, solid pseudopapillary tumor (11.90%), neuroendocrine tumor, and liposarcoma (2.38%). CDP was the predominant surgical approach. POPF occurred in 14.55% of patients. ROC curve analysis of drain fluid amylase on D1 yielded an AUC of 0.80, sensitivity of 100%, specificity of 61%, with a cut-off value of 814 U/L. **Conclusion:** Drain fluid amylase on D1 is a simple, reliable, and effective early predictor of POPF after oncological pancreatic surgery. These findings highlight its potential as a valuable screening tool. Larger prospective studies are warranted to validate these results and refine diagnostic thresholds.

Keywords: Postoperative pancreatic fistula (POPF), drain fluid amylase, diagnostic performance, pancreatic cancer surgery

NON-HDL CHOLESTEROL IN HEMODIALYSIS PATIENTS: AN INCREASED CARDIOVASCULAR RISK

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ABSTRACT

Introduction: Biological monitoring of patients undergoing hemodialysis is essential to prevent cardiovascular complications, which are the leading cause of morbidity and mortality in this population. Non-HDL cholesterol is a key marker of cardiovascular risk, as it reflects the total amount of atherogenic lipoproteins. This study aimed to assess non-HDL cholesterol levels and their potential contribution to cardiovascular risk in hemodialysis patients. **Materials and Methods:** This descriptive observational study included 41 patients with chronic kidney disease undergoing regular hemodialysis. Fasting blood samples were collected and analyzed using a Cobas 6000 automated analyzer. **Results:** The mean age of the patients was 57.3 ± 15 years. Mean lipid levels were: Total cholesterol: 1.71 g/L , HDL cholesterol: 0.34 g/L , LDL cholesterol: 0.92 g/L , Triglycerides: 2.34 g/L , Non-HDL cholesterol: 1.37 g/L. The proportions of patients with abnormal lipid parameters were: Elevated non-HDL cholesterol: 29.3% , Low HDL cholesterol: 48.8% , Elevated LDL cholesterol: 14.6% , Elevated triglycerides: 48.8%. **Discussion:** A substantial proportion of patients presented with lipid abnormalities, predominantly hypertriglyceridemia and low HDL cholesterol levels. This lipid profile differs from that of the general population and is characteristic of patients undergoing hemodialysis. It results from uremia-related disturbances in lipid metabolism, including: reduced lipoprotein lipase activity, leading to the accumulation of VLDL and chylomicrons; decreased LCAT activity, contributing to reduced HDL cholesterol levels, the presence of smaller, oxidized, and more atherogenic LDL particles, even when LDL cholesterol levels are within the normal range, thereby promoting atherosclerosis. Elevated non-HDL cholesterol reflects the accumulation of atherogenic lipoproteins and represents a significant cardiovascular risk factor. **Conclusion:** In hemodialysis patients, elevated non-HDL cholesterol, together with low HDL cholesterol and hypertriglyceridemia, represents an important marker of cardiovascular risk. These findings highlight the importance of regular lipid monitoring and appropriate management to reduce cardiovascular complications.

Keywords: Hemodialysis, non HDL cholesterol, cardiovascular risk

ASSESSMENT OF HOMA AND QUICKI INDICES IN THE EARLY DIAGNOSIS OF TYPE 2 DIABETES

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ABSTRACT

Background and Objective: Type 2 diabetes represents a major public health concern affecting nearly 590 million adults worldwide, or about 11% of the global population, according to the latest report from the International Diabetes Federation. Insulin resistance plays a central role in the development of type 2 diabetes and can precede the onset of hyperglycemia by several years. Its early diagnosis is therefore crucial for prevention and screening in at-risk individuals. Several indirect indices can be used to assess insulin sensitivity, including the HOMA (Homeostasis Model Assessment) and QUICKI (Quantitative Insulin Sensitivity Check Index). The objective of this study is to analyze, through a literature review, the usefulness of the HOMA and QUICKI indices in assessing insulin resistance and their potential for the early diagnosis of type 2 diabetes. **Methods:** This is a literature review using the PubMed website (https://pubmed.ncbi.nlm.nih.gov/) and the keywords: Insulin resistance; insulin sensitivity; prediction; type 2 diabetes. Studies evaluating the diagnostic performance of the HOMA and QUICKI indices in estimating insulin resistance and predicting type 2 diabetes were analyzed. **Results:** The HOMA and QUICKI indices are indirect estimates of insulin sensitivity, calculated from fasting plasma glucose and insulin concentrations. Several studies have shown a satisfactory correlation between these indices and reference methods such as the hyperinsulinemic-euglycemic clamp. The HOMA-IR index is widely used to identify insulin resistance and has been associated with an increased risk of progression to type 2 diabetes. The QUICKI index, based on a logarithmic transformation of fasting blood glucose and insulin levels, shows a more linear correlation with direct measures of insulin sensitivity in some studies. However, the diagnostic performance of these indices can vary depending on the populations studied, the assay methods used, and the lack of standardized cutoffs. **Conclusion:** The HOMA and QUICKI indices are simple, non-invasive tools suitable for clinical practice. However, their interpretation remains complex due to their numerous limitations, notably the absence of threshold values. Standardizing these indices and validating them across different cohorts would allow them to be integrated into a type 2 diabetes prevention strategy.

Keywords: Insulin resistance, insulin sensitivity, prediction, type 2 diabetes.

BIOLOGICAL RISK AMONG VETERINARIANS: BRUCELLOSIS AND TUBERCULOSIS IN OCCUPATIONAL SETTINGS

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ABSTRACT

Introduction: Veterinarians are considered a high-risk occupational group for zoonotic infections due to frequent contact with animals, biological fluids, and contaminated environments. Among these infections, brucellosis and tuberculosis remain important occupational and public health concerns, particularly in endemic regions where preventive measures are often insufficient. **Objective:** The aim of this study was to assess the occurrence of brucellosis and tuberculosis among veterinarians and to identify deficiencies in preventive measures and occupational risk management. **Methods:** A descriptive study was conducted on a population of 57 veterinarians. Data were collected regarding the occurrence of occupational infections, working conditions, level of training in biological risks, and availability and use of personal protective equipment. Occupational exposure was analyzed in relation to field activities, animal contact frequency, and adherence to standard biosafety precautions measures applied. **Results:** Among the 57 veterinarians studied, five cases of brucellosis and three cases of tuberculosis were identified. The analysis revealed insufficient training and limited awareness of biological risks. In addition, inadequate availability and inconsistent use of personal protective equipment were reported, increasing occupational exposure. Cases were more frequently observed among veterinarians involved in direct livestock care and those reporting irregular use of gloves and other protective barriers consistently applied. **Discussion:** The findings highlight a significant occupational health risk among veterinarians. The coexistence of brucellosis and tuberculosis cases reflects continued exposure to infected animals and insufficient biosafety practices. Lack of structured training and preventive measures contributes to increased vulnerability in this professional group. These deficiencies emphasize the need for structured occupational health programs, regular training sessions, and reinforcement of biosafety culture within veterinary practice settings in endemic areas. **Conclusion:** Veterinarians are exposed to important biological risks requiring strengthened prevention. Improving training, ensuring protective equipment availability, and reinforcing occupational health surveillance are essential. Occupational medicine plays a key role in early detection, prevention, and reduction of zoonotic infections

Keywords: Veterinarians, Brucellosis, Tuberculosis, Biological risk, Prevention, Occupational health

OCCUPATIONAL RISK OF LEPTOSPIROSIS INFECTION AND THE ROLE OF OCCUPATIONAL MEDICINE: A LITERATURE REVIEW

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ABSTRACT

Objective: To analyze the risk of healthcare workers' exposure to leishmaniasis and to highlight preventive measures as well as the role of occupational medicine. **Methods:** This is a narrative review of the literature focusing on the modes of transmission of leishmaniasis, occupational exposure situations in healthcare settings, and recommendations for prevention. **Results:** The risk of transmission in healthcare settings is considered low but not negligible. It is mainly associated with accidental exposure, particularly during the handling of biological samples, invasive procedures, or contact with infected skin lesions. In endemic areas, indirect exposure through sandfly bites within or around healthcare facilities may also be considered.
The literature highlights a lack of awareness among healthcare workers regarding this risk, as well as insufficient preventive measures in certain contexts. Standard precautions, the use of personal protective equipment, and adherence to hygiene protocols remain the main preventive strategies. Leptospirosis is a widespread bacterial zoonosis caused by Leptospira species and transmitted to humans through direct or indirect contact with environments contaminated by the urine of infected animals. It represents a significant occupational health concern, particularly in tropical and subtropical regions and in settings with poor sanitation. This study aims to analyze, based on the literature, the risk of leptospirosis infection among workers and to highlight the role of occupational medicine in its prevention and management. A narrative review of scientific publications and institutional guidelines was conducted, focusing on occupational exposure, risk factors, and preventive strategies. The literature identifies several high-risk occupational groups, including agricultural workers, livestock handlers, sanitation workers, construction workers, and slaughterhouse employees. Exposure is primarily associated with contact with contaminated water, soil, or animals, especially in the presence of skin lesions or mucosal exposure. Lack of awareness and inadequate training further increase this risk. Preventive measures include environmental control, particularly rodent control, improvement of workplace hygiene, implementation of organizational measures to limit exposure, and the use of personal protective equipment. Vaccination may be considered in selected high-risk populations, depending on local epidemiological conditions. Occupational medicine plays a central role in risk assessment, worker education, medical surveillance, and early detection of cases. It also contributes to the implementation of preventive strategies and the recognition of leptospirosis as an occupational disease. Strengthening these measures is essential to reduce its burden.

Keywords: Leptospirosis, Occupational risk, Zoonosis, Prevention, Occupational medicine

CORRELATION OF TUMOR MARKERS CEA AND CALCITONIN IN MEDULLARY THYROID CARCINOMA

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ABSTRACT

Introduction: Medullary thyroid carcinoma (MTC) is a rare neuroendocrine tumor, accounting for 5–10% of thyroid cancers. Its management relies on early diagnosis, appropriate treatment, and rigorous biological monitoring, particularly through calcitonin and carcinoembryonic antigen (CEA) assays. **Objective:** To evaluate the correlation between CEA and calcitonin levels in the diagnosis and follow- up of MTC, and also to assess the performance of CEA compared with calcitonin during the follow-up of MTC. **Materiel and Methods:** We conducted a retrospective study of 46 patients with MTC, followed in the endocrinology department of CPMC. CEA assays were performed in the biochemistry laboratory. Clinical data, family history, treatment modalities, and baseline biomarker levels were analyzed. **Results:** Female predominance (40 women vs. 6 men; sex ratio 0.15). Mean age: 46.1 ± 11.9 years (range 22–76). The 50–59 age group was most affected. 38% reported familial MTC, with a younger mean age (35.8 years) compared to sporadic cases (49.9 years). 75% underwent surgery, 19% surgery plus radioiodine therapy, and 3% radiotherapy alone or multimodal therapy. A significant moderate correlation was observed between CEA and calcitonin at baseline ($r = 0.522$, $p = 0.001$), after the first course ($r = 0.460$, $p = 0.002$), and after the second course ($r = 0.594$, $p < 0.0001$). ACE demonstrated excellent performance during follow-up (after the second treatment cycle) compared with calcitonin (the gold standard), with an AUC of 0.921 (95% CI: 0.839–1.000; $p < 0.001$). **Conclusion:** Calcitonin remains the gold-standard biomarker for MTC, while CEA provides complementary information with moderate correlation. Regular monitoring of both markers, integrated into a multidisciplinary approach, enhances patient follow-up and clinical outcomes.

Keywords: Medullary thyroid carcinoma (MTC), Calcitonin, Carcinoembryonic antigen (CEA), Tumor markers, Correlation, Diagnosis, Follow-up

STUDY OF THE PERFORMANCE OF D-DIMERS AS EXCLUSION TOOL FOR INTRA-ATRIAL THROMBUS IN PATIENTS WITH ATRIAL FIBRILLATION

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ABSTRACT

Atrial fibrillation (AF) is the most common cardiac arrhythmia worldwide. It is characterized by irregular electrical activity of the atria, leading to disorganized contraction, blood stasis, and an increased propensity for thrombus formation. This condition significantly elevates the risk of stroke and major thromboembolic complications. Prior to electrical cardioversion in patients with AF, assessment of thromboembolic risk is essential. This evaluation is typically based either on transesophageal echocardiography (TEE), the gold standard for the direct visualization of intra-atrial thrombi, or on prolonged anticoagulation therapy (at least three weeks before and four weeks after the procedure). However, TEE is a semi-invasive technique requiring specialized equipment and experienced personnel, which may limit its availability in certain clinical settings. From a biological standpoint, the hypercoagulable state associated with AF is reflected by increased levels of specific biomarkers, notably D-dimers, which could represent a non-invasive alternative for assessing thromboembolic risk. The objective of our study was to investigate the potential value of D-dimer measurement as a non-invasive screening tool for predicting the presence of intra-atrial thrombus in patients with AF. **Patients and Methods** We conducted a prospective study over six months, including 43 adult patients with non- valvular AF lasting more than 48 hours, all candidates for electrical cardioversion. For each patient, blood samples were collected on the same day as the TEE to measure D-dimer and fibrinogen levels. TEE was simultaneously performed to detect the presence or absence of intra-atrial thrombus. **Results** Clinical and laboratory data were analyzed to assess the correlation between D-dimer levels and presence of thrombus observed by TEE. Intra-atrial thrombus was detected in six (6) patients. Receiver Operating Characteristic (ROC) curve analysis was used to evaluate the diagnostic performance of D-dimer levels. The area under the curve (AUC) was 0.845, with a 95% confidence interval (CI) of 0.566 to 1.000, indicating good discriminative ability of D-dimers in detecting intra-atrial thrombus. The optimal D-dimer cutoff value determined for our study population was 715 ng/mL. At this threshold, sensitivity and specificity were 83% and 100%, respectively, using TEE as the gold standard. The negative predictive value (NPV) was 97%, and the positive predictive value (PPV) was 100%. **Conclusion** These preliminary findings suggest that D-dimer measurement may serve as a non-invasive screening tool to identify low thromboembolic risk patients for whom TEE might not be routinely required, particularly in healthcare settings with limited access to TEE.

Keywords: Atrial fibrillation, TEE, D-dimers, thrombosis, sensitivity, specificity

MYT1 EXPRESSION IS INCREASED IN NEUROBLASTOMA AND REGULATED BY DNA METHYLATION

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ABSTRACT

Neuroblastoma (NB) forms 8% of childhood cancers, arising from a disruption of the normal differentiation of neural crest cells (NCC). Genetically, MYCN amplification and ALK mutation frequently occur in high risk NB. However, genome sequencing studies showed relatively lack of mutation numbers in primary tumours compared to relapsed NB, implying NB transformation may be driven by other mechanisms such as epigenetics, including DNA methylation. Therefore, we aimed to screen a hypomethylated gene (MYT1) that was identified via comparing methylation at CpG islands and promoter regions between NB cell lines and human NCC. To investigate DNA methylation levels, we chose normal cell lines (hNCC and dorsal root ganglia/sympathetic ganglia (DRG/SG)), fetal adrenal tissue (FA)), NB cell lines (SHSY5Y, SKNAS, GiMEN, BCHNDW, BE2M17, BE2C, SHEP, IMR32, KELLY, NGP and SMSKANR) and NB tumours (NB33, NB35, NB04, NB06, NB01, NB08, NB11, NB19, NB21, NB03, NB32 and NB34). The COBRA assay, which is based on extracting and bisulphite converting the DNA, was employed to test methylation. MethPrimer was used to design the primers(http://www.urogene.org/methprimer/). The University of California, Santa Cruz (UCSC) genome browser (https://genome.ucsc.edu/) was utilised to observe changes in methylation between the NB cell lines and hNCC after uploading the microarray data. Therefore, pairs of primers were accurately designed in a region that shows a lower degree of methylation in NB cell lines compared to hNCC. The designed amplicons were amplified using an endpoint PCR machine and afterwards, specific restriction enzymes were used to cut DNA the fragments. UN-M DNA(unmethylated DNA) and M DNA (methylated DNA) were assigned as assay controls, which should either be completely digested after being treated with a restriction enzyme in the case of M DNA, or undigested in the case of UN-M DNA. Digested fragments were separated by agarose gel electrophoresis and to calculate the degree of methylation, we used ImageJ, which is based on measuring the percentage of a cut fragment of DNA relative to an uncut fragment. To determine mRNA expression, we examined all of the normal cell lines and tissue (hNCC, DRG/SG and FA), NB cell lines (IMR32, KELLY, NGP, LAN-1, SHSY5Y, SHEP, GiMEN, BCHNDW, BE2C, SKNAS, SHIN, LAN-5 and SMSKANR) and NB tumours (NB20, NB33, NB35, NB06, NB14, NB23, NB30, NB01, NB07, NB08, NB19, NB21, NB03, NB13, NB17, NB18, NB25, NB26, NB32 and NB34). RNA was extracted and then made into cDNA and then we conducted qPCR. The investigation has revealed that the MYT1 promoter was methylated in hNCC and FA, which might have prevented mRNA expression. Lower degrees of methylation were seen in 91% and 83% of the NB cell lines and NB tumours tested, respectively; consequently, increased levels of mRNA were observed. These data suggest that methylation at a MYT1 promoter may repress MYT1 expression at a transcriptional level. Our studies suggest that DNA methylation may contribute in the regulation of MYT1 gene that is involved in NB progression. Thus, further investigations of these epigenetic changes may conclude in finding a new way to target NB.

Keywords: Neuroblastoma, MYT1, DNA methylation, Gene Expression, Cell lines.

ARTIFICIAL NEURAL NETWORK-BASED PREDICTION OF COVID-19 SEVERITY USING BIOMEDICAL DATA

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ABSTRACT

Prior to the start of research for this study, we established a clear aim: to construct a deep learning model that would use an artificial neural network (ANN) to predict COVID-19 severity from biological, clinical, and epidemiological variables/data points. We also set out to discover which biological markers had the strongest association and/or influence on the progression of severe COVID-19 disease, as well as evaluate how effective ANN(s) were in making biomedical decisions/pathways. **Methods**: In order to accomplish our stated goals, we conducted a retrospective study utilizing approximately 13,000 confirmed cases of COVID-19 obtained during the course of the pandemic. The variables we used in our research included demographic data (age, sex); clinically-observed findings (fever, dyspnea, oxygen saturation); co-morbidities; and the following biological markers: C-reactive protein (CRP), D-dimer, ferritin, lymphocyte count, and lactate dehydrogenase (LDH). The ANN model was created with multilayer perceptron deep neural network model with multiple hidden layers, ReLU activation functions, and dropout regularization. That was divided into three independent data subsets: training, validation, and test datasets. The accuracy, sensitivity, specificity, F1-score, and AUC (area under the ROC curve) were the basis for evaluating the performance of the ANN model(s) used in this study. **Results and Discussion.** ANN Modeled Severely Ill COVID 19 patients with better predictive ability than statistical methodologies, specifically, an accuracy of 94.2% and Area Under Curve 0.97, identifying advanced age, increased D-dimer, elevated C-reactive protein (CRP) level, lymphopenia, obesity, comorbid diabetes, and oxygen desaturation being the most important determinants of severity. ANN was also found superior to traditional statistical methods for identifying complex, non-linear interactions across many biomedical variables. These results indicate that use of AI technologies can assist with risk stratification at an earlier point of time, improve the management of patients, and better support the overall concept of Precision Medicine. **Conclusion**: ANNs represent an effective and efficient means of predicting the severity of COVID 19 based upon multidimensional biomedical data. The addition of deep learning-based models into clinical care will likely improve the ability to diagnose disease at an earlier stage, provide personalization of treatment options, and facilitate the decision-making process within both the biomedical and the infectious disease arenas into the future.

Keywords: COVID 19, Epidemiology, Intelligent analysis, ANNs

METABOLIC AND ANTIOXIDANT BENEFITS OF A CELLULOSE/PSYLLIUM DIET IN AGING DIABETIC RATS

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ABSTRACT

Dietary fiber is now recognized as a key food ingredient due to its dual role in food production and human health, providing technological advantages during food processing as well as physiological benefits to consumers. During aging, dietary fibers exert beneficial health effects, such as regulating intestinal transit, reducing serum cholesterol levels, slowing glucose absorption, improving insulin sensitivity, and protecting against oxidative damage observed in certain metabolic pathologies. The objective of the present study is to evaluate the effect of a diet enriched with dietary fibers (cellulose/psyllium: CP) on the carbohydrate and lipid profiles, as well as the redox status, of aged rats made diabetic by alloxan. Experimental diabetes was induced in rats by alloxan injection. Eighteen-month-old diabetic rats were fed either a standard diet (SD) or a diet enriched with dietary fibers (CP). After a 3-month experimental period, biochemical parameters (blood glucose, TC, TG, LDL-C, HDL-C) and markers of oxidative/antioxidant status (malondialdehyde MDA, catalase CAT, reduced glutathione GSH) were determined. Aged diabetic rats fed the CP-supplemented diet were compared to the SD group. A decrease in blood glucose and lipid parameters (TC, TG, LDL-C) along with an increase in HDL-C were noted. Furthermore, an increase in antioxidant markers (CAT, GSH) and a decrease in oxidative status markers (MDA) were observed. Dietary fibers may therefore aim to prevent or attenuate the deleterious effects of oxidative stress by reducing the accumulation of aging-related oxidative damage. A diet rich in cellulose/psyllium could offer a comprehensive response to the complex problem of diabetes mellitus, thereby helping to delay the onset of diabetic complications.

Keywords: diabetes, dietary fibers, metabolism, oxidative stress

EFFECTS OF DATE SEED (PHOENIX DACTYLIFERA L.) POWDER ON ORGAN FUNCTIONS, AND OXIDATIVE STRESS IN OBESE WISTAR RATS

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ABSTRACT

The valorization of date seeds at different scales is an important approach for the utilization of by-products from date processing. Algerian date seed powder (Phoenix dactylifera L.) is a natural by-product rich in bioactive molecules, such as fibers, vitamins, flavonoids, and polyphenols, offering valuable nutritional and antioxidant properties that help mitigate diabetes-related oxidative stress and metabolic disorders. This study aimed to evaluate the impact of a diet enriched with date kernel powder on renal function, hepatic function, and oxidative stress in obese Wistar rats. Obese and control Wistar rats were fed either a standard diet or a diet supplemented with date seed powder. Renal parameters (urea and creatinine) and hepatic enzymes (AST and ALT) were assessed in serum. Additionally, antioxidant markers were evaluated in erythrocytes by catalase activity was measured via spectrophotometric analysis of H2O2 decomposition at 240 nm, and reduced glutathione (GSH) was quantified using a Sigma assay kit. Oxidative marker was assessed by hydroperoxides were determined using the ferrous oxidation-xylenol orange (FOX) assay, Compared to the controls, obese rats exhibited elevated levels of urea, creatinine, AST, ALT, and hydroperoxides, alongside a significant decrease in catalase activity and reduced glutathione. Dietary supplementation with date seed powder effectively restored renal and hepatic functions, reduced oxidative stress markers, and enhanced antioxidant defenses, thereby correcting redox imbalance in obese rats. In conclusion, consuming date kernel powder does not cause any alterations to the kidneys or liver, helps correct markers of oxidative stress resulting from obesity, therefore it presents no risk to human health.

Keywords: Date seed powder, organ functions, obese rats, oxidative stress.

MEDICINAL PLANTS AND METABOLIC DISORDERS: EXPERIMENTAL EVIDENCE OF ANTIDIABETIC AND ANTI-OBESITY EFFECTS

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ABSTRACT

Metabolic diseases, particularly type 2 diabetes mellitus and obesity, represent major public health challenges worldwide and are closely associated with oxidative stress, chronic inflammation, and metabolic imbalance. In recent years, growing interest has been directed toward medicinal plants as complementary therapeutic agents, owing to their bioactive compounds and favorable safety profiles. The present study aimed to investigate the antidiabetic and anti-obesity potential of selected medicinal plants traditionally used in the Mediterranean region through both experimental and mechanistic approaches. An experimental study was conducted using an in vivo animal model of metabolic disorders, in which diabetes and obesity were induced by dietary and chemical methods. Plant extracts were administered orally for a defined treatment period. Biochemical parameters related to glucose homeostasis, lipid profile, insulin sensitivity, and oxidative stress markers were evaluated, alongside histological examination of metabolic tissues. In parallel, phytochemical screening was performed to characterize the major bioactive constituents of the investigated plants. The results demonstrated that supplementation with plant extracts significantly improved glycemic control, reduced body weight gain, and ameliorated dyslipidemia compared with untreated groups. These metabolic improvements were accompanied by a marked reduction in oxidative stress and inflammatory biomarkers, as well as partial restoration of tissue architecture. The observed effects are likely attributable to the presence of polyphenols, flavonoids, and dietary fibers, which act through modulation of glucose and lipid metabolism, inhibition of digestive enzymes, and enhancement of antioxidant defenses. **In conclusion,** this experimental evidence supports the potential use of medicinal plants as effective and sustainable complementary agents in the management of diabetes and obesity. Further clinical investigations are warranted to confirm these findings, standardize formulations, and ensure long-term safety.

Keywords: Phytotherapy, Experimental study, Diabetes, Obesity, Oxidative stress

REACTIVE SILVER INK-BASED PRINTED ELECTRODES FOR RESISTANCE-BASED GLUCOSE DETECTION

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ABSTRACT

Glucosuria is an important indicator for monitoring diabetes and metabolic disorders; however, conventional glucose monitoring systems commonly rely on invasive blood sampling. Therefore, the development of low-cost, printable, and non-invasive glucose sensing platforms remains an important research target. In this study, reactive silver ink-based printed electrodes were fabricated and evaluated as resistance-based sensing platforms for glucose detection. A particle-free reactive silver ink was synthesized and deposited onto flexible substrates using inkjet printing. Thermal annealing enabled the in-situ formation of conductive silver nanostructures on the electrode surface. The resulting electrodes were characterized by scanning electron microscopy, energy-dispersive X-ray spectroscopy, and X-ray photoelectron spectroscopy. SEM analysis revealed dense and interconnected silver nanostructures with an average particle size of approximately 142 nm. EDX analysis showed that silver was the dominant element on the surface, with an Ag content of 84.32 wt.%, while XPS analysis further confirmed the presence of silver on the electrode surface. The glucose sensing performance of the printed electrodes was investigated by immersing them in glucose solutions with different concentrations for varying exposure times, followed by drying and resistance measurement. The resistance response increased systematically with glucose concentration, indicating that the developed electrodes were sensitive to concentration-dependent changes in the solution. Calibration curves were obtained for different immersion times, and all tested conditions showed a linear relationship between glucose concentration and resistance. Among these conditions, the 60 min immersion time provided the highest linear correlation, with an R^2 value of 0.976, indicating the most suitable response for quantitative glucose detection. These results demonstrate that reactive silver ink-based printed electrodes can provide a simple, low-cost, and resistance-based platform for glucose detection. With further optimization, including repeatability studies, interference analysis, and validation in real urine samples, this approach may contribute to the development of practical sensing systems for glucosuria monitoring.

Keywords: Glucosuria, reactive silver ink, printed electrode, glucose detection, resistance-based sensing

MODELING PROBABILISTIC HEALTH RISKS OF FLUORIDE EXPOSURE FROM LENTIC ECOSYSTEMS IN THRACE REGION OF TÜRKIYE

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ABSTRACT

In this comprehensive and detailed toxicological investigation, we aimed to model the non-carcinogenic health hazards and potential physiological effects of fluoride exposure from the Sultanköy and Altınyazı Dam Lakes (Northwest Türkiye) for local consumers using an advanced probabilistic risk assessment approach. Based on the long-term hydrochemical datasets of these reservoirs, a multi-pathway probabilistic human health risk assessment was performed to systematically address inherent uncertainties in various environmental exposure parameters. The Hazard Quotient (HQ) values via the drinking water ingestion pathway were simulated across four distinct age cohorts: infants, children, teenagers, and adults, to capture age-dependent susceptibility. The probabilistic risk characterization revealed that the simulated HQ values for fluoride did not exceed the critical toxicological threshold of 1.0 in either reservoir, demonstrating that these surface waters pose no immediate adverse systemic health hazards or chronic fluorosis risks for the regional population. Across all evaluated demographic categories, the highest risk orientation was consistently observed in children, followed by teenagers, adults, and infants, respectively. In a comparative framework, the estimated risk indices for Sultanköy Dam Lake were systematically higher across all age groups than those calculated for Altınyazı Dam Lake due to varying baseline anion levels. From a preventive dentistry and public health perspective, while both aquatic ecosystems are completely safe from a dental or skeletal fluorosis standpoint, the prominently lower exposure profiles in Altınyazı Dam Lake suggest a potential deficit in meeting the daily optimal fluoride requirements necessary for dental caries mitigation, emphasizing the need for targeted nutritional and dental planning in the region.

Keywords: Probabilistic risk assessment, Fluoride exposure, Hazard Quotient, Preventive dentistry, Public health

EVALUATION OF FLUORIDE AND CHLORIDE CONCENTRATIONS IN SULTANKÖY AND ALTINYAZI RESERVOIRS (TÜRKIYE): A COMPARATIVE AND DENTAL PUBLIC HEALTH APPROACH

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ABSTRACT

In this comprehensive and detailed hydrochemical investigation, the seasonal water quality dynamics, spatial variations, and overall pollution profiles of the Sultanköy and Altınyazı Reservoirs, which hold immense strategic importance for extensive agricultural irrigation practices and regional freshwater reserves within the economically vital Meriç-Ergene Basin, were comparatively evaluated and monitored based on precise fluoride (F^-) and chloride (Cl^-) ion parameters. The extensive analytical results, laboratory data, and field observations revealed that despite both artificial aquatic systems being located within the exact same geographical area and climatic region, the fundamental hydrochemical characteristics and major anion compositions of these two crucial water bodies significantly differ on a critical basin scale. According to the quantitative findings of the monitoring program, Altınyazı Reservoir prominently stands out with its remarkably high chloride concentrations and elevated salinity indicators, whereas fluoride accumulation exhibits a much more dominant, persistent, and distinctive hydrochemical character throughout the Sultanköy Reservoir ecosystem. This sharp contrast in the dominant anion distribution and geochemical fingerprints of the reservoirs clearly points to highly differing anthropogenic pressures occurring along the specific drainage lines feeding the dams, the varying quality and volume of agricultural return waters draining from surrounding crop fields, or the distinct local lithological configurations and geological structures characterizing the respective drainage basins. Consequently, this comparative research study provides critical baseline data, scientific insights, and environmental indicators necessary for implementing sustainable water resource management strategies in the region, protecting aquatic ecosystems, and assessing the future long-term utilization potential and ecological safety of both reservoirs for irrigation and secondary purposes.

Keywords: Sultanköy Reservoir, Altınyazı Reservoir, Fluoride, Chloride, Dental health, Meriç-Ergene Basin

HOSPITAL COCKROACHES AS RESERVOIRS OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS: A ONE HEALTH PERSPECTIVE

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ABSTRACT

Background Cockroaches are recognized as mechanical vectors capable of harboring and spreading pathogenic microorganisms, including Staphylococcus aureus, posing a significant public health risk. The increasing prevalence and severity of S. aureus infections are largely driven by antibiotic resistance, associated with excessive antibiotic use and poor hospital hygiene. Within a One Health framework, environmental reservoirs such as hospital pests play a key role in the dissemination of resistant pathogens. **Materials/Methods** A total of 40 cockroaches were collected from two hospitals in Biskra, Algeria, over a 10-day period in March 2024. Isolation and identification of S. aureus were performed using standard microbiological techniques. Antibiotic susceptibility testing was carried out using the disk diffusion method on agar media, including β-lactams, macrolides, lincosamides, and glycopeptides such as vancomycin. All results were confirmed using the VITEK[X] automated system, which also allowed phenotypic detection of methicillin resistance, glycopeptide resistance, and inducible MLSb mechanisms. **Results** Out of 40 cockroaches, 22 S. aureus isolates were recovered, indicating a high contamination rate. Most isolates displayed multidrug resistance, with high resistance to penicillin, oxacillin, and cefoxitin. Phenotypic analysis showed that 81.25 % were methicillin-resistant (MRSA). A low but concerning level of reduced susceptibility to vancomycin was observed, representing a potential therapeutic concern. Resistance to clindamycin combined with erythromycin indicated inducible MLSb mechanisms. **Conclusion** Hospital cockroaches represent a significant reservoir of multidrug-resistant S. aureus. Strengthening hygiene, pest control, and continuous surveillance of antibiotic resistance are essential to limit the spread of resistant pathogens in healthcare settings within a One Health approach.

Keywords: Cockroaches, Staphylococcus aureus, MRSA, Antibiotic resistance, One Health

ENVIRONMENTAL CHEMICALS RESPONSIBLE FOR INFERTILITY: THE CASE OF ALGERIA

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ABSTRACT

Infertility in Algeria affects approximately 15% to 20% of couples. The causes are evenly distributed between female and male factors (40% each), with the remaining 20% being mixed or unexplained. The annual number of new marriages hovers around 282,000 unions. Exposure to toxic chemicals is a major and growing cause of both male and female infertility, often acting through endocrine disruption. These carcinogenic, mutagenic, and reprotoxic (CMR) substances affect male reproduction by reducing sperm quality and count (azoospermia, oligospermia, teratospermia, asthenospermia) and impact female reproduction. Certain substances cause a reduction in the number of oocytes; they are responsible for cycle suppression and can lead to miscarriages or fetal developmental abnormalities. Endocrine disruptors interfere with sexual maturation and the development of reproductive organs, and are linked to hormone-dependent cancers. These disruptors are present in our daily lives (in water, food, cosmetics, and medications). Xenobiotics that negatively affect fertility are found in many everyday objects and products (tobacco, cosmetics, etc.). They are also present in the environment due to contamination of soil (pesticides, metals, etc.), food (pesticide residues, cadmium, aluminum), bottled water (nitrates, nitrites, phthalates, bisphenol A, metals), and air (particulates, hydrocarbons, lead oxides, etc.). Today, the findings of several scientific studies regarding exposure to endocrine disruptors—and bisphenol A in particular—all converge on the conclusion that these xenobiotics are definitively implicated in the development of infertility issues among couples.

Keywords: Exposure, xenobiotics, pesticides residus, infertility, couple, sperm, environment

DOUBLE IGG PEAK: A MISLEADING MONOTYPIC KAPPA MULTIPLE MYELOMA

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ABSTRACT

Monoclonal bicomponent profiles detected by serum protein electrophoresis are rare, accounting for approximately 3% of monoclonal gammopathies, and may represent a significant diagnostic challenge. They may reflect a true biclonal gammopathy, the coexistence of two independent plasma cell clones, or other mechanisms of immunoglobulin heterogeneity. We report the case of a 65-year- old man presenting with asthenia, diffuse bone pain, anemia, hypercalcemia, hyperproteinemia, and an elevated β2-microglobulin level. Serum protein capillary electrophoresis revealed two distinct monoclonal peaks in the gamma region. Capillary immunofixation identified two monoclonal IgG components, namely IgG κ (21.8 g/L) and IgG λ (37 g/L), with the IgG λ component being quantitatively predominant. Despite this apparent predominance, bone marrow examination revealed 40% infiltration by monoclonal κ plasma cells, while radiological examinations demonstrated multiple osteolytic lesions. The patient was therefore diagnosed with stage III IgG κ multiple myeloma according to the International Staging System (ISS). The IgG λ component, which was not confirmed by bone marrow findings, was considered compatible with an associated monoclonal gammopathy of undetermined significance (MGUS). This case highlights that the quantitatively predominant serum monoclonal component does not necessarily correspond to the malignant plasma cell clone. It underscores the limitations of relying solely on serum electrophoresis and immunological findings and emphasizes the importance of integrating the clinical presentation, laboratory data, immunofixation results, and bone marrow examination to accurately identify the pathological clone and establish the correct diagnosis in patients with bicomponent monoclonal gammopathies.

Keywords: multiple myeloma, biclonal gammopathy, serum protein electrophoresis, immunofixation, IgG kappa, monoclonal gammopathy of undetermined significance (MGUS)

PHYTOCHEMICAL PROFILING, ANTIMICROBIAL EFFICACY, AND ANTIOXIDANT POTENTIAL OF LEPIDIUM DRABA AERIAL PARTS

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ABSTRACT

The escalating prevalence of multidrug-resistant pathogens and oxidative stress-related disorders has intensified the search for novel bioactive compounds from natural sources. In this context, the present study was undertaken to comprehensively evaluate the phytochemical composition, antimicrobial efficacy, and antioxidant potential of the aerial parts of Lepidium draba (family Brassicaceae), a perennial herb traditionally used in folk medicine but still largely unexplored from a phytopharmacological standpoint. The preliminary phytochemical screening of the powdered aerial parts, carried out using standard qualitative protocols, unveiled a diverse array of secondary metabolites. The plant proved to be a rich reservoir of alkaloids, terpenoids, tannins, saponins, leucoanthocyanins, triterpenoids, and flavonoids—indicating its substantial biosynthetic capacity for defense-related and therapeutic compounds. Building upon these findings, a targeted isolation procedure was performed on the whole-plant extracts using successive solvent fractionation and column chromatography. This approach led to the successful purification of three known flavonoid glycosides, namely rhamnocitrin-3-O-β-D-glucoside (1), complanatuside (2), and genkwanin-4'-O-β-D-glucoside (3). The structural elucidation of these isolated compounds was unequivocally established through comprehensive nuclear magnetic resonance (NMR) spectroscopy, including ^{1}H-NMR, ^{13}C-NMR, and two-dimensional experiments, complemented by acid hydrolysis to confirm the sugar moieties and their linkage positions. Moving to the biological assessment, the antibacterial activity of crude extracts (prepared with solvents of varying polarities) was screened in vitro using the standard disc diffusion assay against a panel of Gram-positive and Gram-negative bacterial strains. The results revealed variable inhibition zones, with certain extracts demonstrating promising bactericidal effects, thereby supporting the ethnopharmacological use of the plant against infectious conditions. Concurrently, the *n*-butanol fraction—selected for its highest polarity and presumed richness in phenolic compounds—underwent quantitative spectrophotometric evaluation for total phenolic content using the Folin–Ciocalteu reagent, alongside antioxidant activity assessment via DPPH radical-scavenging and, where applicable, FRAP or ABTS assays. The n-butanol extract exhibited a notable dose-dependent free-radical scavenging capacity, which correlated positively with its elevated phenolic content, suggesting that these secondary metabolites are major contributors to the observed redox activity. Collectively, the findings of this investigation not only confirm the presence of pharmaceutically relevant phytoconstituents in Lepidium draba but also provide, for the first time, a coherent scientific rationale for its traditional medicinal applications. The isolation of the three flavonoid glycosides enriches the chemotaxonomic knowledge of the genus, while the demonstrated antimicrobial and antioxidant activities open promising avenues for the development of natural health products. Nonetheless, further studies encompassing in vivo toxicity assessments and

mechanistic explorations are warranted to fully harness the therapeutic potential of this underexplored botanical resource.

Keywords: Lepidium draba, antimicrobial efficacy, antioxidant potential

AGE-SPECIFIC PROBABILISTIC HEALTH RISKS OF FLUORIDE EXPOSURE VIA GROUNDWATER CONSUMPTION IN LOW AND HIGH ELEVATION AQUIFERS OF NORTHWEST TÜRKİYE

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ABSTRACT

Chronic exposure to fluoride via drinking water consumption is a well-documented global public health concern due to its capacity to induce non-carcinogenic health complications, such as dental and skeletal fluorosis, depending on the dose and physiological susceptibility. This study presents a comparative and age-specific probabilistic health risk assessment of fluoride exposure for populations utilizing groundwater from two distinct topographic zones (high-elevation/slope and low-elevation/plain) in the İpsala district of Edirne province, Northwest Türkiye. To evaluate the toxicological and non-carcinogenic hazards across different human developmental stages, the Hazard Quotient (HQ) was mathematically modeled for four demographic cohorts: infants, children, teenagers, and adults. The probabilistic risk assessment demonstrated that fluoride-induced health hazards are significantly influenced by both the topographic origin of the water source and age-specific physiological characteristics. In the high-elevation slope zone, fluoride exposure poses a negligible non-carcinogenic risk for all studied groups, with HQ values remaining comfortably below the safe regulatory threshold (HQ < 1), ranging from 0.04680 for infants to 0.33150 for children. Conversely, a substantial increase in exposure hazards was characterized in the low-elevation plain zone. In this lower terrain, the calculated HQ for children escalated sharply to 0.80372, followed by teenagers (0.56733), adults (0.45459), and infants (0.11347). These findings reveal that while no cohort currently exceeds the absolute safety limit, the child population in the low-elevation plain zone approaches this critical benchmark closely. Consequently, children constitute the most vulnerable demographic segment to chronic fluoride exposure in this region. This study underscores the necessity of implementing age-specific public health monitoring and target-driven water management strategies, particularly within the low-lying plain sectors of the basin, to mitigate long-term fluoride health risks.

Keywords: Fluoride exposure, Probabilistic risk assessment, Hazard Quotient, Demographic cohorts, Children vulnerability, İpsala Basin

VARIATIONS IN FLUORIDE GEOCHEMISTRY OF GROUNDWATER IN THE İPSALA (EDIRNE) BASIN BASED ON TOPOGRAPHIC ELEVATION DIFFERENCES AND ITS EVALUATION FROM A DENTISTRY PERSPECTIVE

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ABSTRACT

Groundwater geochemistry plays a pivotal role in public health, especially concerning elements with a narrow margin of safety such as fluoride. In this study, the fluoride dynamics of groundwater aquifers operated at similar depths (about 100 m) but located at different topographic elevations (high elevation/slope and low elevation/plain) in the İpsala district of Edirne province (Türkiye) were comprehensively investigated, and a clinical evaluation was conducted from the perspective of preventive dentistry. In addition to the primary fluoride parameter, physicochemical variables including pH and Electrical Conductivity (EC), which significantly govern fluoride hydrogeochemistry, mobilization, and dissolution kinetics, were systematically monitored in the sampled well waters. According to the analytical results, the groundwater fluoride concentration was measured as 0.351 ppm in the high-elevation (slope) well, whereas it reached 0.851 ppm in the low-elevation (plain) well. The concomitant sharp increase in EC levels (from 380 to 1919 μS/cm) and the alkaline shift in pH (from 7.42 to 7.53) from high to low elevations demonstrated that prolonged water-rock interactions, mineral dissolution, and alkaline anion exchange processes trigger significant geogenic fluoride enrichment in the low-lying plain aquifer. From a dental perspective, it was determined that groundwater from the high elevation contains insufficient fluoride for optimal dental caries prophylaxis (

Keywords: İpsala district, Groundwater hydrogeochemistry, Geogenic fluoride, Dental caries prophylaxis, Dental fluorosis

ANTIVIRAL IMMUNITY: FROM PROTECTION TO IMMUNOPATHOLOGY

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ABSTRACT

Nowadays, viral infections constitute a threat to human health, causing several million deaths each year. In response to these infections, the immune system reacts differently from one individual to another. Several factors are responsible for this variability, making the infection acute and benign in some cases, while it may progress to chronic or even fatal forms in others. Immunoglobulin G antibodies play a determining role in antiviral defense and virus neutralization. However, they may act in a paradoxical manner by increasing the severity of infections due to modifications in the glycosylation of their Fc fragment. Several recent studies have highlighted this phenomenon, particularly in the case of enveloped viruses such as SARS-CoV-2. Similar observations have also been reported in other viral infections, including dengue virus infection, where afucosylated IgG has been associated with enhanced disease severity through excessive FcγRIIIa-mediated immune activation. Indeed, afucosylation of immunoglobulin G significantly increases their affinity for FcγR receptors, which induces excessive stimulation of immune cells such as macrophages and NK cells, thereby promoting antibody-dependent cellular cytotoxicity. This causes a major amplification of inflammation, making the infection more severe. Further understanding of how these modifications in the core glycan of immunoglobulin G increase the immunopathology of viral infections may pave the way for new therapeutic advances targeting the control of their production or activity.

Keywords: Afucosylated IgG, Viral infection, Fc glycosylation, Immunopathology

EXTRACTION TEMPERATURE INFLUENCES SUNFLOWER RAY FLORETS VALORIZATION FOR BIOMEDICAL APPLICATIONS

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ABSTRACT

The exploitation of *Helianthus annuus* L. (sunflower) plant for oil extraction results in a series of by-products, such as the stem, leaves, floral organs (ray and disc florets, receptacle) and pollen, leading to environmental pollution. In recent years, there has been a growing interest in valorizing *H. annuus* by-products, due to the multitude of chemical compounds responsible for various biological activities with benefits for human health. The aim of the present study was to study the influence of the extraction temperature on the phenolics composition of green extracts of *H. annuus* ray florets and their antioxidant activity, in view of biomedical applications. Samples were collected from an agro-ecological location in the Republic of Moldova during the full flowering stage. The dried powder of ray florets was subjected to a green ultrasound-assisted extraction (UAE) technique in 70% (v/v) ethanol, at a ratio of 1:30 (w/v), at 40 and 80 °C, respectively, for the isolation of phenolics. The resulting extracts were analyzed by RP-HPLC coupled with DAD for both identification and quantification of main phenolic acids and flavonoids, in comparison with standard compounds (Sigma-Aldrich, Germany). In addition, the free DPPH radical scavenging capacity of the extracts was determined and expressed as the concentration that inhibited 50% of free radicals (IC50). UAE technique was used to facilitate the destruction of cellulose walls and cell membranes in a short time exposure, thus saving energy consumption and acting as an alternative to traditional time-consuming methods, thus presenting a high potential for transfer into the bioeconomy. The results of the HPLC analysis indicated similar profiles of the phenolic extracts, but significantly different quantities of each compound. Chlorogenic and caffeic acids were the main identified phenolic acids, while rutin and myricetin were the main identified flavonoids. Their quantification by peak integration showed that the extract obtained at lower temperature (40 °C) exhibited higher phenolics concentration, compared to the extract obtained at high temperature (80 °C). The lower yield of phenolics obtained at high temperature could be due to thermal degradation. The DPPH assay results indicated an increase of the free radicals scavenging capacity, in a dose-dependent manner. The IC50 value of the extract obtained at lower temperature (40 °C) was lower than that of the extract obtained at high temperature (80 °C), indicating higher antioxidant activity. This result showed a direct positive correlation between the higher quantity of phenolics and the antioxidant activity of *H. annuus* extracts. All these results demonstrated a major role of the extraction parameters, in particular that of temperature, which needs optimization in view of isolation of high yields of antioxidant phenolics. In addition, other factors involved in phenolics extraction, such as method, solvent, pH, time, should be further investigated. These findings support the valorization of *H. annuus*

ray florets, considered an agricultural by-product, as a natural source of antioxidant compounds with potential utilization as ingredients of novel nutraceutics for human and animal health promoting.

Acknowledgement. This work was supported by the research project (PN-IV-P8-8.3ROMD-2023-0269) Comprehensive valorization of *Helianthus annuus* L. by-products for the development of new products with biomedical potential, funded by UEFISCDI, Romania and by the Subprogram 011101 Genetic and biotechnological approaches to agroecosystem management under climate change, financed by the Ministry of Education and Research of the Republic of Moldova.

Keywords: antioxidant activity, Helianthus annuus, phenolics, ray florets, UAE

THROMBOSIS AND HEMATOLOGICAL MALIGNANCIES: INTRACARDIAC THROMBOSIS REVEALED DURING A BIPHENOTYPIC ACUTE LEUKEMIA IN A CHILD: A CASE REPORT

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ABSTRACT

Introduction: Cancer is a prime example of acquired hypercoagulability. Activation of coagulation and a prothrombotic state are frequently observed in cancer patients, even if they do not systematically lead to clinically significant thromboembolic complications. Indeed, tumor cells exhibit strong procoagulant activity, inducing local activation of coagulation with fibrin formation. We report the case of a child with acute biphenotypic leukemia who was diagnosed with intracardiac thrombosis. **Materials and Methods:** This concerns patient S.M., a 12-year-old with no significant past medical history, admitted for pallor and persistent bone pain. A complete blood count, bone marrow biopsy, and immunophenotyping were performed on this patient. An echocardiogram was performed as part of a pre-therapeutic assessment. A coagulation panel (PT+TCK+Fg+ D-dimer) as well as a thrombophilia panel and antiphospholipid antibody screening were performed as part of the investigation. A family history was taken to identify any thrombotic events. **Results:** The complete blood count revealed pancytopenia with 70% circulating blasts. Biocytosis confirmed the diagnosis of acute leukemia. Immunophenotyping established the diagnosis of biphenotypic leukemia (T-cell ALL+AML). Echocardiography revealed a mobile echogenic mass suggestive of thrombosis, which was confirmed by cardiac MRI. The patient's D-dimer level was elevated, while the coagulation panel returned normal. Tests for coagulation inhibitor deficiency and antiphospholipid antibodies were negative. No history of thrombosis was found in this patient. **Conclusion:** In summary, thrombosis secondary to cancer is a frequent and serious complication requiring particular attention in oncology. A better understanding of the mechanisms involved and advances in management can improve the prognosis and quality of life of affected patients.

Keywords: acute leukemia, thrombosis

IMPACT OF THE MATRIX EFFECT OF INDUSTRIAL CALIBRATORS ON INR CALCULATION: IMPORTANCE OF DETERMINING AN INTERNAL REFERENCE VALUE ON A COAGULOMETER

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ABSTRACT

Introduction & Objective The INR (International Normalized Ratio) is the key parameter for monitoring patients on oral anticoagulant therapy (AVK). Its exact mathematical formula is based on a precise ratio: INR = (Patient PT / Control PT) ISI
In many laboratories, when using semi-automated "coagulometer" analyzers (such as the STArt Max), the 100% point of the lyophilized industrial calibrator is assumed by default to be the control. **Objective:** To demonstrate the existence of an analytical bias induced by the matrix effect of the lyophilized samples and to evaluate the clinical benefit of manually configuring an internal control from fresh plasma on the STArt Max. **Materials and Methods** Analytical system: STArt Max semi-automated analyzer (Diagnostica Stago). Reagents: NeoPTimal, Unicalibrator (Stago). Determination of the industry control: Time obtained at the 100% point of the standard calibration curve using the Unicalibrator. Determination of the internal control: Mean of the prothrombin time (PT) measured in a pool of 20 healthy patients. Comparison: Evaluation of the impact of the two calculation methods on the INR of routine patients on vitamin K antagonists (VKAs). **Results** Comparative measurements revealed a systematic discrepancy in clotting times: Parameter Evaluated Plasma Source Measured Time (sec) Point 100% Calibration Unicalibrator Lyophilized 14.5 s Internal Control Pool of 20 Patients Fresh 13.0 s. Clinical Impact on INR Calculation (Concrete Example): For a patient on treatment measured at 28 seconds (with a reagent at ISI = 1.05): Calculation using the calibrator point (14.5 s): INR = (28 / 14.5)^1.05 = 2.00 Calculation using the internal control (13.0 s): INR = (28 / 13.0)^1.05 = 2.24 Using the standard industrial calibrator underestimates the patient's true INR, potentially leading to a false sense of Therapeutic underdosing. **Discussion**: The observed discrepancy between the calibrator at 14.5 s and the fresh plasma at 13.0 s is explained by the matrix effect. Industrial stabilization processes (freezing, lyophilization) slightly alter the physical structure and viscosity of the control plasma, infinitesimally slowing its coagulation compared to the purity and reactivity of fresh patient blood. While older generations of semi-automatic analyzers blocked the calculation at the 100% calibration point, the modern STArt Max interface allows the two parameters to be separated. It is possible to maintain the Unicalibrator calibration for the PT in % while manually entering the internal control (13.0 s) to ensure the correct INR. **Conclusion & Recommendations** Quality Control: The 100% mark of a lyophilized calibrator should not be confused with the time of the internal control. Configuration: It is strongly recommended to use the STArt Max configuration menu to manually insert the control derived from plasma samples from healthy individuals. Safety: This harmonization ensures the complete continuity and accuracy of INR results transmitted to clinicians, in full compliance with international recommendations (GEHT, WHO).

Keywords: INR, unicalibrateur, internal control

PREVALENCE STUDY OF HEREDITARY SPHEROCYTOSIS CASES DIAGNOSED AT THE CHTS OF CHU MUSTAPHA

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ABSTRACT

Introduction: Hereditary spherocytosis (HS) is the most common inherited hemolytic anemia. It results from a deficiency or dysfunction of red blood cell membrane proteins, leading to decreased erythrocyte deformability and chronic hemolysis. The clinical presentation is variable, ranging from asymptomatic anemia to severe forms requiring regular blood transfusions. This study aimed to analyze the epidemiological, clinical, and hematological characteristics of patients diagnosed with HS at the Hematology and Blood Transfusion Laboratory of Mustapha University Hospital, Algiers. **Materials and Methods:** This retrospective study, conducted over a 13.5-year period, included 277 patients with HS. Patients' ages ranged from 11 days to 65 years (mean: 17 years); the female-to-male sex ratio was 1.08. Clinical assessment included evaluation for signs of anemia, jaundice, and splenomegaly. Laboratory parameters included complete blood count, hemoglobin level, reticulocyte count, and peripheral blood smear examination. The diagnosis was confirmed using the Pink test, a quantitative assay assessing the osmotic hemolysis of red blood cells. **Results:** At the time of diagnosis, the main clinical manifestations were pallor (74.9%), jaundice (12.5%), splenomegaly (2.9%), and cyanosis (2.9%). Anemia was present in 76.2% of patients, with a mean hemoglobin level of 9.96 g/dL. It was normocytic in 56.8% of cases, normochromic in 76.1%, and regenerative in 81.9%. The Pink test was positive in 100% of cases, confirming the diagnosis of hereditary spherocytosis. **Conclusion:** Our study highlights the clinical variability of HS, with a predominance of moderate forms. The Pink test proved to be a reliable diagnostic tool. Appropriate management, including regular hematological follow-up and family screening, remains essential to prevent complications and optimize patient care.

Keywords: Hereditary spherocytosis, Pink test, EMA test, Anemia

NANOZYMES IN MEDICAL BIOLOGY: FROM EARLY DIAGNOSIS TO TARGETED THERAPY

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ABSTRACT

Nanozymes, a new generation of nanomaterials with enzyme-like catalytic activity, have attracted considerable attention as innovative tools for advancing precision healthcare. Compared with natural enzymes, nanozymes offer remarkable catalytic stability, cost-effective production, tailored physicochemical properties, and enhanced resistance to harsh biological environments. Owing to these distinctive features, nanozymes have emerged as promising candidates for a wide range of biomedical applications. Continuous progress in nanotechnology and materials engineering has further accelerated the development of multifunctional nanozyme platforms with improved catalytic efficiency, biocompatibility, and therapeutic performance. As research in this field continues to evolve, increasing attention is being directed toward designing nanozymes with enhanced specificity and multifunctionality for complex biological systems. This work provides an updated overview of recent advances in nanozyme research and highlights their expanding role in modern medical biology. Particular emphasis is placed on their growing potential to support early disease diagnosis through highly sensitive biosensing technologies and to improve targeted therapeutic strategies. Current trends in engineering multifunctional nanozyme platforms and examines the potential they offer for addressing major challenges are summarized. Finally, key obstacles to clinical translation, including biosafety, standardization, large-scale production, and regulatory considerations, are briefly discussed together with future perspectives for the development of next-generation nanozymes.

Keywords: Nanozyme, Nanotechnology, diagnosis, Targeted therapeutics, Biomedical applications

A NORMAL "MOLECULAR KARYOTYPE" DOES NOT EXCLUDE A BALANCED TRANSLOCATION: PATERNAL T(2;14) UNMASKED BY PGT-A PATTERN RECOGNITION IN A COUPLE WITH RECURRENT PREGNANCY LOSS — A CASE REPORT

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ABSTRACT

Background: Chromosomal microarray ("molecular karyotype", array-CGH) is often presented as superior to conventional karyotyping, yet it detects only copy-number change and cannot identify balanced structural rearrangements — a critical limitation in recurrent pregnancy loss (RPL). **Case presentation**: A 29-year-old woman and her 37-year-old partner presented with recurrent pregnancy loss, including several biochemical pregnancies and a first-trimester miscarriage following intrauterine insemination. A prior couple array-CGH ("molecular karyotype") was reported normal for both. One IVF/PGT-A cycle (NGS) produced 5 blastocysts, all abnormal: four had segmental imbalances of chromosomes 2p and 14q — three with identical breakpoints in complementary directions — and one was mosaic. This recurrent single-pair involvement, in an all-abnormal cohort discordant with the woman's young age, prompted conventional karyotyping, which revealed a paternal balanced translocation, 46,XY,t(2;14) (p10;q10). Notably, the unbalanced segments were localized more precisely by NGS (distal 2p and 14q) than by the pericentromeric breakpoints assigned on banding. The only transferable (mosaic) embryo, balanced for the translocation, failed to implant. **Conclusion:** A normal array-CGH does not exclude a parental balanced translocation; it is blind to such rearrangements by design, and conventional karyotyping remains the gold standard in RPL. Recurrent, complementary segmental imbalances of one chromosome pair across PGT-A embryos — especially when discordant with maternal age — are a signature of a parental rearrangement and warrant karyotyping and PGT-SR referral. In a parallel case at our centre, a paternal t(4;16) was instead detected through products-of-conception array-CGH, illustrating the complementary roles of molecular and conventional cytogenetics in reproductive failure.

Keywords: balanced reciprocal translocation, t(2;14), array-CGH limitations, PGT-A, recurrent pregnancy loss, conventional karyotype; PGT-S

A COMPARATIVE HPLC-DAD STUDY OF CHARACTERIZATION OF PHENOLIC AND FLAVONOID COMPOUNDS IN CASUARINA GLAUCA

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ABSTRACT

This study investigated the extraction and characterization of bioactive compounds from different parts of Casuarina glauca, including leaves, stems, fruits, and seeds. Two extraction techniques were employed in order to evaluate their efficiency in recovering phenolic constituents: conventional maceration and ultrasound-assisted extraction (UAE). The obtained aqueous extracts were subsequently analyzed using high-performance liquid chromatography coupled with diode-array detection (HPLC-DAD) to identify and quantify the major phytochemical compounds present in the plant material. The chromatographic analysis revealed a rich phenolic profile composed of fifteen identified compounds. These compounds were classified into three main groups: eight phenolic acids, six flavonoids, and one phenylethanoid glycoside. The quantitative results showed that catechin was the dominant compound detected in the extracts, particularly in the leaf extract, where its concentration reached 139.7 mg/mL. This high abundance suggests that the leaves of Casuarina glauca represent a significant reservoir of flavonoid compounds with potential biological activities. The composition and concentration of phenolic compounds were found to vary considerably depending on both the plant organ analyzed and the extraction technique applied. In general, ultrasound-assisted extraction proved to be more efficient than maceration in recovering phenolic substances from the plant matrix. This trend was further confirmed through the determination of the Total Phenolic Content (TPC) and Total Flavonoid Content (TFC). The highest values were obtained for the leaf extract produced by UAE, which reached 17.53 mg gallic acid equivalents per gram of dry weight (mg GAE/g DW) for TPC and 15.43 mg quercetin equivalents per gram of dry weight (mg QE/g DW) for TFC. Furthermore, the antioxidant potential of the different extracts was evaluated using DPPH radical scavenging and ferric reducing antioxidant power (FRAP) assays. Among all tested samples, the aqueous leaf extract obtained by ultrasound-assisted extraction exhibited the strongest antioxidant activity. This result is consistent with its higher phenolic and flavonoid contents. Overall, these findings provide the first detailed phytochemical characterization of Casuarina glauca aqueous extracts obtained through UAE and maceration. The results highlight the plant's considerable potential as a natural source of antioxidant compounds. Such properties may open new perspectives for the valorization of this species in the development of natural antioxidant formulations, particularly in the fields of green pharmacy, complementary medicine, and preventive health strategies.

Keywords: Casuarina glauca, Ultrasound-assisted extraction, Maceration extraction, Bioactive compounds; HPLC-DAD, Antioxidant activity.

INTEGRATED PHYTOCHEMICAL ANALYSIS AND IN VITRO EVALUATION OF ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF VIOLA ODORATA

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ABSTRACT

Viola odorata, a perennial medicinal plant belonging to the Violaceae family, has long been recognized for its diverse therapeutic properties, including anti-inflammatory, expectorant, analgesic, and antioxidant effects. Owing to its richness in bioactive secondary metabolites such as flavonoids, alkaloids, saponins, and mucilaginous compounds, it is widely used in traditional medicine, particularly for the treatment of respiratory and dermatological disorders. In recent years, this species has attracted increasing scientific interest in the fields of phytochemistry and pharmacology due to its potential as a natural source of biologically active compounds.

The present study focuses on the phytochemical characterization and the evaluation of key biological activities namely antioxidant, antibacterial, and antifungal of different solvent extracts obtained from a medicinal plant of the Viola genus. Qualitative phytochemical screening revealed a significant presence of various classes of secondary metabolites, including tannins, anthocyanins, terpenoids, and alkaloids, highlighting the chemical diversity of the investigated extracts. Quantitative analysis of total polyphenol and flavonoid contents demonstrated comparable concentrations in the ethyl acetate (AcOEt) and *n*-butanol (*n*-BuOH) fractions, suggesting a similar extraction efficiency for phenolic constituents in these solvents. The antioxidant capacity of the extracts was assessed through multiple in vitro assays, including DPPH and ABTS radical scavenging methods, *o*-phenanthroline assay, and ferric reducing antioxidant power (FRAP). Among the tested fractions, the ethyl acetate extract exhibited the most pronounced antioxidant activity, indicating a high potential for neutralizing reactive oxygen species. The antibacterial activity was evaluated using the agar diffusion method against representative Gram-positive and Gram-negative bacterial strains. The results revealed that the ethyl acetate extract displayed notable inhibitory effects against *Staphylococcus aureus* and *Escherichia coli.* In addition, antifungal activity was assessed against *Fusarium oxysporum*, where the same extract demonstrated appreciable fungicidal properties. Overall, these findings highlight the significant bioactive potential of *Viola odorata* extracts, particularly the ethyl acetate fraction, supporting their possible application as natural antioxidant and antimicrobial agents in pharmaceutical and biomedical fields.

Keywords: Viola odorata, Phytochemical screening, Polyphenols, Antioxidant activity, Antibacterial activity, Antifungal activity, Natural products

COMPOUND HETEROZYGOSITY INVOLVING HEMOGLOBINOPATHY ASSOCIATIONS: A REPORT OF FOUR FAMILY STUDIES

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ABSTRACT

Hemoglobinopathies are genetic disorders affecting the structure or production of the hemoglobin molecule. They can cause severe anemia in homozygous patients but moderate anemia in heterozygous individuals, depending on the type of pathology. Some patients are heterozygous for two different hemoglobinopathies and present with anemia of variable severity. Despite the great molecular diversity of the underlying abnormalities, the diagnosis is generally based on phenotype alone. The use of a combination of reliable and sufficiently precise techniques allows diagnosis to be established in the vast majority of cases. Interpretation of results requires knowledge of the clinical and transfusion history, the biological context (complete blood count, iron status, hemolysis workup), as well as the ethnic and family background of the patient. **Objective:** The aim of this study is to present the clinico-biological profile and family investigations of patients with hemoglobinopathy associations diagnosed at the CHTS of Mustapha University Hospital. **Patients and Methods:** We report four patients (3 boys and 1 girl) aged between 3 and 18 years, referred for hemoglobinopathy workup following severe chronic anemia or as part of a family investigation. A complete blood count, reticulocyte count, blood smear, and capillary hemoglobin electrophoresis were performed for each proband, followed by family studies. **Results:** Two patients presenting with hypochromic microcytic anemia with pseudo-polycythemia [poorly regenerative or aregenerative] were diagnosed with compound heterozygosity involving the associations (HbS/HbO-Arab) and (HbS/Beta^0 thalassemia), with the following Hb percentages: (HbA= 0%, HbF= 4.6%, HbS= 50.2%, HbO-Arab= 45.2%) and (HbA= 0%, HbA2= 4.7%, HbF= 27.2%, HbS= 68.1%), respectively. The other two patients had no anemia, but microcytosis and hypochromia were present. They were diagnosed with compound heterozygosity involving the associations (HbC/HbO-Arab) and (HbC/HbA2 variant), with the following Hb percentages: (HbA= 0%, HbF= 0%, HbO-Arab= 53%, HbC= 27%) and (HbA= 61.9%, HbA2= 2.1%, HbF= 0%, HbC= 34.7%, HbA2 variant= 1.3%), respectively. All four diagnoses were confirmed by family investigations. **Conclusion:** Screening of heterozygous individuals is essential to inform them of the risk of having a homozygous affected child. Screening should be offered when the complete blood count is suggestive, in at-risk ethnic groups, during family investigations, or at premarital consultations. Screening should be followed by genetic counseling and, where appropriate, prenatal diagnosis using molecular biology techniques.

Keywords: Hemoglobinopathy, Compound heterozygosity, Capillary electrophoresis

IODINE-INDUCED HYPERTHYROIDISM FOLLOWING HYSTEROSALPINGOGRAPHY: A CASE REPORT

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ABSTRACT

Hysterosalpingography (HSG) is an imaging procedure used to evaluate the uterine cavity and fallopian tubes through the injection of an iodinated contrast medium. It is commonly performed in women presenting with infertility or recurrent miscarriage. Although generally considered safe, several complications have been reported, including uterine perforation, allergic reactions, hemorrhage, and hyperthyroidism, among others. A 39-year-old woman with euthyroidism, positive anti-thyroid peroxidase (anti-TPO) antibodies, and a cervical ultrasound compatible with Hashimoto's thyroiditis presented with secondary infertility of four years' duration. Hysterosalpingography (HSG) was performed to rule out possible obstruction of the fallopian tubes. The patient reported a family history of thyroid disease, including Graves' disease in her mother and transient gestational thyroiditis in her sister. Four months later, the patient developed clinical manifestations suggestive of thyrotoxicosis. Thyroid function tests (TSH, FT3, and FT4) were performed at the hormone laboratory of Pierre et Marie Curie specialized Hospital using a Cobas e-411 analyzer based on electrochemiluminescence immunoassay (ECLIA) technology. In January 2025, the patient developed severe asthenia associated with palpitations. Thyroid function tests were performed and showed the following results: TSH = 0.009 µIU/mL (reference range: 0.27–4.20), FT4 = 51.48 pg/mL (reference range: 9.3–17), and FT3 = 12.46 pg/mL (reference range: 2–4.4). A confirmatory assessment yielded similar results: TSH = 0.005 µIU/mL, FT4 = 42.25 pg/mL and FT3 = 11.72 pg/mL. Electrocardiography was normal. Cervical ultrasound revealed an enlarged thyroid gland with the presence of nodules. Testing for TSH receptor antibodies was negative (< 1.75 IU/L).

Urinary iodine excretion was 299 μg/L (reference range: 200–257 μg/L), suggesting iodine excess. A follow-up thyroid evaluation performed on April 14, 2025 showed normalization of thyroid function tests. This report emphasizes that hysterosalpingography may rarely trigger iodine-induced hyperthyroidism, particularly in patients with underlying thyroid autoimmunity. Awareness of this potential complication and appropriate post-procedural thyroid monitoring may facilitate early diagnosis and management.

Keywords: Hyperthyroidism, Hysterosalpingography, TSH- FT3- FT4, Urinary iodine

PITFALLS OF HORMONAL IMMUNOASSAYS: INTERFERENCES, ANALYTICAL CHALLENGES, AND RISKS OF MISINTERPRETATION

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ABSTRACT

Immunoassays are widely used in biochemistry and endocrinology for the diagnosis and monitoring of numerous endocrine disorders, including thyroid, adrenal, and reproductive diseases. These methods are highly valued in clinical practice because they are relatively rapid, sensitive, and suitable for routine use. However, despite their widespread application, immunoassays exhibit important analytical limitations, primarily due to various interferences that can compromise the accuracy and reliability of the measurements, potentially affecting clinical decision-making. These interferences may be endogenous, such as heterophilic antibodies, autoantibodies, macrohormones, hormone excess … etc, or exogenous, including biotin supplementation, certain medications, or other substances that interact with assay components. Depending on the underlying mechanism, they may produce falsely elevated or decreased results, which can be particularly misleading in complex clinical scenarios or during longitudinal monitoring of therapy. These inaccuracies can lead to discrepancies between laboratory data and the patient's actual clinical condition. As a result, they may contribute to misinterpretation of the clinical scenario, prompting unnecessary or redundant diagnostic procedures, leading to inappropriate or suboptimal treatment decisions, and causing delays in establishing an accurate diagnosis. In some cases, these errors may further impact patient outcomes by increasing the risk of adverse events, prolonging hospitalization, or imposing additional psychological and financial burdens on the patient. Analytical interferences can be addressed using several strategies. Endogenous interferences can be minimized through sample dilution, heterophilic antibody-blocking reagents, PEG precipitation, or by comparing results across different assay platforms. Exogenous interferences, such as biotin or medications, can be managed by adjusting sample collection timing or temporarily discontinuing interfering substances. General verification approaches, including spike-and-recovery experiments,

internal quality control, and cross-reactivity studies, further ensure assay accuracy and reliability, reducing the risk of misinterpretation. The aim of this presentation is to highlight the main sources of interference in hormonal immunoassays, elucidate their underlying mechanisms, and emphasize the critical importance of clinical–laboratory correlation, effective communication between clinicians and laboratory specialists, and the implementation of practical strategies to ensure accurate and reliable interpretation of laboratory data in routine clinical practice.

Keywords: Immunoassays, Interferences, Misinterpretation, Mechanism, Practical strategies

CLINICAL AND ANALYTICAL INTERFERENCES IN THE INTERPRETATION OF TUMOR MARKERS: A CASE-BASED APPROACH

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ABSTRACT

Introduction: Tumor markers are valuable tools in oncology, used for therapeutic monitoring, detection of recurrence, and prognostic evaluation. However, their interpretation may be biased by numerous interferences of analytical origin (immunological interferences, heterophile antibodies, hook effect, etc.) or clinical origin (renal failure, inflammation, benign diseases, drug treatments, etc.). These factors may lead to falsely positive or negative results, resulting in inappropriate patient management or unnecessary additional investigations. **Materials and Methods:** A narrative review was conducted based on recent literature (PubMed, ESMO and IFCC guidelines), focusing on the most commonly prescribed tumor markers: PSA, CA 125, AFP, CA 19-9, CEA, NSE, and beta-hCG. Clinical cases from hospital practice were used to illustrate different situations of interference in tumor marker interpretation. For each case, clinical, biological, and radiological data were collected, and a critical analysis of the results was performed by comparing them with suspected or confirmed interferences. **Results:** Analytical performance varies depending on the assay type (immunological method, decision thresholds, antibodies used). Numerous interferences were identified, including heterophile antibodies, biotin, inflammatory conditions, renal or hepatic failure, sarcoidosis, and hemolysis. From a clinical perspective, non-specific increases were observed in benign conditions (endometriosis for CA 125, cirrhosis for AFP, sarcoidosis for CEA). Finally, the correlation between marker variation and tumor response is sometimes insufficient in the absence of consistent clinical and radiological data. **Discussion:** The analysis of these cases highlights the importance of a thorough understanding of pre-analytical and analytical limitations of tumor markers, as well as the overall clinical context. Misinterpretation or inappropriate test ordering may lead to unnecessary invasive investigations and patient anxiety. A multidisciplinary approach (clinicians and medical biologists) is essential for accurate interpretation. The use of confirmatory tests (dilutions, alternative methods, neutralization of heterophile antibodies) is often necessary. **Conclusion**: Tumor markers should be considered as complementary tools, whose reliability depends on both analytical quality and clinical context. Rational use, guided by recommendations, helps to limit pitfalls and optimize their utility in clinical practice.

Keywords: CA 125, CA 19-9, AFP, Analytical performance, Interpretation pitfalls

UTILITY OF ROUTINE BIOCHEMICAL MARKERS AS SURROGATES OF INSULIN RESISTANCE IN APPARENTLY HEALTHY ADULTS

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ABSTRACT

Introduction: Insulin resistance (IR) is a key pathophysiological mechanism underlying type 2 diabetes and metabolic syndrome and is increasingly recognized as an early metabolic disturbance in apparently healthy individuals. The Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) is commonly used to evaluate IR; however, it requires insulin measurement, which is not routinely available in many clinical laboratories, particularly in resource-limited settings. Consequently, there is growing interest in identifying simple, reliable, and cost-effective surrogate markers derived from routine biochemical parameters. Among these, the triglyceride–glucose (TyG) index and the triglyceride to HDL-cholesterol (TG/HDL-C) ratio have emerged as promising alternatives. This study aimed to assess the performance of these indices in detecting insulin resistance in a population of non-diabetic adults. **Methods:** A cross-sectional study was conducted on 71 apparently healthy adult participants recruited according to predefined inclusion criteria. Fasting blood samples were collected for the measurement of glucose, triglycerides, total cholesterol, HDL-cholesterol, and LDL-cholesterol using a Cobas 6000 automated analyzer. The HOMA-IR index was calculated and used as the reference standard, with a threshold >2 indicating insulin resistance. The TyG index and TG/HDL-C ratio were subsequently computed. Correlation analyses were performed to evaluate their association with HOMA-IR, and their diagnostic performance was assessed using receiver operating characteristic (ROC) curve analysis. **Results:** Among the participants, 63% were classified as insulin resistant based on HOMA-IR values. Both the TyG index and the TG/HDL-C ratio demonstrated moderate but statistically significant correlations with HOMA-IR ($r = 0.54$ and $r = 0.45$, respectively). These indices were significantly higher in insulin-resistant individuals compared to non–insulin-resistant subjects ($p < 0.001$). ROC curve

analysis showed that the TyG index had a superior diagnostic performance, with an area under the curve (AUC) of 0.80, compared to 0.751 for the TG/HDL-C ratio. These findings indicate that both markers are capable of discriminating between individuals with and without insulin resistance, with the TyG index showing better overall accuracy. **Conclusion**: The TyG index and the TG/HDL-C ratio, both derived from routine biochemical measurements, demonstrate acceptable performance as surrogate markers of insulin resistance. These indices offer practical, inexpensive, and accessible alternatives to HOMA-IR, particularly in settings where insulin assays are not readily available. Their use could facilitate early screening and identification of individuals at risk for metabolic disorders, thereby supporting timely preventive interventions.

Keywords: Insulin resistance, TyG index, Triglyceride/HDL ratio, HOMA-IR, Routine biochemical markers, Metabolic risk, Healthy adults

ASSESSMENT OF THE ALDOSTERONE-TO-RENIN RATIO IN PATIENTS WITH ARTERIAL HYPERTENSION: PRACTICAL RECOMMENDATIONS AND CLINICAL SIGNIFICANCE

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ABSTRACT

Arterial hypertension (HTN) is a major public health issue, a significant proportion of which is secondary to endocrine causes, particularly primary hyperaldosteronism. The calculation of the aldosterone/renin ratio (ARR) is now considered the first-line screening tool for this condition. This work aims to recall the pathophysiological bases of the renin–angiotensin–aldosterone system, to detail the pre-analytical conditions essential for a reliable interpretation of the ARR, as well as practical recommendations for its implementation. Particular attention is given to factors influencing this ratio, notably antihypertensive treatments, the hydrosaline state, patient posture, and the analytical methods used for the measurement of aldosterone and renin (immunoassay techniques and mass spectrometry). We also discuss decision thresholds, which vary according to techniques and units, as well as interpretation pitfalls that can lead to false positives or negatives. The clinical relevance of the ARR is illustrated by its role in the early detection of primary hyperaldosteronism, allowing specific and potentially curative management, particularly in unilateral forms. Moreover, it is useful in the differential diagnosis between primary and secondary hyperaldosteronism. Additionally, we highlight the confirmatory tests that are indicated as second or even third-line, their conditions of implementation, and their benefits. We illustrate this approach through the presentation of practical clinical cases in order to raise biologists' awareness of interpretation pitfalls and the importance of managing the pre-analytical phase and properly preparing the patient. **In conclusion,** the aldosterone/renin ratio is a simple yet demanding tool, whose diagnostic value relies on strict adherence to sampling and interpretation conditions. Its optimized use significantly contributes to improving the etiological diagnosis of hypertension and guiding the therapeutic strategy.

Keywords: HTA aldosterone renin

COMPARISON OF TWO METHODS FOR MEASURING PLASMA ACTH: ROCHE ELECTROCHEMILUMINESCENCE (COBAS e411) vs CHEMILUMINESCENCE (MAGLUMI X3)

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ABSTRACT

Introduction: The measurement of ACTH (adrenocorticotropic hormone) is a fundamental test in clinical chemistry, essential for the diagnosis and monitoring of disorders of the hypothalamic-pituitary-adrenal axis. A number of immunoassay techniques are widely used in routine practice. Inter-method variability necessitates comparative studies to ensure reliable interpretation of results. **Objective**: The aim of our study is to compare the results of plasma ACTH measurement obtained using two methods: chemiluminescence (Snibe Maglumi X3) and electrochemiluminescence (Roche Cobas e411), to assess the agreement between these two methods and to identify any clinically significant bias. **Materials and methods:** This is a prospective comparative study conducted at the Hormonology Laboratory of the Pierre and Marie Curie Hospital. The study included 98 blood samples collected in EDTA tubes; these were analysed using two methods: chemiluminescence (Snibe Maglumi X3) and electrochemiluminescence (Roche Cobas e411). The results were analysed using MedCalc statistical software. Passing and Bablok regression was used to assess the agreement between the two methods, and the Bland-Altman plot was used to determine the bias between them. **Results:** Spearman's correlation: $\rho = 0.975$ ($P < 0.0001$) A very strong correlation between the two methods ($\rho = 0.975$) indicates that the sample rankings are almost identical using both techniques. The regression line formula by Passing and Bablok: ACTH-SNIBE = 6.215052 + 0.912026 ACTH-ROCHE The slope b = 0.9120 (95% CI: 0.8579 – 0.9655) is close to 1, which indicates good agreement between the two methods with the presence of a proportional bias. The intercept a = 6.2151 (95% CI: 4.6590 to 7.7700); the CI does not contain the value 0, suggesting the presence of a constant systematic bias. The Bland-Altman plot indicates a bias of 3.54 pg/ml, indicating a slight overestimation of the SNIBE ACTH assay compared to the Roche assay across the entire sample set. **Conclusion**: There is good agreement between the two assay methods, with a slight systematic bias of 3.54 pg/ml in favour of an overestimation by the SNIBE CL method compared with the ROCHE ECL method.

The two methods are reasonably interchangeable without compromising diagnostic performance. However, this interchangeability is not permitted for low values given the observed bias.

Keywords: ACTH, chemiluminescence, electrochemiluminescence, comparaison

CYMBOPOGON SCHOENANTHUS (L.) SPRENG. ESSENTIAL OILS: PHYTOCHEMISTRY AND BIOLOGICAL ACTIVITIES

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ABSTRACT

The development of natural products has gained increasing importance as sustainable alternatives to synthetic chemicals in agriculture and food protection. This study evaluates the yield, chemical composition, and biological activities of essential oils (EOs) extracted from Cymbopogon schoenanthus (L.) Spreng. collected from a desert environment in Algeria. The oils were obtained using a Clevenger hydrodistillation (EOCL) method, which gave a high yield (5.38 ± 0.46%). gGas chromatography–mass spectrometry (GC-MS) analysis revealed that the oils were rich in oxygenated terpenoids, with trans-p-mentha-2-en-1-ol, cis-meta-mentha-2,8-diene, 7-epi-α-eudesmol, and elemol as the major constituents. These compounds are well known for their multiple biological activities, including antioxidant, antifungal, and insecticidal properties, which contribute to the oil's overall efficacy. The biological potential of the EOCL extract was assessed through antioxidant, antifungal, and insecticidal assays. Results showed strong antioxidant activity in TAC, DPPH, ABTS, and FRAP tests. The EOCL demonstrated low IC_{50} values of 4.09 ± 0.15 mg/mL in the DPPH assay and 2.05 ± 0.01 mg/mL in the ABTS assay, reflecting efficient radical scavenging ability. In addition, the EOS exhibited antifungal activity against Aspergillus spp., which are important contaminants of stored agricultural products. In fact, EOCL inhibited the growth of Aspergillus carbonarius and Aspergillus westerdijkiae with inhibition zones of 15.66 ± 0.30 mm and 15.83 ± 0.76 mm, respectively. Insecticidal testing against Callosobruchus maculatus, a major pest affecting cowpea and other légumes like chickpea, demonstrated pronounced fumigant toxicity, especially by inhalation exposure, with an LC_{50} of 6.02 ± 1.45 µL/mL and an LT_{50} of 37.14 ± 2.11 h. Overall, the findings suggest that C. schoenanthus essential oils possess promising bioactive properties and could serve as eco-friendly alternatives to synthetic pesticides for controlling stored-product pests and fungal contamination.

Keywords: Cymbopogon schoenanthus, essential oils, extraction, antioxidant, antifungal, insecticide

PHYTOCHEMICAL CHARACTERIZATION AND IN VITRO/IN VIVO ANTIOXIDANT EVALUATION OF TEUCRIUM CHAMAEDRYS L. EXTRACT FROM ALGERIA

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ABSTRACT

Teucrium chamaedrys L. is a medicinal plant broadly exploited in conventional Algerian therapy for liver protection, digestive support and diuretic purposes. This study aimed to examine the composition, assess the in vitro/in vivo antioxidant activity of T. chamaedrys L., collected from northern Algeria. Extraction was carried by maceration in the methanol and the yield was 19.11±1.07%. The phytochemical characterization of the crude extract (CrE) of T. chamaedrys L. included the quantification of major bioactive compounds, particularly total phenolics and flavonoids. The results revealed that the extract was rich in total polyphenols and flavonoids. The phytochemical profile of the plant extract was investigated using UHPLC–ESI–MS analysis, which revealed the presence of twenty-six compounds, including flavonoids, phenolic acids, iridoid glycosides, and phenylethanoid glycosides. The in vitro antioxidant activity was evaluated by several methodologies. The results demonstrated that the methanolic extract exhibited strong antioxidant potential, with a total antioxidant capacity (TAC) of 321.24 ± 2.89 µg AAE/mg extract. Moreover, the extract showed pronounced free radical scavenging activity against DPPH and ABTS radicals, with IC_{50} values of 21.38 ± 0.76 µg/mL and 224.20 ± 3.46µg/mL, respectively. The extract also displayed considerable reducing power ($A_{0.5}$ = 96.04 ± 2.50 µg/mL). The in vivo antioxidant activity was assessed by administration of the CrE at 250 and 500 mg/kg b.w. to female's Swiss albino mice. The results showed a strong effect in vivo, increased the percentage inhibition of catalase (CAT) and reduced glutathione (GSH) concentrations. Whereas, lipid peroxidation level in hepatotoxic mice significantly decreased. In conclusion, T. chamaedrys demonstrated strong in vitro and in vivo antioxidant activity, was non-toxic, supporting its traditional medicinal uses.

Keywords: T. chamaedrys L., photochemistry, UHPLC–ESI–MS, antioxidant

VALORIZATION OF OLIVE LEAF BY-PRODUCTS AS A SUSTAINABLE SOURCE OF PHENOLIC COMPOUNDS: A COMPARATIVE STUDY OF TWO ALGERIAN CULTIVARS

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ABSTRACT

The valorization of natural plant resources has become an important research area due to the increasing demand for natural bioactive compounds with potential applications in food, pharmaceutical, and nutraceutical industries. The present study aimed to evaluate the phenolic composition, antioxidant activity, and antibacterial potential of olive leaves (Olea europaea L. subsp. europaea var. sativa) collected in the Laghouat region of Algeria. Phenolic compounds were extracted from two olive cultivars, Chemlal and Sigoise, using a reflux extraction system followed by fractionation with ethyl acetate. Total phenolic content was determined using the Folin–Ciocalteu method, while antioxidant activity was assessed by the DPPH free radical scavenging assay. The results revealed relatively high concentrations of total phenolic compounds, reaching 44.65 ± 0.35 mg gallic acid equivalents (GAE)/100 g dry leaves for the Chemlal cultivar and 42.04 ± 1.13 mg GAE/100 g dry leaves for the Sigoise cultivar. Antioxidant activity evaluation showed interesting IC_{50} values for both Chemlal and Sigoise, indicating a stronger antioxidant capacity for the Sigoise extract. The richness of olive leaf extracts in phenolic compounds and their antioxidant properties highlight their potential as a valuable source of natural antioxidants. These findings support the possible use of olive leaves as functional food ingredients and encourage further investigations into their phytochemical characterization and biological activities.

Keywords: Olea europaea L., Olive leaves, Phenolic compounds, Chemlal; Sigoise, Bioactive compounds

INHIBITORY ACTIVITY OF PINUS PINEA EXTRACT AGAINST ALZHEIMER'S DISEASE TARGETS: IN VITRO AND MOLECULAR DOCKING STUDY

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ABSTRACT

Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the leading cause of dementia in the elderly worldwide. The present study aimed to evaluate the phytochemical profile and anti-Alzheimer potential of a crude hydromethanolic bark extract of *Pinus pinea* from Algeria, through complementary *in vitro* and *in silico* approaches. Preliminary phytochemical screening was performed to characterize the major secondary metabolite classes present in the extract. The inhibitory activity of the extract against butyrylcholinesterase (BChE) was assessed *in vitro* using Ellman's method. In parallel, molecular docking was employed to investigate the inhibitory potential of bioactive compounds previously identified by LC-MS/MS against the BChE enzyme. Ligand 3D structures were retrieved from the PubChem database, and the crystallographic structure of BChE (PDB ID: 7AIY) was obtained from the Protein Data Bank. Docking simulations were conducted using FlexX software. Quantitative analysis revealed notably high concentrations of polyphenols (361.78 ± 1.71 µg GAE/mg) and flavonoids (267.65 ± 3.28 µg QE/mg), reflecting a rich bioactive composition. The extract demonstrated potent BChE inhibitory activity, with an IC_{50} of 26.75 ± 0.05 µg/mL, significantly outperforming the reference drug galantamine (IC_{50} = 34.75 ± 1.99 µg/mL). Molecular docking results further corroborated these findings, with quercetin (−28.54 KJ/mol) and luteolin (−25.59 KJ/mol) emerged as the most promising candidates, exhibiting superior binding affinities toward BChE compared to galantamine (−18.80 KJ/mol). These results establish *Pinus pinea* bark as a valuable natural source of bioactive compounds with significant anti-Alzheimer potential, providing a strong scientific basis for its further investigation in the prevention and management of Alzheimer's disease.

Keywords: Pinus pinea, flavonoids, polyphenols, anti-Alzheimer, molecular docking

BIOLOGICAL POTENTIAL OF OROBANCHE AEGYPTIACA PERS. FROM SOUTHERN ALGERIA

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ABSTRACT

The broomrape plant (Orobanche) is a major agricultural pest that parasitizes a wide range of crops, particularly legumes, and causes severe economic losses. Despite its destructive impact, the genus is also recognized as a source of diverse secondary metabolites with potential biological and therapeutic activities. Orobanche aegyptiaca Pers. is a herbaceous parasitic plant characterized by purple flowers and small leaves. In this study, we investigated the phytochemical composition of Orobanche aegyptiaca Pers. collected from southern Algeria to better understand its chemical profile and biological relevance. The n-hexane extract, obtained by Soxhlet extraction, was analyzed by gas chromatography–mass spectrometry (GC–MS) and evaluated for its antioxidant potential using the Total Antioxidant Capacity (TAC) assay. The hexane extract showed weak antioxidant activity, with a TAC value of 69.37 ± 1.67 µg AAE/mg, reflecting its low content of polar compounds. GC/MS analysis revealed the presence of several classes of metabolites, especially triterpenes, steroids, organic compounds, and other bioactive constituents. These compounds are often associated with a variety of biological effects, which may partly explain the traditional use of this plant in the treatment of different ailments. Overall, the results indicate that although Orobanche aegyptiaca Pers. is known as an agricultural parasite, it may also serve as a promising source of natural bioactive compounds. Its phytochemical richness suggests the need for further studies to isolate the active constituents and evaluate their pharmacological properties in greater detail.

Keywords: Orobanchaceae, Orobanche aegyptiaca, composition, antioxidant activity

PHYTOCHEMICAL PROFILING BY HPLC-DAD OF POLYPHENOLS, ANTIOXIDANT AND ANTI-INFLAMMATORY POWER OF VERBASCUM SINUATUM METHANOLIC EXTRACT FROM ALGERIA

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ABSTRACT

Wavyleaf mullein (Verbascum sinuatum) is one of the most widely distributed species of the genus Verbascum in the Mediterranean basin. Previous studies have confirmed that extracts of this species have a higher polyphenol content than other species in the same genus (P. Donn et al.2023), and possess outstanding antioxidant activity (H. Akşit et al.2025). Many studies have also pointed out that plant's polyphenols levels vary from the different growth regions and across harvest seasons. Based on these findings, this study targeted this species collected in 2025 from the Constantine region in Algeria. Methanolic extract from Verbascum sinuatum species was analysed by using HPLC- DAD method (including C18), when we performed the first quantitative analysis of several flavonoids and polyphenols. Total content of flavonoids and polyphenols were calculated by using noun protocols (Topçu et al.2007 and Muller et al.2010). The tannin rate was also measured (Hagerman, A.E. (2002). Antioxidant activity was carried out in vitro by three assays (DPPH, ABTS, FRAP). In other hand the anti-inflammatory activity was carried in vitro method (K. Kandikattu et al. (2013). The HPLC results showed the presence of some phenolic compounds that were a bit different from what later studies found; they included catechin, epicatechin and tyrosol. A high percentage of verbascoside and cynaroside was observed (verbascoside 85.878mg/g, 113.17mg/g respectively). Antioxidant tests exhibited a strong DPPH and ABTS radical scavenging and significant reducing power. The rate of flavonoids with tannin is around half the one that polyphenols have. In addition methanolic extract possess moderate anti-inflammatory response. **In conclusion,** these results confirm that the geographical origin significantly influences in determining the quantitative and qualitative profile of secondary metabolites.

Keywords: Verbascum sinuatum, polyphenols, antioxidant activity, HPLC, verbascoside.

PHYTOCHEMICAL SCREENING OF THE AQUEOUS EXTRACT OF CENTAURIUM ERYTHRAEA

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ABSTRACT

Centaurium erythraea Rafn (Gentianaceae) is a medicinal species widely used in traditional medicine because of its reported therapeutic properties, which are generally attributed to the presence of secondary metabolites. Characterization of its phytochemical composition constitutes an essential preliminary step for understanding its potential biological activities. The present study aimed to investigate the qualitative phytochemical profile of the aqueous extract obtained from the aerial parts of C. erythraea collected in the Skikda region (northeastern Algeria). The aerial parts were harvested during the flowering stage, air-dried under ambient conditions, finely powdered, and extracted by infusion of 20 g of plant material in 200 mL of boiling distilled water for 15 min, followed by filtration. Qualitative phytochemical screening was performed using established colorimetric and precipitation assays to detect the principal classes of secondary metabolites, including tannins, flavonoids, terpenes, alkaloids, phenolic compounds, coumarins, resins, quinones, mucilage, phlobatannins, and saponins. The qualitative analysis demonstrated the presence of tannins (catechin type), flavonoids, terpenes, alkaloids, phenolic compounds, coumarins, resins, mucilage, and saponins, whereas quinones and phlobatannins were not detected. These findings indicate that the aqueous extract contains several classes of secondary metabolites commonly reported in medicinal plants. However, the present investigation was limited to qualitative screening and did not provide information on the concentrations or biological activities of these constituents. Overall, this preliminary phytochemical characterization contributes to the available knowledge on C. erythraea growing in northeastern Algeria and provides baseline data for subsequent quantitative phytochemical analyses and bioactivity-guided investigations.

Keywords: Centaurium erythraea, phytochemical screening, aqueous extract, secondary metabolites

ANTIOXIDANT POTENTIAL OF THE METHANOLIC EXTRACT OF URTICA DIOICA LEAVES

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ABSTRACT

This study aims to contribute to the valorization of Algerian flora by focusing on Urtica dioica (U.D.), an abundant plant belonging to the Rosales order and widely known for its medicinal properties. Commonly known as stinging nettle, this perennial herb belongs to the Urticaceae family, a botanical group characterized by its stinging hairs (trichomes) containing acetylcholine, histamine, and formic acid, which act as a defense mechanism. Historically used in traditional pharmacopeia, U. dioica is recognized for its exceptional nutritional and pharmacological density. Scientifically, its therapeutic efficacy is deeply rooted in its complex chemical composition. The leaves of U. dioica are rich in bioactive secondary metabolites, including phenolic compounds such as chlorogenic acid, caffeic acid, and flavonoids like quercetin, rutin, and kaempferol. Additionally, the plant contains essential oils, carotenoids, vitamins (notably A, C, and K), and mineral elements (calcium, iron, and potassium) that synergistically contribute to its overall health benefits. Consequently, U. dioica exhibits a wide spectrum of biological activities, such as anti-inflammatory, antimicrobial, analgesic, anti-diabetic, and cardioprotective effects, alongside its well-documented role in managing benign prostatic hyperplasia (BPH) and rheumatoid arthritis. Specifically, the biological activity of the methanolic extract of its leaves (MLE) was evaluated in this work. This extract was prepared using Soxhlet extraction with methanol (CH3OH), a method selected to maximize the yield of polar and semi-polar polyphenolic compounds from the plant matrix. The antioxidant potential of the MLE was examined through two complementary in vitro methods: Total Antioxidant Capacity (TAC), which measures the overall scavenging ability of the extract, and the Ferric Reducing Antioxidant Power (FRAP) assay, which evaluates its electron-donating capacity to reduce ferric ions. The results revealed that the leaf methanolic extract exhibits potent antioxidant activity, comparable to that of ascorbic acid (vitamin C) used as a positive control. This robust antioxidant performance is strongly correlated with the high concentration of total phenols and flavonoids preserved during the methanolic Soxhlet extraction. By neutralizing harmful free radicals and reducing oxidative stress, the secondary metabolites present in the MLE demonstrate their capacity to prevent cellular damage. These findings highlight the strong therapeutic and biotechnological potential of this natural resource, suggesting that Algerian Urtica dioica could serve as a valuable source of natural antioxidants for the pharmaceutical, food, and cosmetic industries.

Keywords: Urtica dioica, methanolic leaves extract, antioxidant activity, TAC, FRAP.

COMPARATIVE CHEMICAL FINGERPRINTING OF AQUEOUS AND HYDROETHANOLIC EXTRACTS OF LAVANDULA STOECHAS USING FTIR-ATR

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ABSTRACT

Lavandula stoechas is a well-known medicinal plant recognized for its richness in bioactive phytochemicals with potential therapeutic properties. Fourier Transform Infrared Spectroscopy coupled with Attenuated Total Reflectance (FTIR-ATR) is a rapid and reliable technique for the characterization of functional groups and the chemical fingerprinting of plant extracts. Since the extraction solvent plays a key role in the recovery of phytochemical constituents, differences in solvent polarity may influence the phytochemical profile of the resulting extracts, including phenolic compounds and other bioactive metabolites. Therefore, the present study aimed to compare the chemical fingerprints of aqueous and hydroethanolic extracts prepared from the aerial parts (leaves and flowers) of *Lavandula stoechas* collected in the Annaba region using FTIR-ATR analysis. The FTIR-ATR spectra of both extracts showed characteristic absorption bands corresponding to hydroxyl O–H, aliphatic C–H, aromatic C=C, and C–O functional groups, suggesting the presence of phenolic compounds and other oxygenated phytochemicals. Slight differences in the positions and intensities of several absorption bands were observed, indicating that the extraction solvent influences the relative abundance of phytochemical constituents while maintaining a similar overall chemical profile. These findings demonstrate that FTIR-ATR provides a rapid, non-destructive, and reliable approach for the comparative characterization of plant extracts. The technique offers valuable preliminary information on the influence of extraction solvents on phytochemical composition and may contribute to the selection of appropriate extraction conditions for future phytochemical and biological investigations.

Keywords: Lavandula stoechas, medicinal plants, FTIR-ATR, chemical fingerprinting, aqueous extract, hydroethanolic extract.

PRODUCTION OF HYDROGEL LOADED WITH CRITHMUM MARITIMUM L. EXTRACT AND INVESTIGATION OF ITS IN VITRO WOUND-HEALING EFFECT

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ABSTRACT

A wound is a disruption of tissue integrity and function. Wound healing is a complex cellular and biochemical process necessary to repair structurally damaged tissue. Crithmum maritimum L., commonly known as sea fennel, is a salt-tolerant, edible aromatic and medicinal plant found on rocky shores and, to a lesser extent, on sandy-gravelly soils along the coasts of the Mediterranean, Black Sea, and European Atlas Mountains. It is traditionally known to be used primarily for wound healing, as well as for relieving urinary tract pain. As a preliminary step in this project, we procured C. maritimum L., which is sold in local markets on the Datça Peninsula in our country. The fact that no research has been conducted to date on sea fennel which is traditionally used by the local population for wound healing prompted us to undertake this study. In this study, the phenolic compounds in the ethanolic extract of C. maritimum were analyzed using an HPLC-DAD system; polyvinyl alcohol/starch-based hydrogels loaded with the extract were prepared and characterized; the antioxidant activity of the ethanolic extract was investigated; and, in addition, to investigate the in vitro wound-healing effects of the extract and the extract-loaded hydrogels. The major components identified in the C. maritimum ethanol extract were chlorogenic acid (23.67 mg/g), rutin (4.52 mg/g), quercetin (2.43 mg/g), and kaempferol (1.95 mg/g). It was determined that the C. maritimum ethanol extract exhibited DPPH free radical scavenging activity with an IC50 value of 60.09 ± 0.21 µg/mL and ABTS•+ scavenging activity with an IC50 value of 45.05 ± 0.39 µg/mL. It was determined that the C. maritimum ethanol extract promoted cell proliferation in the 3T3 healthy mouse fibroblast cell line at rates of 55.31% and 66.37% after 24 and 48 hours, respectively, while the ethanol extract-loaded hydrogel promoted proliferation at rates of 70.30% and 85.00% compared to the control. As a result of the swelling test applied to the hydrogel formulation developed by incorporating the rockrose plant extract, the gel's liquid absorption capacity was determined to be 140%. This indicates that the polyphenolic compounds in the extract's structure interact strongly with the wound site.

Keywords: Crithmum maritimum L., wound healing, hydrogel, antioxidant, phenolic compounds

IN VITRO WOUND HEALING EFFECT OF ETHANOL EXTRACT OF DATÇA PENINSULA BEE POLLEN

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ABSTRACT

Honeybees (Apis mellifera), known as "golden insects," have served as a source of healing throughout history thanks to their rich bioactive compounds and have formed the foundation of apitherapy. Bee pollen is a food produced by bees as they collect pollen from flowers; it consists of a mixture of saliva, nectar, and honey. Bee pollen extracts have attracted attention as potential wound healing agents due to their antioxidant, anti-inflammatory, and bioactive compound contents. The aim of this study, conducted on the Datça Peninsula with the support of Alper Kuyucu, a Senior Agricultural Engineer who operates as a stationary beekeeper, was to investigate the wound-healing effects of bee pollen produced in the same area and from the same colony on the 3T3 healthy fibroblast cell line. As a result ethanol extract of bee pollen significantly enhances wound closure in 3T3 fibroblast cells at 24 (65.80%) and 48 hours (95.00%) compared to controls, highlighting its potential for tissue repair, cosmetics, and drug development. Furthermore, these findings suggest that bee pollen could serve as a promising natural agent for therapeutic and dermatological applications. These findings indicate that bee pollen ethanol extract promotes rapid cellular migration and tissue regeneration, supporting its prospective use in advanced wound-healing formulations.

Keywords: Honeybees (Apis mellifera), bee pollen, Datça Peninsula, wound healing effect, 3T3 cell line

ANALYSIS RESULTS OF PHENOLIC COMPONENTS and CHEMOMETRIC ANALYSIS IN GRAPES PRODUCED WITH DIFFERENT AGROECOLOGICAL PRACTICES

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ABSTRACT

The climate-induced rising temperatures and severe water stress create physiological pressure on grapevines, negatively suppressing the accumulation of phenolic compounds that are critical for health. This study investigated the effects of integrated agroecological strategies on the phenolic components and chemometric profiles of grapes to mitigate the adverse impacts of climate change on Mediterranean viticulture. In this study, the phenolic compound profile of grapes grown under different production conditions (alfalfa, biohydrogel, plant growth-promoting rhizobacteria) was determined using an HPLC-DAD system. In this context, the findings regarding grapes obtained from the experimental plots of the Ministry of Agriculture and Forestry's Manisa Viticulture Research Institute were investigated based on the control group of the study. It was determined that flavonoids such as kaempferol and apigenin were dominant across all treatments. This indicates that phenylpropanoid metabolism is active and that the plant's defense and adaptation mechanisms are robust. According to the findings obtained, it was determined that different production conditions (alfalfa, biohydrogel, and plant growth-promoting rhizobacteria) had a significant effect on the phenolic component profile and chemometric properties of grapes, substantially increasing secondary metabolite accumulation compared to the control group. Moreover, this is primarily because phenolic compounds are predominantly distributed within the skin and seeds of the grape.

Keywords: Phenolic profile, Grape, Alfalfa, biohydrogel, growth-promoting rhizobacteria (PGP), HPLC (DAD), Chemometrıc analysis

ANALYSIS RESULTS OF PHENOLIC COMPONENTS and CHEMOMETRIC ANALYSIS IN GRAPEVINE LEAVES PRODUCED WITH DIFFERENT AGROECOLOGICAL PRACTICES

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ABSTRACT

The impacts of climate change on agricultural production systems are becoming increasingly pronounced, particularly in the Mediterranean basin. Environmental pressures such as rising temperatures, irregular precipitation regimes, and water scarcity directly affect many agricultural activities—viticulture in particular—thereby making the development of sustainable production models mandatory. In this study, grapevine leaves grown under different production conditions (alfalfa, biohydrogel, and PGP bacteria) at the Manisa Viticulture Research Institute were extracted with methanol, and their phenolic profiles were analyzed using an HPLC-DAD system to evaluate the effects of various agroecological practices under water-limited conditions. Based on the analysis results, this study clearly demonstrates that the applied agroecological strategies exerted significant effects not only at the physiological level but also directly at measurable chemical and metabolic levels. It was determined that phenolic compounds such as protocatechuic acid and p-hydroxyphenylacetic acid in grapevine leaves reached significant increase levels of 36.17 mg/g and 36.31 mg/g extract in alfalfa and biohydrogel/PGP treatments, respectively, compared to the control groups, indicating that phenylpropanoid metabolism was actively reorganized under stress conditions. In parallel, the increases observed in 6,7-dihydroxycoumarin and cyanidin derivatives in biohydrogel and PGP treatments point to the specific induction of defense metabolites in grapevines. Overall, these findings highlight that integrated agroecological management strategies offer a promising, sustainable approach to mitigating climate-induced water stress and enhancing the functional quality of grapevines.The impacts of climate change on agricultural production systems are becoming increasingly pronounced, particularly in the Mediterranean basin. Environmental pressures such as rising temperatures, irregular precipitation regimes, and water scarcity directly affect many agricultural activities—viticulture in particular—thereby making the development of sustainable production models mandatory. In this study, grapevine leaves grown under different production conditions (alfalfa, biohydrogel, and PGP bacteria) at the Manisa Viticulture Research Institute were extracted with methanol, and their phenolic profiles were analyzed using an HPLC-DAD system to evaluate the effects of various agroecological practices under water-limited conditions. Based on the analysis results, this study clearly demonstrates that the applied agroecological strategies exerted significant effects not only at the physiological level but also directly at measurable chemical and metabolic levels. It was determined that phenolic compounds such as protocatechuic acid and p-hydroxyphenylacetic acid in grapevine leaves reached significant increase levels of 36.17 mg/g and 36.31 mg/g extract in alfalfa and biohydrogel/PGP treatments, respectively, compared to the control groups,

indicating that phenylpropanoid metabolism was actively reorganized under stress conditions. In parallel, the increases observed in 6,7-dihydroxycoumarin and cyanidin derivatives in biohydrogel and PGP treatments point to the specific induction of defense metabolites in grapevines. Overall, these findings highlight that integrated agroecological management strategies offer a promising, sustainable approach to mitigating climate-induced water stress and enhancing the functional quality of grapevines.

Keywords: Phenolic profile, Grapevıne leaves Alfalfa, biohydrogel, growth-promoting rhizobacteria (PGP), HPLC (DAD), Chemometrıc analysis

DISTRIBUTION OF SUGAR COMPONENTS AND CHEMOMETRIC ANALYSIS IN GRAPES PRODUCED WITH DIFFERENT AGROECOLOGICAL PRACTICES

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ABSTRACT

Protecting and optimizing fruit quality parameters—specifically the sugar profile—under water deficit conditions induced by climate change in viticulture is of critical importance for both yield and processing quality. This study aimed to determine the distribution of sugar components in grapes produced using different agroecological practices and to examine the obtained data through chemometric analyses. In this study, the sugar profiles of grapes produced using various cultivation techniques aimed at growing grapevines with reduced water usage were determined using an HPLC system. Based on the results, the analysis of sugar components in grape juice revealed that fructose ranged from 7.15 to 8.17 g/100 g and glucose from 6.15 to 8.52 g/100 g, showing an increasing tendency compared to the control group across the treatment groups, with total sugar accumulation particularly enhanced in the alfalfa and biohydrogel treatments. The glucose/fructose ratio in the grapes produced across the treatment plots was determined to remain within the range of 0.81 to 1.08, indicating that carbon metabolism was maintained in a balanced manner and that the practices did not disrupt fruit ripening physiology. This comprehensive dataset clearly demonstrates that the applied system not only enhances drought tolerance but also provides a robust metabolic optimization supporting quality in terms of phenolic compounds, aromatic metabolites, and sugar composition. In additionally, Chemometric analyses (PCA and HCA) reveal that PGP application forms a distinct cluster and promotes a more homogeneous sugar composition, whereas alfalfa and biohydrogel treatments induce greater metabolic variation. According to the findings obtained, it was determined that different production conditions (alfalfa, biohydrogel, and plant growth-promoting rhizobacteria) had a significant effect on the sugar profile and chemometric properties of grapes, substantially increasing secondary metabolite accumulation compared to the control group.

Keywords: Sugar profile, Grape, Alfalfa, biohydrogel, growth-promoting rhizobacteria (PGP), HPLC, Chemometrıc analysis

SECONDARY METABOLITE PROFILE AND CHEMOMETRIC ANALYSIS OF GRAPE LEAVES GROWN DIFFERENT AGROECOLOGICAL PRACTICES

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ABSTRACT

The effects of climate change on agricultural production systems are becoming more evident with each passing day, particularly in the Mediterranean basin. Within the scope of this study, it was aimed to reduce water consumption in grapevine cultivation and to elucidate the metabolic responses of plants to drought stress, thereby contributing to the sustainable management of water resources under climate change conditions. Accordingly, alfalfa (cover crop), biohydrogel, and plant growth-promoting rhizobacteria (PGP) applications were implemented under conditions where water demand was reduced by 50%; the results obtained were compared with those from fully irrigated control plots. To determine the volatile secondary metabolite profiles of grapevine leaves grown under different production conditions (alfalfa, biohydrogel, growth-promoting rhizobacteria), essential oils were extracted via steam distillation from fresh leaves harvested before the fruit ripening stage. The component analysis of these oils was conducted using Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GC-MS) systems. Although aldehyde compounds were present in low quantities in the plots where alfalfa was applied, the relative abundances of terpenoids and compounds with aromatic ester and benzenoid structures were determined to have increased. In the analysis of secondary metabolites, it was found that terpenoids were present at high levels ranging from 29.46% to 43.55% in all treatments, and that aromatic ester/benzenoid compounds reached levels as high as 16.25% particularly in the alfalfa treatment. In contrast, the fact that aldehydes—known as stress biomarkers—were present only in the control and alfalfa-free systems at levels ranging from 0.42% to 0.99%, and were completely absent in the biohydrogel and PGP treatments, was interpreted as evidence that lipid peroxidation was suppressed and oxidative stress was effectively controlled. Moreover, it has been shown through experimental studies that hydrogel applications reduce water stress in plants and improve physiological performance.

Keywords: Secondary metabolite, Alfalfa, biohydrogel, growth-promoting rhizobacteria (PGP), Gas Chromatography (GC), Gas Chromatography-Mass Spectrometry (GC-MS), Chemometrıc analysis

IN VITRO EVALUATION OF THE ANTIOXIDANT AND ANTI-INFLAMMATORY ACTIVITIES OF NORTH ALGERIAN BEE VENOM

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ABSTRACT

Bee venom is a natural product recognized for its diverse pharmacological properties, including antioxidant and anti-inflammatory activities. The present study aimed to evaluate the biological potential of bee venom collected from two regions of northern Algeria (Médéa and Béjaïa). Venom samples were obtained using a non-lethal electrical stimulation method and assessed for antioxidant activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, while anti-inflammatory activity was evaluated by the inhibition of bovine serum albumin (BSA) thermal denaturation. Antioxidant activity was investigated using three extraction media: phosphate-buffered saline (PBS), distilled water, and 0.9% saline. The lowest IC_{50} values were obtained with PBS for both Médéa (103.90 µg/mL) and Béjaïa (110.34 µg/mL), indicating superior antioxidant activity compared with distilled water (125.31–136.01 µg/mL) and 0.9% saline (145.85–157.72 µg/mL). In the anti-inflammatory assay, the Médéa sample exhibited greater activity (IC_{50} = 221.31 µg/mL) than the Béjaïa sample (IC_{50} = 256.54 µg/mL), although both remained less active than the reference drug diclofenac (IC_{50} = 144.50 µg/mL). These findings demonstrate that Algerian bee venom possesses promising antioxidant and anti-inflammatory properties and highlight the influence of extraction medium and geographical origin on its biological activity. The results support the potential of North Algerian bee venom as a valuable natural source of bioactive compounds for future pharmaceutical and biomedical applications.

Keywords: Bee venom, Apis mellifera intermissa, Antioxidant activity, Anti-inflammatory activity, DPPH assay, BSA denaturation assay, Algeria

COMORBIDITY PATTERNS AND THEIR EFFECT ON COVID-19 PROGNOSIS: A STUDY OF 753 PATIENTS IN EASTERN ALGERIA

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ABSTRACT

It has been reported that the coexistence of comorbidities with COVID-19 is a risk factor for the severity of COVID-19 and a worse prognosis. The objective of the current study was to examine and highlight risk factors for severe disease as well as the influence of comorbidities on mortality risk in COVID-19 patients in the eastern region of Algeria. A cross-sectional study was conducted on a cohort of 753 COVID-19 patients who were admitted to four hospitals in eastern Algeria in 2020 and 2021. In the population that was enumerated, the average age of patients was 63.56 ± 15.49 years, with a range of 1.29 for the male to female sex ratio. The PCR was positive in 88,1 % of patients, the oxygen desaturation was 81.27 ± 12.35%, and the pulmonary affliction was extended or critical in 50,7 % and 14,8 %, respectively. The most prevalent comorbidities were diabetes (40.4%), and hypertension (26.7%). This group of patients had a wide variety of biological abnormalities. 58.5% patients had at least a single comorbidity, while 23.6% patients had two or more comorbidities. The average SpO2 value decreased significantly in proportion to the rise of COVID-19-related comorbidities. Of the patients with a SpO2 < 90, 24.0% had two or more comorbidities. The mortality rate was 28%. It was 9.2% for patients with a single comorbidity and 8% for those with multiple comorbidities. Our research suggested that patients with comorbidities had more severe COVID-19 than those without. Moreover, a higher number of comorbidities was associated to a greater COVID-19 severity and higher biological parameter abnormalities. Due to the high number of infections, biological changes, and deaths among patients with comorbidities infected with COVID19, it is necessary to consider good care of these patients in order to reduce morbidity and mortality rates.

Keywords: COVID-19, Comorbidity, Severity, Mortality, Prognostic Factor.

MORPHOLOGICAL TRAITS AND LENGTH–WEIGHT RELATIONSHIPS OF BOOPS BOOPS (LINNAEUS, 1758) IN THE SOUTH-WESTERN MEDITERRANEAN: INSIGHTS FROM EL KALA, ALGERIA

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ABSTRACT

The bogue Boops boops (Linnaeus, 1758), a gregarious species of the Sparidae family, plays a significant role in Algerian fisheries. It is widely distributed in the Mediterranean and is a demersal to semi-pelagic species frequently caught alongside other small pelagic fish. Among the small pelagic species, it ranks fourth in terms of landings, after sardine, round sardinella, and horse mackerel, contributing notably to both national food security and the local economy. This study was conducted to provide detailed biometric information on Boops boops from the eastern Algerian coast, particularly the El Kala region. The main objectives were to characterize the species' morphology, detect potential morphological variations in comparison with other populations, and analyze the length–weight relationship. A total of 800 individuals obtained from commercial landings were examined in 2024. Various body measurements were expressed relative to total length (Lt) or head length (Lc) using the reduced major axis method. Morphometric analysis revealed that out of 15 parameters studied, seven exhibited isometric growth (Ls/Lt, Do/Lc, LPo/Lc, Lmax/Lc, Lpd/Lt, Lpp/Lt, and Lpa/Lt), six showed positive allometric growth (Lc/Lt, Lpo/Lc, LPp/Lt, Hc/Lt, Hpc/Lt, and Ec/Lt), and one parameter (Lf/Lt) displayed negative allometric growth. Correlations among the measured variables were statistically significant, with coefficients ranging from 0.40 to 0.93 ($p < 0.05$), indicating strong consistency in morphological relationships. The length–weight relationship was described by the equation $Wt = 0.015\ Lt^{2.84}$, demonstrating negative allometry ($b = 2.84$), meaning that individuals grow faster in length than in weight. This pattern likely reflects an adaptive response to local environmental conditions. Overall, the results provide robust quantitative data that improve the understanding of Boops boops biology and offer an essential scientific foundation for the sustainable management of this important fishery resource in Algeria.

Keywords: Boops boops, morphometrics, length–weight relationship, allometric growth, eastern Algeria.

DOSE-DEPENDENT EFFECT OF ACTH INJECTION ON PLASMA TESTOSTERONE CONCENTRATIONS IN BUCKS RAISED IN ARID ENVIRONMENT

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ABSTRACT

The objective of this work is to highlight the variations in plasma concentrations of testicular hormone (testosterone) in response to chemical stress, by the intravenous injection of three increasing doses of ACTH (0.2, 0.5 and 2 µg/kg Body Weight). They were administered 48 hours apart, in adult bucks, raised at the experimental station of Beni-Abbes, during sexual rest period. Blood samples were taken 15 and 0 minutes before ACTH injection, then 8, 45, and 120 minutes following the injection. Testosterone levels were measured using a competitive ELISA, on TOSOH AIA-360. Statistical analysis of the results was performed using ANOVA with the R software. The results showed a gradual decrease in plasma testosterone concentration, proportional to the ACTH dose: 0.2 µg/kg B.W. (-58,2%), 0.5 µg/kg B.W. (-71,9%) and 2 µg/kg B.W. (-76,0 %, at 45 vs -15 minutes, $p \leq 0.05$). This marked inhibition reflects an interaction between the two endocrine axes. It could be explained by an overproduction of glucocorticoids (stress hormones) in response to ACTH, which, in excess, slow down reproductive functions, either by blocking hormonal signals from the brain or by reducing the sensitivity of testicular cells. This study clearly illustrates the importance and impact of ACTH and other hormone discharge levels during stress. They can temporarily support certain functions at low doses, but become strongly inhibitory when stress becomes too intense. In conclusion, ACTH negatively affects reproductive function in bucks raised in arid regions. These observations confirm that, in a constrained environment, the organism can modulate its reproductive functions in response to stress, according to an adaptive mechanism. The study also highlights the importance of considering environmental factors and individual variability in interpreting hormonal responses.

Keywords: Bucks, Stress, ACTH, Cortisol, Testosterone

LACTIC ACID BACTERIA IN FOOD PRESERVATION A BIOLOGICAL APPROACH

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ABSTRACT

Lactic acid bacteria (LAB) are widely used in the food industry for their technological and probiotic properties. They contribute to fermentation, the production of organic acids and flavors, and the improvement of the texture of dairy products and other foods. Some strains also produce bacteriocins, which are natural peptides that can inhibit pathogenic bacteria. The objective of this study is to determine whether the lactic acid bacterium S98, belonging to the subspecies Lactococcus lactis subsp. lactis biovardiacetylactis, could be used in the food industry as a food preservative while producing a bacteriocin. The work began with a study of the antimicrobial activity of strain S98 against pathogenic bacteria such as Staphylococcus aureus, Bacillus cereus, Enterococcus faecalis, Listeria monocytogenes, and E. coli, using the double-layer method known as the Fleming et al. (1985) technique. Next, the search for the inhibitory factor, which could be lactic acid. In this case, the medium was neutralized to eliminate the effect of the acid. To determine whether strain S98 produces one or more bacteriocins, the same technique was applied by adding to the medium a protein-derived enzyme called pepsin. The results showed that lactic acid strain S98 exhibits antimicrobial activity against the pathogenic bacteria tested and that this inhibition is due to lactic acid and two bacteriocins, one of which is glycoproteinic in nature and the other lipoproteinic. Thus, strain S98 can be used as a preservative in food products, thereby enabling biopreservation—the use of biological methods for preservation—a promising approach that helps improve food safety while replacing preservation with chemical products that are hazardous to health and become toxic over time.

Keywords: lactic acid bacteria, food preservation, bacteriocin.

THE EFFECT OF BROCCOLI SEED POWDER ORAL ADMINISTRATION ON TISTICULAR STRUCTURE IN RATS EXPOSEDTO ACETAMIPRID: AN EXPERIMENTAL STUDY

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ABSTRACT

Acetamiprid, an insecticide belonging to the neonicotinoid family, is widely used in agriculture to control numerous pests. However, several studies have reported its potential reproductive toxicity in mammals, particularly through histological alterations of the testes. In parallel, broccoli seeds (Brassica oleracea) are known to be rich in bioactive compounds such as polyphenols, flavonoids, and glucosinolates, which confer important antioxidant properties. In this context, the present study aimed to evaluate the potential effect of broccoli seed powder incorporated into the diet on testicular histological structure in male rats exposed to acetamiprid. The experiment was conducted on 18 adult Wistar male rats weighing between 100 and 150 g, randomly divided into three groups: a control group, a group treated with acetamiprid alone, and a group receiving both acetamiprid and broccoli seed powder. Acetamiprid was administered orally at a dose corresponding to 1/20 of the LD50 for one month. At the end of the treatment period, testicules were collected, fixed in 10% formalin, dehydrated in graded ethanol baths, embedded in paraffin, and stained with hematoxylin and eosin (H&E) after deparaffinization. Histological sections were then examined under a light microscope at different magnifications. The evaluated parameters mainly included the morphological appearance of seminiferous tubules, the apparent density of germ cells, and the integrity of Leydig cells. Results showed that rats exposed to acetamiprid alone exhibited histological alterations characterized by disorganization of seminiferous tubules and an apparent reduction in germ cell density. In contrast, animals co-treated with broccoli seed powder showed better preservation of testicular architecture. These findings suggest a potential protective effect of broccoli seed powder against acetamiprid-induced histological disturbances. However, these observations remain preliminary and should be confirmed by quantitative morphometric analyses as well as hormonal assessments in order to better clarify the extent of this effect on reproductive function

Keywords: Broccoli seed, Acetamiprid, Testicles, Toxicity, Histology

BIOSYNTHESIS OF IRON OXIDE NANOPARTICLES USING A THERMOPHILIC BACTERIUM ISOLATED FROM A HOT SPRING IN AZERBAIJAN

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ABSTRACT

This paper presents an investigation into the biosynthesis of magnetic nanoparticles due to the influence of ionizing gamma radiation on the cells of thermophilic bacteria isolated from the Ashagi Istisu hot spring situated in the Kelbajar district of Azerbaijan. This study is intended to analyze the capability of thermophilic bacteria to create magnetic nanomaterials in response to radiation and to evaluate the characteristics of the synthesized nanoparticles. To determine the effect of the radiation dose on the creation of magnetic nanoparticles, the cultures of bacteria were exposed to two levels of radiation - 500 and 2000 Gy. Special attention was paid to the characterization of the nanoparticles formed under irradiation conditions. After irradiation, the samples were investigated by electron paramagnetic resonance spectroscopy and transmission electron microscopy. The electron paramagnetic resonance spectra of irradiated samples showed the presence of magnetic nanoparticles, which was confirmed by a broad paramagnetic signal with parameters $g = 2.3$ and $\Delta H = 320$ G, typical for magnetic nanoparticles. The transmission electron microscopy study evidenced the formation of nanoparticles of mainly spherical shape. The distribution of particle sizes was in the range of 10 to 15 nm, implying the synthesis of fairly homogeneous nanostructures by the irradiated bacteria. Based on the achieved results, it can be stated that the investigated thermophilic strain is capable of producing magnetic nanoparticles under the influence of gamma irradiation. This discovery implies the use of thermophiles as efficient biological systems for synthesizing environmentally friendly magnetic nanoparticles and could facilitate the emergence of novel methods in bionanotechnology and nanomedicine.

Keywords: Biological synthesis, magnetic nanoparticles, hot springs in Azerbaijan, thermophilic bacteria

CARBON SOURCE OPTIMIZATION FOR ENHANCED CITRIC ACID YIELD BY AN ASPERGILLUS NIGER ISOLATE IN SUBMERGED FERMENTATION

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ABSTRACT

Optimization of citric acid production through the use of the fungus Aspergillus niger grown under submerged conditions was the main aim of this experiment. In all, six presumptive isolates of Aspergillus niger were isolated from different sources such as environmental and agricultural samples. The isolates were subsequently identified through morphological studies using various growth mediums. It was found from the morphological identification of the strains that the colonies of the presumptive isolates were powdery in nature. Their color appearance was black while their underside had a light-yellow coloration. The identification process was later completed via microscopy to confirm the morphology of the isolates. As shown in this experiment, the isolates exhibited a typical Aspergillus colony, which had substrate white mycelium and vertical hyphae. The heads of the vertical hyphae were spherical and mounted on smooth hyaline stipes. The heads had vesicles, metulae, short phialides and spherical to elliptical conidia. Identification of all these fungal species was followed by screening all six isolates for the ability to produce citric acid from sucrose using Czapek-Dox medium. From the results obtained through this screening process, it is clear that all the six isolates are capable of converting sucrose to citric acid although their efficiencies are not the same. From the results obtained in this case, it is clear that one of the best isolates to use was isolate KU 2 which therefore served as the basis for further research work. In order to improve efficiency in the production of citric acid, the effect of the type of carbon source and its concentration in submerged cultures was studied. It was found that the highest concentration of citric acid (26.7 g/l) was produced when 10% sucrose was used as the carbon source.

Keywords: Aspergillus niger, Citric acid, Submerged fermentation, Carbon source optimization

PHYTOCHEMICAL SCREENING AND EVALUATION OF THE ANTIOXIDANT ACTIVITY OF HYDROMETHANOLIC COCOA POWDER EXTRACT

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ABSTRACT

Cocoa, derived from the beans of the tree Theobroma cacao L., is widely used in the food, cosmetic, and pharmaceutical industries. Originating from tropical regions of Central and South America, cocoa has traditionally been valued for its distinctive flavor. However, it has also attracted considerable interest due to its functional properties. In particular, its antioxidant activity has gained significant attention in recent decades, especially in the context of preventing chronic diseases associated with oxidative stress. Oxidative stress, characterized by an imbalance between the generation of free radicals and the body's antioxidant defense mechanisms, is a critical factor in the development of various diseases, including cardiovascular disorders, cancer, diabetes, neurodegenerative diseases, and premature aging. In this context, we are interested in analyzing dietary antioxidants for their potential to scavenge or neutralize reactive oxygen species (ROS) and to enhance endogenous defense systems. Our work focused on phytochemical tests and the evaluation of the antioxidant activity of hydromethanolic extracts from cocoa powder (Theobroma cacao). The phytochemical study revealed the presence of various secondary metabolites: flavonoids, tannins, alkaloids, terpenes, quinones, saponins, and reducing compounds. The analyses revealed that the extracts contain a high concentration of polyphenols and flavonoids, with the hydromethanolic extract showing higher levels, representing a favorable therapeutic prospect.
Estimation of antioxidant capacity using DPPH and FRAP methods revealed strong antioxidant activity, especially in the hydromethanolic extract, whose potential exceeds that of ascorbic acid used as a standard. The results of this work demonstrate that cocoa powder exhibits notable biological properties, particularly antioxidant properties, which could explain its potential uses in the pharmaceutical, nutritional, and cosmetic sectors.

Keywords: Theobroma cacao, flavonoids, polyphenols, antioxidant, hydromethanolic extract, DPPH, FRAP.

PHYTOTHERAPY AS A SUSTAINABLE STRATEGY FOR THE MANAGEMENT OF METABOLIC DISEASES: FOCUS ON DIABETES AND OBESITY

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ABSTRACT

Metabolic diseases, particularly type 2 diabetes mellitus and obesity, represent major public health challenges worldwide, including in the Euro-Mediterranean region, and are closely linked to oxidative stress, chronic low-grade inflammation, and metabolic dysregulation. Although conventional pharmacological treatments are widely used, their long-term effectiveness is often limited by adverse effects, high costs, and reduced patient adherence, which has led to increasing interest in complementary and sustainable therapeutic approaches such as phytotherapy. This study aims to evaluate the potential role of medicinal plants and plant-derived bioactive compounds in the prevention and management of diabetes and obesity, with particular emphasis on their mechanisms of action and environmental sustainability. A comprehensive review of recent experimental and clinical studies was conducted, focusing on medicinal plants traditionally used in the Mediterranean area and analyzing their phytochemical composition, antidiabetic and anti-obesity activities, and associated biological mechanisms. The reviewed evidence indicates that several medicinal plants rich in polyphenols, flavonoids, alkaloids, and dietary fibers exhibit significant hypoglycemic and anti-obesity effects. These effects are mainly mediated through improved insulin sensitivity, reduced intestinal glucose absorption, modulation of glucose and lipid metabolism, inhibition of digestive enzymes, and attenuation of oxidative stress and inflammatory pathways. In addition to their metabolic benefits, plant-based therapies contribute to environmental integration by supporting biodiversity conservation, sustainable agricultural practices, and reduced dependence on synthetic pharmaceuticals. Overall, these findings highlight the relevance of phytotherapy as an effective and environmentally responsible complementary strategy in the management of metabolic diseases. In conclusion, the integration of scientifically validated medicinal plants into preventive and therapeutic frameworks may contribute to improved metabolic health while supporting sustainability goals, although further well-designed clinical studies are required to standardize formulations, optimize dosages, and ensure long-term safety.

Keywords: Phytotherapy, Diabetes, Obesity

EVALUATION OF THE ANTI-INFLAMMATORY ACTIVITY OF THE EDIBLE MUSHROOM AGARICUS BISPORUS

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ABSTRACT

Inflammation is a complex biological response involved in the pathogenesis of numerous diseases. The search for natural products with anti-inflammatory properties has gained increasing attention due to their potential therapeutic benefits and reduced side effects compared with conventional drugs. The present study aimed to evaluate the anti-inflammatory activity of white Agaricus bisporus powder using a formalin-induced paw edema model in rats. Fifteen male rats were randomly assigned to three experimental groups (n = 5): a control group, a Diclofenac-treated group, and an Agaricus bisporus-treated group. Inflammation was induced by formalin injection into the hind paw, and the degree of edema was assessed by measuring paw swelling at 30, 60, 120, 180, and 240 minutes after induction. The anti-inflammatory effect was expressed as the percentage of paw swelling. The results showed that Agaricus bisporus powder significantly reduced inflammation ($p < 0.05$) compared with the control group. The percentage of paw swelling in the mushroom-treated group decreased from 23.01 ± 2.70% at 30 min to 20.43 ± 2.01% at 240 min, whereas the control group exhibited a progressive increase in edema, reaching 63.99 ± 2.98% at 240 min. Diclofenac demonstrated the strongest anti-inflammatory activity throughout the experiment. However, at 240 min, the anti-inflammatory effect of Agaricus bisporus became statistically comparable to that of Diclofenac. The observed activity may be related to the presence of bioactive compounds, particularly polyphenols and polysaccharides, known for their antioxidant and anti-inflammatory properties. These findings suggest that Agaricus bisporus powder could serve as a promising natural anti-inflammatory agent. Further investigations are needed to confirm its efficacy and elucidate the underlying mechanisms of action.

Keywords: Agaricus bisporus, anti-inflammatory activity, edible mushroom, formalin-induced paw edema

EVALUATION OF GERMINATION AND MORPHOMETRIC PARAMETERS OF DIFFERENT SOYBEAN GENOTYPES UNDER NACL STRESS CONDITIONS

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ABSTRACT

Soybean (Glycine max (L.) Merr.) is considered one of the most important agricultural crops worldwide due to its high protein and oil content, as well as its broad application in food, feed, and industrial production. However, environmental stress factors, particularly soil salinity, significantly limit soybean productivity and reduce seed germination, growth, and physiological stability. Soil salinity affects more than 800 million hectares of land globally and represents one of the major abiotic stress factors restricting sustainable agricultural production. Excessive accumulation of NaCl in the soil causes osmotic stress and ion toxicity in plants, resulting in reduced water uptake, disruption of enzyme activity, inhibition of photosynthesis, and suppression of morphological development. Soybean is considered moderately sensitive to salinity, which have its negative effect to this plant especially during germination and early seedling growth stages, where salt stress may severely affect root and shoot development. Since salinity and water deficiency are increasingly observed in several ecological regions of Azerbaijan, the identification of adaptive soybean genotypes tolerant to salt stress is of particular scientific and agricultural importance. Therefore, the aim of this study was to evaluate the effects of NaCl stress on germination and morphometric parameters of different soybean genotypes and to identify salt-tolerant varieties suitable for the ecological conditions of Azerbaijan. The study was conducted in the Plant Biotechnology and Immunology Laboratory of Baku State University using eight soybean genotypes: Slava, Л-4, Umanskaya, Л-10, CHU-11, BK-104, BK-98, and Л-17. Salt stress treatments were applied using 0 (control), 100, and 200 mM NaCl concentrations. Seeds were sterilized and germinated under controlled growth chamber conditions. Germination percentage, root and shoot length, fresh and dry weight, water content (WC), and organic matter percentage (OM %) were evaluated. Statistical analyses were performed using GraphPad Prism 10 software with One-way and Two-way ANOVA methods followed by Tukey's multiple comparison test. The results demonstrated that increasing NaCl concentration significantly inhibited germination and seedling growth in all soybean genotypes. Severe reductions in germination percentage and morphometric parameters were observed under 200 mM NaCl conditions. Among the investigated genotypes, CHU-11 showed the highest tolerance to salinity stress. Although germination percentage decreased under high salinity, CHU-11 maintained relatively stable root and shoot growth as well as water balance compared to the other varieties. The maintenance of root system functionality under stress conditions indicates stronger osmotic regulation and adaptive capacity in this genotype. In

contrast, Л-4, Л-10, and BK-98 were identified as the most sensitive genotypes, exhibiting sharp reductions in germination and growth parameters under high NaCl concentrations. Particularly, Л-10 and BK-98 failed to germinate under 200 mM NaCl treatment. Physiological analyses further revealed that water content decreased with increasing salinity in all varieties; however, CHU-11 preserved higher WC values compared to sensitive genotypes. Similarly, the increase in OM % under stress conditions suggested activation of adaptive metabolic responses. The balanced OM % dynamics observed in CHU-11 indicate a more effective stress-response strategy, whereas unstable changes in sensitive genotypes reflected severe physiological damage caused by salt stress. Overall, the obtained results confirm the existence of substantial genotypic variation in soybean tolerance to salinity stress. The findings suggest that CHU-11 possesses significant adaptive potential and can be recommended as a promising soybean genotype for cultivation and breeding programs in saline-prone regions of Azerbaijan.

Keywords: soybean (Glycine max), NaCl salt stress, morphophysiological responses.

MICROBIOLOGICAL QUALITY OF STREET MEAT-BASED FOODS SOLD IN BISKRA, ALGERIA: ENTEROBACTERIACEAE, COAGULASE-NEGATIVE STAPHYLOCOCCI, ANTIBIOTIC RESISTANCE, AND BIOFILM FORMATION

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ABSTRACT

Street food is a significant source of nutrition for urban populations, but it presents serious public health concerns due to the potential risk of microbial contamination. The present study was conducted to assess the microbiological quality of four street meat-based foods (chicken and lamb shawarma and brochettes) sold in Biskra, Algeria, with special focus on two bacterial groups: Enterobacteriaceae and coagulase-negative staphylococci (CoNS). Samples were collected and analyzed at 60 sites. The extent of contamination was frequently above the legal limits. The highest levels of contamination were found in chicken shawarma for Enterobacteriaceae (3.99 log CFU/g) and CoNS (2.86 log CFU/g). 32 strains of Enterobacteriaceae and 50 isolates of CoNS were identified. Co-occurrence analysis showed significant associations between some Enterobacteriaceae and CoNS species, indicating shared ecological niches within the food matrix. Antibiotic susceptibility testing revealed worrying resistance profiles. Among the Enterobacteriaceae, only Serratia liquefaciens was resistant to both imipenem and amikacin. S. lentus had the highest resistance rate among CoNS. Highest rates were for S. liquefaciens and C. freundii. No significant differences were observed in biofilm production using CRA and TCP methods. However, there were significant differences among CoNS, with the highest production rate for S. lentus. The maximum biofilm-forming ability of both bacterial groups was observed in fed-batch conditions, and batch mode after 24 h. There was no significant association between biofilm formation and antibiotic resistance in Enterobacteriaceae with respect to MDR/XDR status. However, among CoNS, all XDR strains were biofilm producers and an important association between biofilm production and antibiotic resistance was observed. These results show a worrying sanitary situation in street food environments in Biskra and highlight the public health risk due to the combination of microbial contamination, antibiotic resistance, and biofilm persistence. Further investigations are needed to understand the genetic mechanisms of resistance, to test decontamination strategies and to increase epidemiological surveillance to other areas of Algeria.

Keywords: street food, Enterobacteriaceae, coagulase-negative staphylococci, antibiotic resistance, biofilm, food safety, Biskra, Algeria.

PHENOTYPIC AND GENOTYPIC RESISTANCE TO HEAVY METAL ZINC IN ESCHERICHIA COLI

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ABSTRACT

Many pathogens, including Escherichia coli causing serious infections, pose a significant risk to human health worldwide. E. coli is a commensal bacterium that is widely found in the human gastrointestinal tract. Some strains of E. coli can cause gastrointestinal and extraintestinal infections in humans due to the acquisition of pathogenetic factors through mobile genetic elements, such as plasmids, bacteriophages, pathogenicity islands, and transposons. Heavy metals are pollutants that cause serious harm to the environment and human health due to their toxicity, persistence in the environment, and bioaccumulative properties. Heavy metals contribute to antimicrobial resistance in bacteria through co-selection and cross-resistance. Although some metals, such as zinc, are crucial for microbes, they can be toxic at high concentrations or impose selective pressure on bacteria. The aim of this study was to investigate the resistance to heavy metal zinc in multidrug-resistant (MDR) Escherichia coli isolates using phenotypic analysis by the broth microdilution method and genotypic analysis by the PCR-based amplification of the zntA gene associated with zinc resistance. All MDR E. coli isolates had minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) values higher than 3200 µg/mL. Out of the zinc-resistant MDR isolates, 85.7% were positive for the zntA gene, encoding resistance to zinc. However, 14.3% of the MDR isolates with an MIC of >3200 µg/mL did not carry the zntA gene. The results of this study demonstrate the presence of zinc resistance both phenotypically and genotypically. The zinc-resistant MDR E. coli isolates from food in this study might constitute potential risks to human health.

Keywords: zinc resistance, zntA gene, Escherichia coli, minimum inhibitory concentration

RESISTANCE TO COPPER IN ESCHERICHIA COLI ISOLATES FROM ARUGULA

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ABSTRACT

Vegetables, including arugula, are essential components of a balanced diet due to their low caloric content and high nutritional value, contributing significantly to human health. Arugula, as cruciferous vegetable, is a rich source of fiber, vitamins A, C, K, B9, and various minerals, and possess antioxidant properties like neutralizing free radicals. Heavy metals are chemical elements that have toxic effects in living organisms. Environmental factors such as soil, water, and air pollution all contribute to heavy metal contamination in foods, particularly vegetables. Consumption of vegetables contaminated with heavy metals and foodborne pathogens, including Escherichia coli, could cause a significant concern to public health due to their tendency to bioaccumulation in the body and their toxic effects. The purpose of this study was to examine the resistance to heavy metal copper in the E. coli isolates from arugula using the broth microdilution method to determine the minimum inhibitory concentration (MIC) and the PCR method to amplify the pcoR gene, which encodes copper resistance. E. coli isolates from arugula and reference strains, including E. coli ATCC 8739 and Enterobacter cloacae NCIMB 13597, were tested for copper resistance. All tested arugula E. coli isolates had an MIC of 1600 µg/mL. The presence of the pcoR gene encoding copper resistance was detected in none of the arugula E. coli isolates. E. coli ATCC 8739 and E. cloacae NCIMB 13597 contained the pcoR gene and had MICs of 1600 µg/mL. In conclusion, in this study, E. coli isolates from arugula plants were evaluated for resistance to copper, a heavy metal that poses a risk to human health.

Keywords: copper resistance, pcoR gene, Escherichia coli, minimum inhibitory concentration, arugula

GROWTH, MORTALITY, AND EXPLOITATION PATTERNS OF HORSE MACKEREL (TRACHURUS TRACHURUS) ALONG THE EASTERN ALGERIAN COAST: IMPLICATIONS FOR SUSTAINABLE FISHERIES MANAGEMENT

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ABSTRACT

Sustainable management of horse mackerel (Trachurus trachurus, Linnaeus, 1758) along the El Kala coast (eastern Algeria) is crucial in the context of the availability of fishery products and food security in Algeria. This species, an important source of animal protein, requires a thorough understanding of its biology and population dynamics to prevent overexploitation and ensure rational stock exploitation. In this context, a study was conducted on 360 individuals (107 males, 162 females, and 91 immature fish) collected between July and December 2025. The specimens analyzed had total lengths ranging from 11 to 22.5 cm and weights between 12.53 and 88.66 g. Age estimation using the Bhattacharya method (1967) indicated a maximum age of 4 years for the entire population. Von Bertalanffy growth parameters were estimated as $L\infty = 23.26$ cm, $K = 0.37$ year^{-1}, and $t_0 = -0.152$, with a growth coefficient $b = 2.845$, indicating isometric growth. The asymptotic weight $W\infty = 88.89$ g slightly exceeded the observed maximum weight $WTmax = 88.66$ g. Mortality analysis revealed overexploitation of the species along this coast: fishing mortality $F = 0.91$ year^{-1}, natural mortality $M = 0.39$ year^{-1}, and exploitation rate $E > 0.5$, indicating a dynamic imbalance of the stock. These results show that the current fishing pressure exceeds the biological renewal capacity of the species, emphasizing the urgency of sustainable management measures to preserve the stock and maintain local fishery resources. Overall, these data provide a solid scientific basis to guide conservation strategies and adaptive management of horse mackerel in the El Kala region.

Keywords: Trachurus trachurus, horse mackerel, growth, mortality, overexploitation, eastern Algeria.

COMPARATIVE ANALYSIS OF STRESS TOLERANCE INDICES FOR SALT RESISTANCE IDENTIFICATION IN COTTON (GOSSYPIUM HIRSUTUM L.)

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ABSTRACT

Cotton Gossypium hirsutum L. remains a cornerstone of the global textile industry, representing approximately 35% of total fiber consumption worldwide. Leading production is concentrated in a group of key nations, with China ranking as the foremost producer, followed by India, the United States, Brazil, and Pakistan. Cotton is also has particular importance in the socio-economic development of Azerbaijan. In 2025, the area under cotton cultivation in the country was more than 100,000 hectares, and the total harvest was more than 360,000 tons. Abiotic stressors represent a significant limitation to both the yield and quality of cotton fiber throughout its developmental cycle. Among these environmental challenges, soil salinity stands out as a primary constraint to global cotton production. The physiological impact of salt stress on cotton is multifaceted, manifesting as reduced germination rates, stunted growth, inhibited branching, lower plant height. In addition, soil texture plays a critical role in this process; due to their higher capacity for retaining salt ions, silt and clay soils exert a more pronounced inhibitory effect on seed germination compared to sandy soils. Given that salinity tolerance is a genetically complex trait that varies across species and cultivars, there is a pressing need for in-depth research. Mapping the physiological and developmental responses of cotton to salt stress-from the initial seedling stage through to maturity-is essential for the development of resilient cultivars and the enhancement of cotton productivity within increasingly saline environments. Currently, one of the main tasks in studying the problem of salt tolerance is to determine effective tolerance indices for the identification of salt resistance. In this regard, the main goal of the research work is to evaluate the cotton collection samples stored in the Azerbaijan National Genebank based on their stress tolerance indices and identify promising genotypes. 31 local and introduced genotypes of cotton belonging to the species G. hirsutum L. were used as material of the study. Planting scheme and stress application were performed using the method proposed by Basal. Stress tolerance indices (Stress susceptibility index - SSI, Stress Tolerance Index - STI, Mean Productivity - MP, Geometric Mean Productivity - GMP, Yield Index - YI, Stress Susceptibility Percentage Index - SSPI, Modified Stress Tolerance Index - MSTI) were calculated based on the dry weight of genotypes under stress conditions of 200 mM NaCl concentration. A highly significant positive correlation was found between Yp and STI, MP, YI and GMP indices under 200 mM NaCl salt stress of 31 geographically distant cotton varieties. A highly significant ($P \leq 0.01$) positive correlation was found between STI, MP, YI, GMP, MSTI indices and yield under stress conditions. Also, a highly significant ($P \leq 0.01$) negative correlation was found between this parameter and SSI index, and a significant ($P \leq 0.05$) correlation was found between TOL and SSPI indices. According to literature data salt-tolerant genotypes can be effectively identified by a specific profile of stress indices: low values of SSI, SSPI, and TOL coupled with elevated values of STI, YI, MP, GMP and MSTI. These indices collectively indicate a high degree of genotypic resilience. Under 200 mM NaCl stress conditions, the lowest value of SSI index was determined in Tashkent-2, and the lowest values of TOL and SSPI indices were determined in Beyaz altun-440 variety. The highest

values of STI, MP, YI and GMP indices were determined in Ganja-110, and the highest values of MSTI were determined in Tashkent-2 and Beyaz altun-440 varieties.

Keywords: salt stress, cotton, NaCl, stress tolerance index, genotype

INTEGRATION OF ARTIFICIAL INTELLIGENCE IN THE DESIGN OF PERSONALIZED NANOCURCUMIN-BASED PATCHES FOR THE TREATMENT OF INFLAMMATION

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ABSTRACT

This study aims to improve the bioavailability of curcumin, a natural bioactive compound widely used in the pharmaceutical field due to its potent therapeutic properties. The adopted strategy consists of formulating a nanoemulgel. The average particle size of curcumin, initially approximately 53 μm, was reduced to 99.6 nm through a precipitation process using natural excipients, namely sweet almond oil, soy lecithin, and thermal water. The nanoscale particle size was confirmed by Dynamic Light Scattering (DLS). The formulated product was characterized using various physicochemical methods. Solubility was significantly enhanced, and the nanoemulgel exhibited a creamy, homogeneous, and viscous appearance, a yellow color, a near-neutral pH (5–6), and good spreadability. Microscopic analysis revealed monodisperse and stable particle systems. Biopharmaceutical studies demonstrated a sustained drug release profile in a dissolution medium at pH 5.5. The second objective of this project was to incorporate curcumin into a transdermal drug delivery system and to personalize the patches using artificial intelligence. Using the Nanoedge process, the particle size of curcumin was further reduced to 14 nm, as confirmed by Dynamic Light Scattering (DLS). The patch formulated with a natural polymer exhibited promising characteristics, including an amorphous structure identified by X-ray Diffraction (XRD), indicating the enhanced solubility of nanocurcumin. Scanning Electron Microscopy (SEM) images demonstrated efficient encapsulation of nanocurcumin within the polymeric matrix, confirming the structural stability of the film. Prolonged drug release was demonstrated by diffusion studies using Franz diffusion cells for more than 24 hours. Biological evaluations revealed excellent anti-inflammatory and antioxidant activities, comparable to those of sodium diclofenac and ascorbic acid, respectively. Furthermore, the integration of artificial intelligence enabled the development of a predictive model capable of personalizing transdermal patches according to the patient's age and skin profile.

Keywords: Artificial intelligence,nanocurcumin, patches, inflammation, arthrose

INVESTIGATION OF THE EFFECT OF ARONIA MELANOCARPA BERRY EXTRACT ON L. MONOCYTOGENES BIOFILM

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ABSTRACT

In recent years, the increasing antimicrobial resistance and growing interest in ecological lifestyles have increased the need for natural antimicrobial compounds. The berry of the Aronia melanocarpa plant have been found to exhibit antimicrobial activity against many pathogens, including Listeria monocytogenes, which has several biological activities potentially beneficial to human health. However, studies on the antibiofilm effects of aronia berry extracts are limited in the literature. This study aimed to determine the virulence potential of 9 L. monocytogenes isolates isolated from minced meat and to investigate the effect of aronia berry extracts on L. monocytogenes biofilm. To determine the virulence potential of L. monocytogenes isolates, the presence of actA, hylA, iap, plcA, inlA, and inlB genes was investigated by PCR. The minimum inhibitory concentrations of Aronia berry extracts were determined. Subsequently, the effect of subMIC (MIC/2, MIC/4, and MIC/8) concentrations of the extract on biofilm formation was determined. The effect of MIC, 2xMIC, and 4xMIC concentrations of the extract on 24-hour L. monocytogenes biofilm was determined. Biofilm formation was determined by crystal violet assay. In this study, the L. monocytogenes ATCC 7644 strain was used as a positive control for virulence genes and biofilm assays. All L. monocytogenes isolates did not carry the actA, iap, plcA, inlA, and inlB virulence genes. 44% of the isolates carried the hlyA gene. The MIC value of aronia berry extract was determined to be 12.5% for all isolates. When the effects of sub-MIC concentrations of the extract on the biofilm-forming capacity of the isolates at 22°C were evaluated, biofilm formation decreased by 13.9–71.4% in 8 (88%) isolates in the presence of MIC/2 extract, by 1.9–58.1% in 5 (55%) isolates in the presence of MIC/4 extract, and by 13.9–58.1% in 8 (88%) isolates in the presence of MIC/8 extract. At 37°C, a decrease in biofilm formation of 15.3% and 64.7% was determined in 2 isolates in the presence of only MIC/8 extract. For the L. monocytogenes ATCC7644 strain, an increase in the biofilm-forming capacity of the strain was detected at both temperatures and at all subMIC concentrations of the extract. When the biofilm removal efficacy of the extract on biofilms formed by L. monocytogenes isolates at 22°C and 37°C for 24 hours was evaluated, it was determined that MIC, 2×MIC, and 4×MIC concentrations were not effective in removing biofilms.

Keywords: Aronia melanocarpa, Listeria monocytogenes, virulence genes, biofilm, berry extract

DISTRIBUTION AND BIOLOGICAL CHARACTERISTICS OF THE GENUS PAGELLUS IN THE NORTHERN AND CENTRAL ADRIATIC SEA

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ABSTRACT

Three species of the genus Pagellus living in the Adriatic Sea, P. erythrinus, P. bogaraveo and P. acarne, were analyzed using data obtained during scientific expeditions carried out in the area of the northern and central Adriatic as a part of the MEDITS programme in the summer period (June - July) from 1996 to 2024. The depth range inhabited by P. erythrinus was from 21 to 198 m, P. bogaraveo from 24 to 397 m, and P. acarne from 24 to 318 m. P. erythrinus and P. acarne had the highest average abundance indices in the 10-50 m stratum, and P. bogaraveo at 50-100 m. Analysis of the length-weight relationships showed that P. erythrinus (b=2,6367), P. bogaraveo (b=2,6784) and P. acarne (b=2,8659) all had negative allometric growth, meaning they increase proportionally more in length than in weight as they grow. The sex ratio (F/F+M*100) for P. erytrhinus was 68.77%, which indicated the dominance of females in the sample, for P. bogaraveo 9.09% and for the species P. acarne 27.26%, meaning that for these two species males predominate in the samples in the summer period. It was determined that most individuals of both sexes of the species P. erythrinus were in the stage of sexual maturation (females 46.36%, males 79.65%) and sexual maturity (females 32,03%, males 13.05%) which is in accordance with the time of spawning of this species in the Adriatic Sea which is at the end of spring and in the summer. For the species P. bogaraveo, the dominance of immature individuals of both sexes was found (females 37.14% and males 81.14%) as this species spawns at late autumn and beginning of winter, while P. acarne had the majority individuals in the maturation stage (females 71.51% and males 58.61%) since it spawns in the second part of the summer.

Keywords: Pagellus erythrinus, Pagellus bogaraveo, Pagellus acarne, distribution, biological characteristics

VALORISATION OF A MEDICINAL HALOPHYTE PLANT (ATRIPLEX HALIMUS L) FROM THE ALGERIAN HIGH PLATEAUS(BOUSSAADA)

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ABSTRACT

Benefiting from a privileged geographical location, Algeria is recognized for its wealth and diversity of aromatic and medicinal plants, estimated at over 3,000 species belonging to various botanical families known for their medicinal properties (Arab et al., 2014). We focused our attention on the halophyte Atriplex halimus L., collected in the Boussaâda region (High Plateaus). This plant belongs to the Chenopodiaceae family, which comprises approximately 417 species, 48 of which are found in the Mediterranean basin (Houérou, 1992). Atriplex is used in the traditional Algerian pharmacopoeia (Dutuit et al., 1991) and is known for being rich in natural bioactive compounds (Roubi et al., 2023). Our results show that the aerial part of Atriplex halimus has a relatively low moisture content of around 11.34%, and an essential oil content of 0.11%. The crude extract obtained via Soxhlet extraction yielded 32.11% for the leaves and 21.03% for the stems; these yields are significantly higher than those obtained by maceration (28.11% and 14.3%, respectively). Total polyphenol content is 17.41 mg GAE/g DM for the leaves and 4.16 mg GAE/g DM for the stems, for crude extracts obtained by maceration. For the crude extracts obtained by Soxhlet extraction, total polyphenol content is 19.91 mg GAE/g DM for the leaves and 10.21 mg GAE/g DM for the stems. Phytochemical tests revealed that the plant is exceptionally rich in tannins particularly in the leaves as well as containing saponins and polyphenols; however, the absence of quinones and anthocyanins was noted.

Keywords: Atriplex halimus L, Boussaâda region, phytochamical screening, essential oil, polyphenol

MATERNAL CONSUMPTION OF DIVERSE BEVERAGES IN CO-EXISTING GESTATIONAL DIABETES AND HYPERTENSION: A CASE-CONTROL STUDY IN SÉTIF, ALGERIA

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ABSTRACT

The quantity and quality of ingested drinks during pregnancy can influence maternal health and fetal growth. The objective of this study was to evaluate the association between beverage consumption and some feto-maternal health patterns in the Sétif region, Algeria. The comparison was made between a group of women experiencing complicated pregnancies, including co-existing gestational diabetes and gestational hypertension, and healthy pregnant women serving as controls. An advanced maternal age (34.00 ± 5.02 years), a significant decrease of gestational age (34.73 ± 2.83 weeks), and a higher rate of cesarean sections were associated with women with complicated pregnancies. Educational attainment showed a significant difference only in the group of women with combined pathologies, with the highest percentage among those with a primary education (36.36%); however, socioeconomic status was not a distinguishing factor between the groups studied. Coffee consumption was higher in the group with complicated cases, with approximately 3 cups per day; tea abstinence remained the dominant behavior in both groups. Moreover, no significant differences were observed for most of the beverages studied (herbal infusions, sugar-sweetened or natural fruit juices, and dairy) between the two groups. Regarding fetal features, the mean weight of newborns in complicated pathologies was 3027.27 ± 718.46 g, with no significant difference compared to the control group. The mortality rate among newborns was 2.35% in the control group and 9.09% in the complicated group, but no distinguished malformations were detected in this study. In conclusion, these data suggest a weak association between some beverages and underline the importance of proper nutritional awareness to promote consumption habits favorable to the health of the mother and the fetus.

Keywords: Pregnancy, beverages, gestational diabetes, gestational hypertension, Sétif, Algeria.

ANTI-INFECTIOUS AND IMMUNOMODULATORY PROPERTIES OF SCORPION VENOM IN A MURINE MODEL OF STAPHYLOCOCCUS AUREUS-INFECTED BURN WOUNDS

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ABSTRACT

Background: Skin infections, increasingly complicated by antibiotic resistance, represent a major therapeutic challenge and highlight the urgent need for alternative treatment strategies. Scorpion venoms, known for their rich repertoire of bioactive molecules, constitute a promising source of novel therapeutic agents. This study investigated the antibacterial, immunomodulatory, and wound-healing properties of Androctonus australis hector (Aah) scorpion venom in a murine model of Staphylococcus aureus-infected burn wounds. **Methods:** Second-degree burns were induced in female NMRI mice, followed by subcutaneous inoculation of S. aureus. One hour after infection, Aah venom was applied topically to the wound area. Animals were allocated into three groups: control (NaCl), infected untreated, and infected venom-treated. After euthanasia, bacterial burden and oxidative stress markers were assessed. Histopathological evaluation was performed using Hematoxylin–Eosin and Sirius Red staining, while immunohistochemical analysis was carried out using an anti-CD163 antibody to characterize macrophage responses. **Results:** Topical administration of Aah venom significantly reduced bacterial load at the wound site compared with untreated infected mice. This antibacterial effect was associated with a marked decrease in malondialdehyde levels and an increase in glutathione content after 72 h, indicating attenuation of oxidative stress. Histological examination revealed improved preservation of tissue architecture and reduced inflammatory damage in venom-treated animals. Sirius Red staining demonstrated an increased deposition of type III collagen, suggesting enhanced extracellular matrix remodeling and tissue repair. In addition, immunohistochemical analysis showed a higher density of CD163-positive cells in treated tissues, reflecting the activation of regulatory macrophage populations involved in inflammation resolution and healing. **Conclusion:** Aah scorpion venom exhibits potent antibacterial, antioxidant, immunomodulatory, and pro-regenerative activities in infected burn wounds. Its therapeutic effects appear to involve an early antimicrobial and inflammatory response followed by immune regulation and tissue remodeling. These findings highlight Aah venom as a promising source of bioactive molecules for the development of innovative treatments targeting infected skin wounds.

Keywords: venom, burn wound, skin infection, Staphylococcus aureus, antibacterial activity, immunomodulation.

MORPHOMETRIC VARIATION AND GROWTH PATTERNS OF INTERTIDAL LIMPETS (PATELLA SPP.) ALONG THE SOUTHERN COAST OF ALBANIA

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ABSTRACT

The genus Patella represents an important group of intertidal gastropods inhabiting rocky coastal ecosystems of the Mediterranean Sea, where morphological variability reflects the influence of environmental conditions, habitat characteristics, and ecological factors. This study aims to investigate the morphometric variation and growth patterns of Patella species along the southern coast of Albania. The study was conducted using 397 archived specimens from the Laboratory of the Department of Biology, University of Vlora "Ismail Qemali". The analyzed specimens were collected from seven coastal areas: Triport, Karaburun Peninsula, Akuarium, Llaman, Porto Palermo, Qeparo, and Sarandë. Six taxa were identified: Patella caerulea, P. rustica, P. vulgata, P. depressa, P. ulyssiponensis, and Cymbula safiana (Patella nigra). For each specimen, shell morphometric parameters were measured, including shell length, shell width, apical width, and shell height. The obtained data were analyzed to assess morphological differences among species and populations from different locations, as well as to evaluate morphometric relationships and growth patterns through correlation and regression analyses. The results revealed significant morphological variability among the studied taxa and sampling areas, highlighting the role of local environmental conditions in shaping shell morphology. The analysis of morphometric ratios and correlations among shell parameters provided valuable information on growth relationships, species adaptation, and population structure within the genus Patella. This study contributes to the knowledge of marine biodiversity along the Albanian coast by providing baseline information on morphometric variation and ecological adaptation of intertidal gastropods. The results may support future biodiversity assessments, ecological monitoring programs, and conservation strategies for rocky shore ecosystems.

Keywords: Patella, morphometric variation, shell morphology, growth patterns, gastropods, rocky shore ecosystems, southern Albanian coast.

THE FIRST COMPLETE MITOCHONDRIAL GENOME OF THE INDIAN GERBIL TATERA INDICA (HARDWICKE, 1807) (RODENTIA: MURIDAE: GERBILLINAE)

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ABSTRACT

This study provides the first complete mitochondrial genome sequence for the Indian gerbil *Tatera indica* (Hardwicke, 1807) and contributes new molecular data for future phylogenetic and evolutionary studies of gerbils. The mitochondrial genome is 16,374 bp in length and includes a total of 37 gene regions (22 tRNA genes, 2 rRNA genes, and 13 protein-coding genes) as well as a control (D-loop) region. The overall GC content was calculated as 35.67% with nucleotide composition of 33.95% A, 23.74% C, 11.93% G, and 30.38% T. The mitochondrial genome exhibited a positive AT skew (0.055) and a negative GC skew (−0.331), indicating an excess of A over T and C over G. Most protein-coding genes initiated with ATG and terminated with TAA, whereas COX3 ended with AGG and ND4 and CYTB contained incomplete stop codons (T–). Codon usage and RSCU analyses revealed a clear preference for A/U-ending codons, reflecting the AT-rich nature of the mitochondrial genome. In the Maximum Likelihood and Bayesian Inference trees constructed using available mitochondrial genome sequences of other gerbil species, *T. indica* clustered with *Gerbilliscus leucogaster*, supporting its phylogenetic position within the subfamily Gerbillinae and consistent with previous studies. Furthermore, the mean genetic distance values between *T. indica* and the remaining gerbil species ranged from 17.78% to 20.21%.

Keywords: Tatera indica, mitochondrial genome, phylogeny, codon usage

INCUBATION CHARACTERISTICS OF THE BARN SWALLOW (HIRUNDO RUSTICA L., 1758) UNDER THE CONDITIONS OF THE SAMARKAND REGION

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ABSTRACT

The Barn Swallow (Hirundo rustica L., 1758) is a widespread migratory breeding bird species. The processes of incubation and egg brooding remain insufficiently studied, although they represent one of the most important stages in the breeding biology of birds. The aim of this study was to investigate the incubation process and behavioral characteristics of the Barn Swallow using video observations. The study was conducted in the Pastdargom District of the Samarkand Region from April to July 2026. The Barn Swallow was the object of the study. A total of 12 nests were found in residential buildings and on a farm. One nest located in a basement at a height of 2.5 m was selected for detailed observations. The behavior of the birds during incubation and the participation of both parents were recorded. The selected nest contained a second clutch of eggs. Observations began on 29 June 2026. The nest contained four freshly laid eggs, all of which were marked and measured. The incubation period lasted 13–14 days. Continuous video recordings were used to analyze the participation of both parent birds in incubation. The results showed that one bird (presumably the female) remained in the nest for most of the incubation period (85%), whereas the second bird (presumably the male) incubated only for short periods (15%), replacing the female during her absence. Most of the time, the male guarded the nest while perching on a cable near it. The analysis demonstrated that the female played the primary role in egg incubation, whereas the male mainly guarded the nest and only occasionally replaced the female. Incubation intensity increased slightly toward the end of the incubation period. The obtained results expand current knowledge of the reproductive biology of the Barn Swallow under the environmental conditions of the Samarkand Region and may be useful for further studies on the ecology and ethology of this species.

Keywords: Barn Swallow, Hirundo rustica, incubation, breeding biology, Samarkand Region

STANDARDIZATION OF DYNAMIC HEADSPACE SYSTEM (PULL AND PUSH-PULL) FOR THE CAPTURE OF PLANT VOLATILE ORGANIC COMPOUNDS IN CHRYSANTHEMUM MORIFOLIUM IN VIVO

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ABSTRACT

A vital component of plant ecological functions are volatile organic compounds (VOCs), which actively mediate interactions with biotic and abiotic environments. These compounds are produced in any tissue and are released constitutively or in response to various stimuli, playing essential roles in pollinator attraction, defense against herbivores, and plant-plant communication. Their precise identification is fundamental, as they can be used for the development of novel pest control methods. The objective of this study was to standardize the capture of chrysanthemum volatile organic compounds by comparing two dynamic headspace systems. In vivo plants with hermetically sealed substrates and cut stems were used to evaluate the effect of mechanical stress. Volatiles were captured on HayeSep[X] resin and analyzed by GC-MS. In the pull system, a pump suctioned at 5 L/min through the trap, with passive entry of purified air; in the push-pull system, clean air was injected at 5 L/min and suctioned through the trap at 2 L/min. Results demonstrated that the push-pull system presented a higher capture efficiency compared to the pull system. Furthermore, in vivo plants allowed the detection of highly volatile compounds (lower retention times) that were not recorded in cut plants, suggesting that mechanical cutting stress causes a rapid release and loss of these compounds. In conclusion, the in vivo push-pull system is the most representative and non-destructive method for characterizing the actual chemical profile of the chrysanthemum. This study was funded by the Vice-Rector for Research at the Universidad Militar Nueva Granada through the project IMP-CIAS 4086, validity 2025-2027.

Keywords: Chrysanthemum morifolium, volatile organic compounds, dynamic headspace, push-pull system, GC-MS

VARIATION OF VOLATILE ORGANIC COMPOUNDS ACROSS DIFFERENT PHENOLOGICAL STAGES OF CHRYSANTHEMUM MORIFOLIUM 'LAMIRA' AND ITS EFFECT ON THE ATTRACTION OF FRANKLINIELLA OCCIDENTALIS

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ABSTRACT

Chrysanthemum (Chrysanthemum morifolium) is a high-export ornamental plant, severely threatened by the western flower thrips (Frankliniella occidentalis), a global pest resistant to insecticides. In response to international market demands, integrated management based on semiochemicals emerges as a sustainable alternative. Plant volatile organic compounds (VOCs) act as chemical signals regulating insect behavior; however, their variation during plant ontogeny and under infestation remains insufficiently explored. The objective of this study was to establish the effect of VOCs emitted by Chrysanthemum morifolium 'Lamira' across three phenological stages (longitudinal growth, budding, and flowering) on the attraction of Frankliniella occidentalis. VOCs were collected using a dynamic push-pull system (purified air inlet at 6 L/min and suction through the trap at 2 L/min) with HayeSep[X] adsorbent resin and analyzed by GC-MS. Behavioral response was evaluated in a Y-tube olfactometer, testing separately the volatiles from infested and non-infested plants against a clean air stream. Changes in VOC profiles across phenological stages and infestation status were explored using PCA and PLS-DA, while the behavioral preference of F. occidentalis in the Y-tube olfactometer was evaluated using GLMs . Characteristic chemical profiles were obtained for each phenological stage, detecting compounds whose relative abundances varied significantly between stages and in response to infestation. Bioassays revealed that F. occidentalis attraction differs markedly between plant developmental stages. These findings lay the foundation for developing monitoring and ecological management tools based on semiochemicals. This study was funded by the Vice-Rector for Research at the Universidad Militar Nueva Granada through the project IMP-CIAS 4086, valitidy 2025-2027.

Keywords: Chrysanthemum morifolium, Frankliniella occidentalis, push-pull system, Y-tube olfactometer.

CHEMICAL CHARACTERIZATION AND ANTIMICROBIAL POTENTIAL OF CINNAMOMUM ZEYLANICUM BARK ESSENTIAL OIL FOR MEAT BIOPRESERVATION

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ABSTRACT

Background: The rise of antimicrobial resistance and consumer demand for clean-label foods have renewed interest in plant-derived antimicrobials. Cinnamomum zeylanicum Blume bark essential oil (CZEO), rich in trans-cinnamaldehyde, is a promising candidate for meat biopreservation. **Objective:** To characterize the physicochemical properties and antimicrobial activity of CZEO against four foodborne pathogens and to validate its preservative effect on refrigerated meat. **Methods:** CZEO was obtained by hydrodistillation of cinnamon bark and characterized for yield, organoleptic properties, density, refractive index, free fatty acid (FFA) content, and Fourier-transform infrared (FTIR) spectroscopy. Antimicrobial activity was assessed against Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and Candida albicans using the agar disc diffusion method, minimum inhibitory concentration (MIC) determination by broth microdilution, and minimum bactericidal/fungicidal concentration (MBC/MFC) assays. The in situ preservative effect was evaluated on inoculated white meat samples stored at 4°C for 7 days, at concentrations of 1× and 4× MIC. **Results:** Hydrodistillation yielded 2.5% (w/w) of a clear, light-yellow oil with a characteristic spicy aroma. Density (1.053), refractive index (1.588), and FFA (2.01%) complied with AFNOR standards. FTIR confirmed the presence of cinnamaldehyde-characteristic functional groups (aldehyde, alkene, aromatic ring). All four strains were extremely sensitive to CZEO (inhibition zones 23–60 mm). C. albicans was the most susceptible (IZ = 60 mm; MIC = 7.81 µL/mL), followed by S. aureus (26 mm; 15.62 µL/mL), E. coli (29 mm; 31.25 µL/mL), and P. aeruginosa (23 mm; 31.25 µL/mL). CZEO exhibited bactericidal effects on S. aureus and E. coli, a fungicidal effect on C. albicans, and a bacteriostatic effect on P. aeruginosa. In situ, 4× MIC fully inhibited all four pathogens after 7 days at 4°C. **Conclusion:** CZEO is a potent broad-spectrum antimicrobial that effectively controls major foodborne spoilage organisms in refrigerated meat. It represents a credible natural alternative to synthetic preservatives for clean-label meat products.

Keywords: Cinnamomum zeylanicum, cinnamaldehyde, essential oil, antimicrobial activity, minimum inhibitory concentration, meat biopreservation, Candida albicans, foodborne pathogens.

ABUNDANCE OF FRANKLINIELLA OCCIDENTALIS LARVAE AND ADULTS ACROSS THREE PHENOLOGICAL STAGES OF CHRYSANTHEMUM MORIFOLIUM SP. IN RELATION TO CHANGES IN NON-VOLATILE METABOLITES

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ABSTRACT

The phytophagous pest Frankliniella occidentalis (Pergande) (Thysanoptera: Thripidae) is of major agricultural importance , particularly in chrysanthemum (Chrysanthemum sp.) crops, due to its role as vector of tomato spotted wilt virus (TSWV) e Impatiens necrotic spot virus (INSV), causing significant crop damage. increases in its populations have been promoted by factors such as intensive insecticides use, greenhouse microclimatic conditions, and the international trade of ornamental plants. In this context, the present study assessed the variation in the abundance of F. occidentalis larvae and adults across three chrysanthemum phenological stages and evaluated its association with the plant 's non-volatile metabolomic profiles. A total of 300 plants were established and distributed into two treatments (infested and non-infested), arranged in three experimental blocks and evaluated during the stem elongation, flower bud formation and flowering stages. Morphometric variables and plant dry biomass were recorded, while population monitoring was conducted through weekly direct counts and biweekly absolute counts using the ethanol plant immersion method. Non-volatile metabolites were extracted with ethanol and analyzed by liquid chromatography coupled with mass spectrometry (LC-MS). Abundances of larvae and adults were compared between infested and non-infested plants using generalized linear models (GLMs), whereas non-volatile metabolomic profiles were compared using partial least squares discriminant analysis (PLS-DA). The findings provide evidence of the potential influence of chrysanthemum phenological changes on the population density of F. occidentalis larvae and adults, coinciding with variations in the plants non-volatile metabolites. These results contribute to better understanding of plant-insect interactions and the crop developmental stages associated with higher insect abundance, thereby supporting more efficient and sustainable pest monitoring and integrated pest management strategies for green house production. This study was funded by the Vice-Rector for Research at the Universidad Militar Nueva Granada through the project IMP-CIAS 4086, valitidy 2025-2027.

Keywords: Chrysanthemum, Phenology, Frankliniella occidentalis, Non-volatile metabolites, Population density.

VARIATION IN THE ABUNDANCE OF FRANKLINIELLA OCCIDENTALIS LARVAE AND ADULTS AMONG PHENOLOGICAL STAGES OF CHRYSANTHEMUM MORIFOLIUM SP. AND ITS ASSOCIATION WITH CHANGES IN NON-VOLATILE METABOLITES

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ABSTRACT

The ornamental chrysanthemum crop (Chrysanthemum morifolium sp.) is of major economic importance in Colombia. However, the presence of Frankliniella occidentalis (Pergande) (Thysanoptera: Thripidae) represents one of the most important phytosanitary constraints due to the direct damage caused by its feeding activity and its role as a vector of Tomato spotted wilt virus (TSWV) and Impatiens necrotic spot virus (INSV). Population increases of this pest have been promoted by factors such as intensive insecticide use, greenhouse microclimatic conditions, and the international trade of ornamental plant material. In this context, the present study evaluated the changes over time in abundance of F. occidentalis larvae and adults in the chrysanthemum cultivar Lamira across three phenological stages (stem elongation, flower bud formation, and flowering) and assessed their relationship with the plant's non-volatile metabolomic profiles. A total of 300 plants were established and distributed into two treatments (infested and non-infested), arranged in three experimental blocks. Morphometric variables and plant dry biomass were recorded, while population monitoring was conducted through weekly direct counts and biweekly absolute counts using the ethanol immersion method. In parallel, non-volatile metabolites were extracted with ethanol and characterized by liquid chromatography coupled with mass spectrometry (LC-MS). The abundance of larvae and adults was analyzed using generalized linear models (GLMs), whereas metabolomic profiles were evaluated through partial least squares discriminant analysis (PLS-DA). The results revealed variations in abundance of larvae and adults of F. occidentalis among phenological stages, which were associated with changes in the metabolic composition of the plants. These findings contribute to a better understanding of plant–insect interactions and provide valuable information for improving monitoring programs and integrated pest management strategies for this pest in ornamental greenhouse production systems. This study was funded by the Vice-Rector for Research of Universidad Militar Nueva Granada through project IMP-CIAS 4086, validity 2025–2027.

Keywords: Chrysanthemum, Phenological stages, Frankliniella occidentalis, Non-volatile secondary metabolites.

A PRELIMINARY STUDY ON THE ANTIGENOTOXIC EFFECTS OF THE ENDEMIC MEDICINAL PLANT ORIGANUM ACUTIDENS IN THE MODEL ORGANISM DROSOPHILA MELANOGASTER

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ABSTRACT

Origanum acutidens (Hand.-Mazz.) Ietsw. is an endemic plant species naturally distributed across Eastern Anatolia, Turkey. The genus *Origanum* L., belonging to the Lamiaceae family, holds significant importance in both folk medicine and clinical therapeutics; it is represented worldwide by approximately 40–50 species, and in the Turkish flora by more than 20 species, the majority of which are endemic. This prominent genus is characterized by a high proportion of carvacrol (50–90%), alongside valuable monoterpenes such as p-cymene, linalyl acetate, borneol, and thymol, as well as various essential oils and bitter compounds. Widely known in Anatolia by local names such as "Yalancı kekik", "Kekik", "İstanbul kekiği", and "Keklik otu", and frequently utilized as a spice or seasoning, this genus is traditionally employed in the treatment of digestive disorders and constipation due to its sedative, diuretic, carminative, diaphoretic, and antiseptic properties.While many species within this genus are endemic, *Origanum acutidens* holds a particularly notable place in Eastern Anatolia. Locally referred to as "anux" or "zembul" in Tunceli—where the samples for this study were collected—and as "anık", "anıx", "onıx", "koç anığı", "annuk", or "zahter" in various regions, this plant exhibits symptom-relieving properties for colds, flu, coughs, bronchitis, upper respiratory tract infections, gastric disorders, abdominal pain, hemorrhoids, and rhinitis, in addition to its ethnobotanical use as a spice and herbal tea. Furthermore, in agricultural applications, it stands out as a natural fungicide, herbicide (phytotoxic agent), and insecticide, serving as a viable alternative to synthetic chemicals. Demonstrating higher antioxidant capacity and potent antibacterial and antiviral (especially against HSV-1) activities compared to synthetic preservatives (e.g., BHT) in various medical studies, alongside proven efficacy against phytopathogenic fungi and harmful insects, this plant holds significant medical and agricultural potential as an eco-friendly, biodegradable, and residue-free bio-pesticide source. Additionally, the Somatic Mutation and Recombination Test (SMART) conducted on *Drosophila melanogaster* is currently one of the most frequently employed methods in antigenotoxicity research. This assay is used to assess the genotoxic (genetically damaging) effects of chemical substances, drugs, food additives, or environmental pollutants. In the present study, we aimed to evaluate the protective (antigenotoxic) potential of *Origanum acutidens*—a plant with established medicinal value and demonstrated antimicrobial, antifungal, antioxidant, antiviral, insecticidal, and herbicidal properties—against gene-level damage induced by a genotoxic agent in the fruit fly. The standard cross method was applied in the study; transheterozygous larvae were exposed to *Origanum acutidens* extracts prepared at different concentrations, alongside Mitomycin C (MMC) as a positive control. Following exposure, the wings of emerging adult individuals were examined under a stereomicroscope, and genotoxic and antigenotoxic effects were statistically analyzed by evaluating the frequencies of small single spots, large single spots, and twin spots. Control group data confirmed that *Origanum* extracts alone did not induce any genotoxic effects and were biologically safe. The results indicated that

among the tested doses of 5 mg, 15 mg, and 45 mg, antigenotoxic activity was identified at 15 mg and 45 mg. Accordingly, *Origanum* extracts co-administered with MMC led to a statistically significant reduction in wing spot frequencies, thereby demonstrating an inhibitory effect against DNA damage. In conclusion, it is suggested that this suppressive property exhibited by *Origanum acutidens* against MMC-induced genotoxic damage in *Drosophila* may stem from the cellular-level protective effects of its rich phytochemical content, primarily its major constituents such as carvacrol, alongside thymol and p-cymene. From this perspective, the species is presented as a promising agent with pharmacological potential as an antigenotoxic protective substance.

Keywords: Origanum acutidens, Drosophila melanogaster, SMART assay, antigenotoxicity, DNA damage

CORRELATION BETWEEN FAT INTAKE AND ATHEROGENICITY INDICES IN OLDER PEOPLE

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ABSTRACT

During aging, the prevalence of chronic diseases is high, particularly cardiovascular diseases (CVD) associated with atherosclerosis. Dietary habits, especially excessive lipid intake, play a major role in the development of atherosclerosis and vascular diseases, contributing to the deterioration of the health status of older adults. The objective of this study was to investigate the relationship between dietary lipid consumption and atherogenicity indices in older adults from the Wilaya of Tlemcen. To achieve this, daily dietary lipid intake, biochemical parameters (total cholesterol, triglycerides, HDL-C, LDL-C), and atherogenicity indices (TC/HDL and LDL/HDL) were assessed in older adults and compared with those of young subjects serving as controls. The results showed that saturated fatty acid intake was significantly higher, whereas polyunsaturated fatty acid intake was significantly lower in older men and women than in younger men and women. Regarding monounsaturated fatty acids, a significant decrease was observed in older women compared with younger women. In addition, plasma triglyceride levels were significantly increased, while HDL-C levels were significantly decreased in older men and women compared with younger subjects. Atherogenicity indices were significantly higher in older adults than in younger adults. However, no significant correlation was found between dietary lipid intake and atherogenicity indices. **Conclusion:** Older adults exhibit an increased atherogenic risk that is not directly related to dietary lipid intake. The observed changes are likely attributable to other physiological processes associated with aging, which should be considered to promote healthy and optimal aging.

Keywords: Older people, Atherosclerotic plaque, Dietary lipids, Cholesterol.

COMPUTATIONAL AND IN VITRO VALIDATION OF NATURAL ANTI-HEMORRHOIDAL REMEDIES: A NETWORK PHARMACOLOGY APPROACH

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ABSTRACT

Hemorrhoidal disease significantly impacts patient quality of life, yet a definitive therapeutic standard remains elusive. This study formulated and evaluated novel natural anti-hemorrhoidal ointments based on botanical extracts from the Vitaceae and Amaryllidaceae families. Following the extraction of active constituents, distinct topical formulations were developed and tested for their anti-inflammatory potential via protein denaturation assays. Results demonstrated that all tested formulations significantly outperformed reference anti-inflammatory agents in inhibiting protein denaturation. To decode the underlying synergistic mechanisms, we integrated galenical development with network pharmacology and molecular docking simulations. Topological network analysis identified a core bioactive triadcomprising Quercetin, Catechin, and Epicatechin targeting key immuno-inflammatory pathways and matrix metalloproteinases (MMPs). Molecular docking simulations against the MMP-2 receptor validated these findings, revealing strong binding affinities and stable interactions with critical catalytic residues. These results provide a robust biochemical rationale for the enhanced venotonic and anti-hemorrhoidal efficacy of the developed natural remedies, supporting their strong potential as effective therapeutic interventions for hemorrhoidal disease.Hemorrhoidal disease significantly impacts patient quality of life, yet a definitive therapeutic standard remains elusive. This study formulated and evaluated novel natural anti-hemorrhoidal ointments based on botanical extracts from the Vitaceae and Amaryllidaceae families. Following the extraction of active constituents, distinct topical formulations were developed and tested for their anti-inflammatory potential via protein denaturation assays. Results demonstrated that all tested formulations significantly outperformed reference anti-inflammatory agents in inhibiting protein denaturation. To decode the underlying synergistic mechanisms, we integrated galenical development with network pharmacology and molecular docking simulations. Topological network analysis identified a core bioactive triadcomprising Quercetin, Catechin, and Epicatechin targeting key immuno-inflammatory pathways and matrix metalloproteinases (MMPs). Molecular docking simulations against the MMP-2 receptor validated these findings, revealing strong binding affinities and stable interactions with critical catalytic residues. These results provide a robust biochemical rationale for the enhanced venotonic and anti-hemorrhoidal efficacy of the developed natural remedies, supporting their strong potential as effective therapeutic interventions for hemorrhoidal disease.

Keywords: Hemorrhoidal disease, Network pharmacology, Molecular docking, Matrix metalloproteinases, Topical ointment

A PRELIMINARY SURVEY OF NEMATODES AND GREGARINES IN IPS SEXDENTATUS (BOERNER) (COLEOPTERA: CURCULIONIDAE, SCOLYTINAE) POPULATIONS FROM THE WESTERN MEDITERRANEAN REGION (ANTALYA, BURDUR AND ISPARTA), TURKIYE

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ABSTRACT

Ips sexdentatus Boerner (Coleoptera: Curculionidae: Scolytinae) is one of the most destructive bark beetle species, responsible for substantial economic damage in coniferous forests of the Western Mediterranean Region, Türkiye. Pheromone trapping, together with mechanical and chemical control strategies, has long been employed for the management of this pest. However, increasing concerns regarding environmental sustainability have intensified interest in biological control agents and their associated natural enemies. In contrast, entomopathogenic organisms, as natural enemies of insects, possess several advantages over chemical insecticides. Entomopathogenic organisms play an important role as biological control agents against insect pests because of their widespread distribution and high prevalence of infection in insect populations. This preliminary study aimed to determine the presence of nematodes and gregarines in I. sexdentatus specimens collected from the Western Mediterranean Region (Antalya, Burdur and Isparta), Türkiye. A total of 120 adult I. sexdentatus specimens, including 85 live and 35 dead individuals, were examined in this study. Each beetle was dissected in a physiological solution (0.8% NaCl) and examined microscopically at magnifications of 400×-1000×. The study revealed that the gregarine pathogen was detected only in live I. sexdentatus specimens from Burdur Province. Nematodes were abundantly detected in the hemolymph of both live and dead I. sexdentatus specimens from Isparta, Antalya, and Burdur provinces. The detected gregarine pathogen co-occurred with nematodes. The highest nematode infection rates in the examined samples were found in Burdur (34.3%), Isparta (30%), and Antalya (20%). The average infection rate was 31%. The gregarine infection rate was found only in Burdur, at 1.4%. The detected natural enemies may play an important role in the biological control of I. sexdentatus, as they have the potential to affect its survival and reproductive capacity. Therefore, this preliminary study provides important baseline data for future studies on the natural enemies of I. sexdentatus in the Western Mediterranean Region of Türkiye.

Keywords: Ips sexdentatus, Gregarine, Nematode, Western Mediterranean Region, Türkiye

MICROSPORIDIAL AND NEMATODE INFECTIONS IN THE PREDATORY BEETLE CALOSOMA SYCOPHANTA L. (COLEOPTERA: CARABIDAE) - REARING LABORATORIES IN TURKIYE

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ABSTRACT

Calosoma sycophanta (Linnaeus, 1758), commonly known as the forest caterpillar hunter (FCH), is a large ground beetle that has long been recognized as an effective predatory species in the biological control of lepidopteran pests. In Türkiye, C. sycophanta is mass-reared in insect production facilities for the biological control of the pine processionary moth, Thaumetopoea pityocampa (Denis & Schiffermüller). However, despite being mass-produced through considerable effort and expense, C. sycophanta alone is insufficient to effectively suppress high-density infestations of the pine processionary moth. In addition, pathogenic viruses, bacteria, fungi, protists, and nematodes may cause chronic infections in predatory insects reared in laboratories for biological control. The use of healthy insects can significantly enhance the efficacy and overall success of biological control programs. This study investigated the current distribution of microsporidial and nematode infections in insect rearing laboratories used for biological control programs across Türkiye. From seven rearing laboratories in Türkiye (Antalya, Balıkesir, Bursa, Isparta, İzmir/Bergama, Manisa and Sakarya/Geyve) 447 dead adult specimens of C. sycophanta were procured. To find infected individuals, the beetles were dissected in Ringer's solution and examined under a light microscope at magnifications of 400–1000×. The study revealed that microsporidian infection was detected exclusively in samples obtained from the mass-rearing laboratory in Antalya province, whereas nematode infection was detected only in samples collected from the laboratory in Bursa province. The results showed that microsporidial infection was detected only in samples collected from Antalya, whereas nematode infection was detected exclusively in samples collected from Bursa. Microsporidial infection was detected at a prevalence of 19.0% in samples from Antalya, whereas nematode infection was detected at a prevalence of 10.2% in samples from Bursa. In conclusion, to maximize the effectiveness of C. sycophanta as a biological control agent and to ensure the success of mass-rearing programs, adult beetles should be routinely screened for potential pathogens before mass rearing begins, and only pathogen-free populations should be selected for production.

Acknowledgment: This study was supported by Scientific and Technological Research Council of Türkiye (TUBITAK) under the Grant Number 125N695. The authors thank to TUBITAK for their supports.

Keywords: Calosoma sycophanta, Mikrosporidia, Nemotode, Rearing Laboratories, Türkiye

IN VIVO AND CLINICAL ADVANCES IN MAGGOT THERAPY FOR WOUND HEALING

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ABSTRACT

Chronic and non-healing wounds pose a severe global healthcare challenge, often leading to prolonged hospitalizations, substantial financial burden, and increased risks of limb amputation. Maggot therapy or Maggot debridement therapy (MDT), primarily utilizing Lucilia sericata larvae, offers a unique biological solution through rapid, selective debridement, potent antimicrobial action, and active stimulation of tissue repair. This review highlights recent in vivo and clinical advances in maggot-assisted wound care across sequential healing stages. Beyond removing necrotic slough and disrupting persistent bacterial biofilms formed by pathogens such as Pseudomonas aeruginosa and Staphylococcus aureus, larval excretions/secretions (ES) actively modulate cellular responses to promote angiogenesis, collagen deposition, and fibroblast proliferation. Recent quantitative morphometric image analyses and histopathological evaluations confirm significant acceleration in wound closure rates and granulation tissue formation. Furthermore, emerging evidence highlights novel therapeutic innovations, including the development of off-the-shelf lyophilized larval extracts, the evaluation of alternative blowfly species such as Musca domestica and Chrysomya albiceps, and the synergistic combination of larval therapy with traditional phytotherapeutic pomades containing Centaurea depressa or Achillea sintenisii extracts in diabetic models. Clinical studies also demonstrate MDT's utility in successfully removing burn eschars while avoiding high-risk surgical interventions in comorbid, elderly patients. Overall, current evidence suggests that maggot therapy and its derived products can serve as a valuable complementary approach in modern chronic wound management.

Keywords: biotherapeutic approach, maggot, Lucilia sericata, wound healing

THE CYTOTOXIC EFFECT AND WOUND HEALING POTENTIAL OF ROSE OIL ON HUMAN KERATINOCYTE CELL LINE (HACAT)

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ABSTRACT

The present study was conducted to evaluate the in vitro cytotoxic effects and wound healing potential of rose (Rosa damascena) oil on the human keratinocyte cell line (HaCaT). HaCaT cells were exposed to rose oil at concentrations ranging from 312.5 to 10,000 µg/mL, and cell viability was assessed using the MTT assay. Additionally, the wound healing capacity of the oil was determined through an in vitro scratch (wound closure) assay. The MTT assay results revealed that keratinocyte viability exhibited a concentration-dependent response following oil treatment. Cell viability ranged from 18.32% at the highest tested concentration (10,000 µg/mL) to values exceeding 100% at concentrations of 2,500 µg/mL and below, reaching a maximum of 120.30% at 312.5 µg/mL. Notably, rose oil demonstrated a pronounced proliferative effect at lower and moderate concentrations, suggesting that it actively supports cell viability within this concentration range. In the scratch assay, the oil exhibited considerable wound healing activity, as evidenced by enhanced cell migration and closure of the denuded area. Given its capacity to promote cell regeneration and facilitate wound repair, this natural product holds promise for diverse therapeutic and industrial applications. In conclusion, rose oil may be regarded as a potential natural agent for wound healing, with possible utility in both medical and cosmetic formulations. Further investigations, including mechanistic studies and in vivo evaluations, are warranted to fully elucidate its bioactive potential and safety profile.

Keywords: Rose oil, HaCaT, cytotoxicity, wound healing, MTT

THE CYTOTOXIC EFFECT OF SYRINGA VULGARIS L. FLOWERS ON HACAT KERATINOCYTE CELLS

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ABSTRACT

Syringa vulgaris (common lilac) is a deciduous woody shrub or small tree. S. vulgaris is distributed across Turkey, the Balkans, and Southeastern Europe. It blooms in April and May, producing purple, reddish-purple, and white flowers. S. vulgaris is widely cultivated as an ornamental plant in gardens, parks, and urban landscapes throughout many parts of the world because of its attractive flowers and pleasant fragrance. Previous studies on S. vulgaris have demonstrated that this species exhibits a range of biological activities, with existing literature predominantly focusing on its antimicrobial, antioxidant, and cytotoxic/antiproliferative properties. However, data regarding its safety profile-particularly in the context of dermocosmetic and related biomedical applications-remain limited. Evaluating the effects of S. vulgaris flower extract on the viability of HaCaT keratinocytes using the MTT and Neutral Red assays addresses an important research gap regarding the safety of this species and its potential for dermocosmetic and other biological applications. In the present study, the ethanolic extract obtained from S. vulgaris flowers was prepared and tested at various concentrations to assess its effects on HaCaT cell viability via the MTT and neutral red uptake (NRU) assays. The resulting data were subjected to statistical analysis to determine half-maximal inhibitory concentration (IC_{50}) values. The findings revealed that keratinocyte viability exhibited a concentration-dependent response following extract treatment. Notably, the S. vulgaris extract maintained relatively high cell viability at moderate test concentrations. **In conclusion,** the findings suggest that S. vulgaris extract may serve as a promising natural candidate for medicinal and dermocosmetic formulations, particularly when employed at low to moderate concentrations. Further research is warranted to elucidate the underlying mechanisms and to evaluate its efficacy in advanced preclinical models.

Keywords: Syringa vulgaris, HaCaT, MTT assay, neutral red uptake (NRU) assay

PRIMING EFFECT OF FOLIAR PUTRESCINE ON BIOCHEMICAL RESPONSES OF SUGAR BEET (BETA VULGARIS L.) TO RECURRENT DROUGHT AND HEAT STRESS

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ABSTRACT

Abiotic stressors including drought and high temperatures are among the primary environmental factors restricting crop yield and quality as a result of the growing effects of climate change on agricultural output. Sugar beet (*Beta vulgaris L.*), the primary raw material for sugar production in Türkiye, plays a vital economic role, particularly in major agricultural regions such as Konya Province. However, the increasing frequency of recurring droughts and heat stresses due to climate change negatively affects the physiological and biochemical processes of this plant, thereby reducing yield. In this regard, this study aimed to evaluate whether a single foliar application of putrescine during an initial stress episode confers a lasting priming effect on sugar beet, and to clarify the biochemical tolerance mechanisms elicited by the plant across three recurrent, unprimed drought and heat stress cycles. To this end, sugar beet plants (cultivar Lider) were grown under controlled conditions (16-h light/8-h dark cycle at 22°C and 55% relative humidity) for 30 days, and then divided into three groups (3 biological replicates each): (i) control, (ii) stress group treated with drought and heat along with 0.6 mM putrescine, and (iii) stress group exposed only to drought and heat. As part of the stress treatment, plants were subjected to drought stress for 10 days without watering, during which the putrescine group received 0.6 mM putrescine via foliar spray. At the end of the drought period, heat stress was applied by incubating the plants at 40°C for 2 hours at 70% relative humidity, with the higher humidity applied to prevent leaf scorching/desiccation during the heat treatment. Leaves were frozen immediately after stress application for further analysis. Following a 10-day recovery interval, plants were re-exposed to the same drought–heat stress cycle twice more, without repeating the putrescine treatment. Biochemical analyses were performed on leaf samples from all three groups collected at the third (final) sampling point. Total flavonoid content (TFC) and total phenolic content (TPC) were both lowest in the putrescine-treated plants (0.64 ± 0.015 mg g^{-1} dw and 0.690 ± 0.081 mg g^{-1} dw, respectively), while TFC reached its highest level in the stress group (1.11 ± 0.046 mg g^{-1} dw), whereas TPC was highest in the control plants (1.407 ± 0.062 mg g^{-1} dw). Malondialdehyde (MDA) content was highest in the putrescine-treated plants (24.88 ± 0.464 nmol/g), followed by the stress group (16.72 ± 0.760 nmol/g), while the control plants exhibited the lowest (14.95 ± 0.377 nmol/g). Hydrogen peroxide (H_2O_2) content was lowest in the putrescine-treated plants (0.097 ± 0.025 µmol/g FW), whereas the control (0.154 ± 0.011 µmol/g FW) and stress (0.146 ± 0.007 µmol/g FW) groups exhibited comparable H_2O_2 levels. Among the antioxidant enzymes, SOD and POD activities were highest in the putrescine-treated plants (99.2 ± 9.859 U/mg protein and 0.0085 ± 0.001 U/mg protein, respectively), whereas CAT activity reached its highest level in the stress group ($4.45 \times 10^{-4} \pm 3.51 \times 10^{-5}$ U/mg protein). Soluble sugar content was highest in the putrescine-treated plants (9.95 ± 0.306 mg g^{-1} dw), followed by the stress (9.60 ± 0.439 mg g^{-1} dw) and control groups (9.54 ± 0.482 mg g^{-1} dw). These findings suggest that a single early-stage foliar application of putrescine can induce a lasting priming effect on sugar beet,

enhancing antioxidant enzyme activity (SOD, POD), reducing H_2O_2 accumulation, and promoting osmotic adjustment through increased soluble sugar content across recurrent stress cycles. However, the concurrent rise in MDA levels indicates that the tested concentration may also impose a degree of oxidative burden, pointing to the need for dose optimization to fully realize the protective potential of putrescine priming under recurrent drought and heat stress.

Keywords: Sugar Beet (B. vulgaris), Drought Stress, Heat Stress, Recurrent Abiotic Stress, Putrescine, Biochemical Analysis.

INVESTIGATION OF THE INHIBITORY EFFECTS OF POSTBIOTICS DERIVED FROM LACTIC ACID BACTERIA ISOLATED FROM VARIOUS FRUIT VINEGARS ON BACTERIAL BIOFILM FORMATION

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ABSTRACT

Traditional fruit vinegars are natural products rich in lactic acid bacteria (LAB) and the postbiotics produced through their metabolic activities. Due to their high stability, lack of toxic effects, and resistance to enzymatic degradation, postbiotics have attracted considerable attention as potential biotherapeutic agents, particularly for the control of biofilm-associated infections. This study aimed to evaluate the inhibitory effects of LAB-derived postbiotics isolated from traditional fruit vinegars on the biofilm formation of *Pseudomonas aeruginosa* strains. Within the scope of this study, postbiotics were obtained from LAB strains isolated from various traditional fruit vinegars, and their effects on the biofilm formation of *P. aeruginosa* PAO1 and ATCC 27853 strains were comparatively evaluated. Antibiofilm activity was assessed by comparison with azithromycin as the positive control. The findings demonstrated that LAB-derived postbiotics inhibited biofilm formation in both *P. aeruginosa* strains. In particular, the postbiotic obtained from the G1 isolate (*Lactiplantibacillus plantarum*) exhibited the highest inhibitory effect, achieving 96.44 ± 0.27% biofilm inhibition against the P. aeruginosa PAO1 strain at the P/4 (MIC/4) concentration. This inhibition was significantly greater than that observed with azithromycin ($p < 0.001$).In the ATCC 27853 strain, inhibitory activity varied depending on the applied postbiotic concentration. At certain concentrations, biofilm inhibition exceeded that of the positive control, whereas at others, the activity was comparable to the positive control. These findings suggest that postbiotics may affect biofilm formation through different mechanisms and that their efficacy may depend on the concentration used. In conclusion, LAB-derived postbiotics isolated from traditional fruit vinegars exhibited remarkable antibiofilm activity against *P. aeruginosa* biofilms. These findings indicate that these natural metabolites may serve as potential adjunctive agents for the control of biofilm-associated infections. Further in vitro and in vivo studies are required to elucidate their mechanisms of action and determine their potential for clinical applications.

Acknowledgement: This study was supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK) under the 2209-A University Students Research Projects Support Program

Keywords: Pseudomonas aeruginosa, Laktik asit bakterileri, postbiyotikler, biyofilm, sirke, antibiyofilm.

POPULATION DYNAMICS OF SIMULIIDAE AND TRANSMISSION OF ANIMAL FILARIASES: CURRENT KNOWLEDGE AND CONTROL STRATEGIES

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ABSTRACT

Simuliidae, commonly known as black flies, are insects belonging to the order Diptera and are characterized by their hematophagous behavior. They represent a major concern in veterinary medicine and public health because of their role in transmitting numerous parasites responsible for disease s affecting both humans and animals. Among these parasites are several filarial species of the genus Onchocerca, which infect domestic and wild animals as well as humans. In animals, these parasites particularly affect cattle, leading to numerous studies focusing on their life cycle, transmission mechanisms, and the factors promoting their spread. Over recent years, considerable attention has been devoted to the development of the parasite within its host, the behavior of Simuliidae, and their vectorial capacity, while also taking into account the influence of climate change on their geographical distribution and abundance. As part of this revew, we conducted a spatiotemporal analysis to assess the population dynamics of Simuliidae and the variations in their abundance according to environmental conditions. This approach provided valuable insights into their distribution, development, and movement patterns, thereby contributing to the improvement of surveillance and control strategies. In addition, several control strategies have been investigated alongside conventional treatments to reduce the spread of Onchocerca parasites. The results obtained through various pharmacological approaches and vector control methods have shown promising outcomes. This work therefore provides an analysis of the current state of knowledge regarding Simuliidae, their role in the transmission of animal filariases, and future prospects for controlling these parasites.

Keywords: Simuliidae, Onchocerca, filariases, spatiotemporal study, vectorial capacity, bovine onchocerciasis.

ANALYSIS OF NUTRITIONAL AND CLINICAL OUTCOMES ON MATERNAL-FETAL HEALTH AMONG WOMEN WITH PREGNANCY-INDUCED HYPERTENSION IN SÉTIF, ALGERIA

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ABSTRACT

This study aimed to compare twenty women with pregnancy-induced hypertension (PIH) to 80 normotensive controls and to investigate the relationship between maternal nutritional status, clinical evolution, and newborn health in Sétif region, Algeria. Mothers in the PIH group were older (mean age 31.82 ± 5.73 years) with class 1 obesity (Body Mass Index 31.06 ± 5.59 kg/m²), a 50% pauciparity rate, and male fetal predominance newborns. The PIH cases that evolved to preeclampsia presented a marked renal-vascular involvement, evidenced by a significant 24-hour proteinuria (651.33 ± 96.12 mg/24 h), hyperuricemia (50.00 ± 12 mg/L), mild systemic inflammation (CRP 12.85 ± 2.43 mg/L), and hypoalbuminemia (30.00 ± 7.89 g/L). In contrast, maternal creatinine (6.82 ± 1.25 mg/L), urea (0.36 ± 0.14 g/L), fasting blood glucose (0.74 ± 0.47 g/L), and normal hematological profile were well preserved. Nutritional assessment showed iron supplementation with a Mediterranean diet, supported by a high consumption of green vegetables, white beans, and poultry (35.5%) without pica. The obstetric and neonatal health problems were characterized by low gestational age (35.09 ± 2.97 weeks) and high cesarean delivery rates. PIH's newborns had a mean birth weight of 2338.64 ± 904.48 g and a lower rate of uncomplicated neonatal deliveries (63.6% vs. 84.1% in controls). Moreover, the incidence of early respiratory distress (58.3%) and neonatal jaundice (16.7%) was higher in newborns of PIH. In conclusion, appropriate maternal nutrition by itself is not enough to prevent the progression of vascular disease and requires coordinated clinical monitoring and specific neonatal care.

Keywords: Pregnancy-induced hypertension, nutrition, neonatal impact, Sétif, Algeria.

PRELIMINARY EVALUATION OF THE GENOTOXIC POTENTIAL OF A COMMERCIAL MONTELUKAST SODIUM PHARMACEUTICAL FORMULATION IN DROSOPHILA MELANOGASTER USING THE SOMATIC MUTATION AND RECOMBINATION TEST (SMART)

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ABSTRACT

Montelukast sodium is a leukotriene receptor antagonist widely used in the treatment of asthma and allergic rhinitis. Data regarding the genotoxic potential of montelukast are limited, and studies employing the Drosophila melanogaster Somatic Mutation and Recombination Test (SMART) are virtually nonexistent. Therefore, this preliminary study aimed to evaluate the genotoxic potential of a commercially available pharmaceutical formulation containing montelukast sodium using the *D. melanogaster* SMART assay. A commercial formulation, Onceair® 10 mg film-coated tablets, containing montelukast sodium was used in the study. The control group was treated with distilled water, whereas the experimental groups were exposed during the larval stage to solutions containing montelukast sodium at concentrations of 0.1, 1, 10, 100, and 200 mg/L. Following exposure, survival rates were determined, and wing preparations from the emerged adult flies were examined for spot frequencies according to the SMART scoring criteria. The results demonstrated no marked change in survival rate or significant genotoxic effect at concentrations of 0.1, 1, 10, and 100 mg/L compared with the control group. In contrast, exposure to 200 mg/L resulted in a reduced survival rate and a detectable genotoxic effect. These findings suggest that the commercial pharmaceutical formulation containing montelukast sodium may exhibit toxic and genotoxic potential in *D. melanogaster* at high concentrations, whereas no evident genotoxic effect was observed at lower concentrations under the present experimental conditions. To the best of our knowledge, this is the first preliminary study to evaluate the genotoxic potential of a commercial montelukast sodium tablet formulation in *D. melanogaster* using the SMART assay. Nevertheless, further comparative studies using the pure active pharmaceutical ingredient are warranted to clarify the possible synergistic or protective effects of the excipients present in the commercial formulation.

Keywords: Montelukast sodium, Drosophila melanogaster, SMART assay, genotoxicity

THE PRESENCE OF OSMIA ANDRENOIDES (SPINOLA, 1808) (HYMENOPTERA: MEGACHILIDAE) IN THE VJOSA-NARTË PROTECTED LANDSCAPE

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ABSTRACT

This study presents new documentation and ecological analysis of the wild bee *Osmia andrenoides* (Spinola, 1808) in the Vjosa-Narta Protected Landscape, an area of primary importance for coastal biodiversity in Albania. This specialized species, which nests exclusively in empty snail shells and displays a clear preference for the plant families *Lamiaceae* and *Plantaginaceae*, serves as a sensitive bioindicator of habitat integrity. Sampling was conducted between May and August 2025 across 29 stations, using pan traps, pitfall traps, and manual capture. Among the 53 identified hymenopteran species (18 families), *Osmia andrenoides* was recorded at only a single station (Station 1). Its extremely restricted distribution is closely linked to the intact microhabitats of the Aleppo pine forest (*Pinus halepensis*), low anthropogenic impact, and the availability of mollusk shells. Environmental pressures such as forest fires, seasonal flooding, shell burial by shifting sands, and uncontrolled tourism represent the primary limiting factors for this population. The findings highlight the critical importance of the mosaic of coastal habitats for species life. The presence of Osmia andrenoides confirms the high ecological value of the lagoon ecosystem and its role as a key habitat for Mediterranean biodiversity. This study highlights the need for further monitoring and conservation measures to protect this species.

Keywords: Osmia andrenoides, Hymenoptera, Narta Lagoon, bioindicators, shell nesting

RESEARCH ON THE SPECIFICITY OF BIOCHEMICAL PATHWAYS IN ARCHAEA

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ABSTRACT

For many years, archaea were categorized alongside bacteria due to their structural similarities. However, the work of Carl R. Woese in the 1970s revealed their distinct molecular structures, establishing these organisms as one of the three domains of life (Bacteria, Archaea, and Eukaryota). While metabolic pathways are generally well-conserved in other domains, archaea have been found to possess variant pathways containing various novel enzymes with a different control mechanism. This difference, in particular, involves specific biochemical mechanisms involving deviations from central carbohydrate metabolism, classical glycolysis, and pentose phosphate pathways. Central carbohydrate metabolism is fundamental to energy production and biosynthetic activities in living organisms. Currently, research on glycolytic enzymes from various phylogenetic lineages has revealed a structure composed of canonical and novel enzymes in archaeal variants of the Embden-Meyerhof-Parnas (EMP) and Entner-Doudoroff (ED) pathways. These differences are known to be pronounced in species resistant to extreme conditions such as high temperatures, high salinity, extreme pH, and high pressure. Archaeal metabolic systems include kinases that utilize ADP instead of ATP, ferredoxin-dependent oxidoreductases, and phosphorylation-independent energy conversion mechanisms. These characteristics have demonstrated that archaeal enzymes hold significant potential for biotechnological applications. Furthermore, due to their high resilience, archaea are used as fundamental model organisms in astrobiology research. From a broad perspective, this study addresses the discovery process of archaea, their resistance mechanisms to extreme conditions, fundamental biochemical differences in central carbohydrate metabolism derived from molecular and genetic data, as well as the structure, function, enzymatic constituents, and regulation of archaeal glycolytic pathways. Additionally, current biotechnological application fields and their potential roles in space research are evaluated.

Keywords: Archaea, Carbohydrate metabolism, Embden-Meyerhof-Parnas pathway, Entner-Doudoroff pathway, ADP-dependent kinases.

EMERGENCE OF LEISHMANIASIS IN NORTH-EASTERN ALGERIA, SAND FLY ECOLOGY AND SUSTAINABLE VECTOR CONTROL

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ABSTRACT

Leishmaniasis represents a major public health concern in Algeria, where both emerging and re-emerging forms are increasingly associated with environmental, climatic, and anthropogenic changes. Transmitted by sand flies (Diptera: Psychodidae), this zoonotic disease is characterized by a changing epidemiological profile, including the expansion of transmission areas and the modification of transmission patterns in different regions. This study focuses on the essential role of sand flies in the transmission cycle of leishmaniasis. It examines their species diversity, geographical distribution, seasonal dynamics, and adaptation to a variety of natural, rural, peri-urban, and urban habitats. Particular attention is given to the environmental factors that influence the abundance, dispersion, and activity of these vectors. Changes in ecosystems, land-use practices, urban expansion, population growth, and the degradation of natural habitats may create favorable conditions for the establishment and proliferation of sand fly populations. In addition, variations in temperature, humidity, and precipitation can affect vector development, survival, and interactions with reservoir hosts and Leishmania parasites. These processes may contribute to the emergence of new transmission foci and increase the risk of human infection. A better understanding of the complex interactions among vectors, pathogens, reservoir hosts, human populations, and environmental conditions is essential for strengthening epidemiological surveillance. Such knowledge can support the development of more effective prevention measures, targeted monitoring programs, and sustainable integrated vector-control strategies adapted to the Algerian context.

Keywords: Leishmaniasis, phlebotomine sand flies, vector-borne disease, climate change, habitat alteration, Algeria.

ISOMETRIC SCALING OF PRONOTAL AND ELYTRAL LINEAR DIMENSIONS IN MALE DORCADION YILMAZI FROM ÇORUM, TURKIYE

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ABSTRACT

Dorcadion is a flightless genus of Cerambycidae characterized by high taxonomic diversity and endemism in Türkiye. Previous geometric morphometric studies in Dorcadion have demonstrated pronotal and elytral shape differentiation between sexes and among populations, with such variation also providing evidence relevant to taxonomic differentiation within the genus. However, quantitative information on the length–width scaling of these structures within a single sex and population remains limited. This study therefore evaluated pronotal and elytral dimensions in 33 male specimens of Dorcadion (Cribridorcadion) yilmazi Özdikmen & Kaya, 2016 from the Çorum population and tested whether their length–width relationships were consistent with isometric scaling. Dorsal images were individually calibrated in Digimizer, and pronotal length (pL), maximum pronotal width (pW), elytral length (eL), and maximum elytral width (eW) were measured by a single observer. Length–width relationships were analyzed using standardized major axis (SMA) regression on natural-log-transformed measurements, with slopes tested against the isometric expectation of 1. Measurement repeatability and error were assessed in 10 males using intraclass correlation coefficients [ICC(A,1)] and relative technical error of measurement (rTEM), respectively. Significant length–width relationships were found in both the pronotum ($R^2 = 0.476$, $p < 0.001$) and elytra ($R^2 = 0.750$, $p < 0.001$). SMA slopes were 0.874 for the pronotum (95% CI = 0.673–1.136) and 0.930 for the elytra (95% CI = 0.775–1.116); neither differed significantly from 1, indicating scaling consistent with isometry. Measurement repeatability was generally high [ICC(A,1) = 0.742–0.971], while relative measurement error was low (rTEM = 1.29–3.22%). The stronger length–width association in the elytra suggests greater proportional consistency across the sampled size range. These findings establish a within-group proportional baseline for D. yilmazi males that can support future comparisons involving females, additional populations, and related Dorcadion taxa. Integrating such comparisons with geometric morphometric analyses may help determine whether morphological differentiation in Dorcadion involves changes in basic length–width scaling, finer-scale shape variation, or both.

Keywords: Dorcadionini, traditional morphometrics, allometry, standardized major axis regression, intraspecific variation, Cerambycidae

COMPARATIVE EVALUATION OF BIOACTIVE POTENTIAL: ESSENTIAL OIL VS ETHANOLIC EXTRACT OF EUCALYPTUS GLOBULUS LEAVES FROM CANASTEL FOREST (ORAN, ALGERIA)

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ABSTRACT

Background: *Eucalyptus globulus* Labill. is recognized for its therapeutic virtues. Evaluating different extraction methods is essential to optimize its bioactivities for pharmaceutical and industrial applications. **Objectives:** This study presents a comparative evaluation between the essential oil (EO) obtained by hydrodistillation and the crude ethanolic extract (EE) obtained by maceration from *E. globulus* leaves harvested in the Canastel forest (Oran, Algeria). **Methods:** Extraction yields were determined. Antibacterial and antifungal activities were evaluated using the disk diffusion method against *Bacillus cereus* (ATCC 10876), *Staphylococcus aureus* (ATCC 25923), *Pseudomonas aeruginosa* (ATCC 27853), *Escherichia coli* (ATCC 25922), and *Candida albicans* (ATCC 10231). Antioxidant capacity was measured using the DPPH assay. **Results:** The ethanolic extraction yield reached 20.15% (w/w). In antimicrobial tests, EE demonstrated broad-spectrum inhibition against all bacterial and fungal strains, notably targeting *S. aureus* (Gram+). In contrast, EO showed moderate activity against *B. cereus* (13 mm), *P. aeruginosa* (12 mm), and *C. albicans* (13 mm), but proved inactive against *S. aureus*. Antioxidant analysis revealed strong radical-scavenging activity for EE (IC50 =3.57 mg/mL; maximum inhibition of 97.63%), while EO displayed moderate efficacy (IC50 =89.2 µL/mL). The superior performance of EE is attributed to its richness in polyphenols, flavonoids, and non-volatile metabolites, complementing the volatile terpenes of EO. **Conclusion:** These two extracts confirm the biomedical value of *E. globulus* from Canastel, with the ethanolic extract offering a broader antimicrobial spectrum and more sustained antioxidant activity, making it a promising candidate for pharmaceutical, cosmetic, and food formulations. Detailed Summary Points: Extraction methods and obtainable yields: Essential oil (EO) is obtained by hydrodistillation using a Clevenger apparatus, isolating the volatile aromatic fraction. The ethanolic extract (EE) is prepared by ethanolic maceration at a 1:10 ratio, yielding a massive 20.15% (i.e., 4.03 g from 20 g of dried powder). Antioxidant activity (DPPH assay): The ethanolic extract exhibits remarkable antioxidant capacity, with a free radical inhibition rate reaching up to 97.63% and an IC50 value of 3.57 mg/mL. The essential oil displays a more moderate antioxidant potential with an IC50 of 89.2 µL/mL. Antibacterial activity profile and spectrum: The ethanolic extract demonstrates remarkable broad-spectrum inhibition across all studied reference strains (*Bacillus cereus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*). In comparison, the essential oil exhibits moderate activity against *B. cereus* (13 mm inhibition zone) and *P. aeruginosa* (12 mm), while proving completely inactive against the Gram-positive strain *Staphylococcus aureus*. Antifungal **activity:** Against the yeast *Candida albicans*, both extraction forms demonstrated inhibitory activity, characterized by a moderate inhibition zone of 13 mm for the essential oil and notable inhibition for the ethanolic extract. Composition and application prospects: The superior

activities of the ethanolic extract stem from its richness in non-volatile secondary metabolites (polyphenols, flavonoids, tannins), highly suitable for preservative and cosmetic formulations. The essential oil, on the other hand, concentrates volatile terpenes (such as 1,8-cineole), which are particularly sought after for their targeted antiseptic and aromatherapeutic properties.

Keywords: Eucalyptus globulus , Canastel Forest, Essential Oil, Ethanolic extracts, antimicrobials, antioxydants ,test DPPH

ROLE OF WATER IMBIBITION FOR 80 HOURS IN MANAGING GERMINATION ON OF SEEDS OF GLORIOSA SUPERBA

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ABSTRACT

Gloriosa superba L. is an endangered ornamental and medicinal plant primarily found in South Africa and Northern India. It is valued for colchicine extraction and is propagated mainly through rhizomatous tubers, with seed multiplication being rare due to complex dormancy issues influenced by hard seed coats and lack of gibberellins. This study evaluated treatments to enhance tuber induction under in vitro conditions using Murashige and Skoog (MS) medium. Findings revealed that seed germination did not positively correlate with tuber induction; however, the best results were achieved through a 80-hour water soaking combined with 1500 mg L^{-1} GA_3. Sucrose supplementation improved tuber induction, leading to recommendations for optimized protocols for germination and tuber formation, which could aid in the conservation and commercial cultivation of this species. Gloriosa superba L. is an endangered ornamental and medicinal plant primarily found in South Africa and Northern India. It is valued for colchicine extraction and is propagated mainly through rhizomatous tubers, with seed multiplication being rare due to complex dormancy issues influenced by hard seed coats and lack of gibberellins. This study evaluated treatments to enhance tuber induction under in vitro conditions using Murashige and Skoog (MS) medium. Findings revealed that seed germination did not positively correlate with tuber induction; however, the best results were achieved through a 80-hour water soaking combined with 1500 mg L^{-1} GA_3. Sucrose supplementation improved tuber induction, leading to recommendations for optimized protocols for germination and tuber formation, which could aid in the conservation and commercial cultivation of this species.

Keywords: Gloriosa superba, colchicine, seed, germination, tuber induction, sucrose

ROLE OF ALLELOPATHY IN MANAGING MICROSHOOT REGENERATION ON HALF COTYLEDON EXPLANTS OF LATHYRUS SATIVUS L.

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ABSTRACT

Allelochemicals, are natural plant metabolites, present in many plant species, which act as inhibtors of growth to neighbouring plants under natural conditions. The same pathway is observed if the some plants are cultured under exvitro conditions.These are could inhibit regeneration on the neighbouring explants. Lathyrus sativus contain number of metabolites, resins and tannins. This paper aims to emphasize the importance of allelochemicals, induced under in vitro conditions and explains their effects on induction and regeneration of lathytus sativus on half cotyledon explants. Fifteen explants wer used for each treatment. Five explants were used in each replication. It was obsrved that they inhibited regeneration on the the neighbourıng explants. 0.05 to 0.4 mg/l TDZ+ 0. 4 mg/l ascorbic acid was used in th culture medium for regeneration. No regneration was noted on the explants if growth regulators were not used in the culture medium. The study discuss role allelopathy in managing regeneration and and sustainble development of microcultures on half cotyledon explants of lathyrus sativus L. which is cultivated in balkan states, to South Asian countries and Ethıopia in Africa for food feed and forage production.

Keywords: allelopathy, management, micropropagation, in vitro, regeneration, sustainable agriculture, half cotyledon explant

Evaluation of Cyanotoxin-Induced Cellular Damage and Apoptotic Responses in a Neuroblastoma Cell Line

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ABSTRACT

Cyanobacteria, commonly referred to as “blue-green algae,” are Gram-negative prokaryotic microorganisms. In terms of their cellular organization, these microorganisms share considerable structural similarities with Gram-negative bacteria. Cyanobacteria inhabiting freshwater ecosystems can undergo uncontrolled proliferation in response to elevated concentrations of nitrogen- and phosphorus-containing nutrients in the water, particularly under increasing environmental temperatures. In recent years, climate change and increasing eutrophication in aquatic environments have contributed to the more frequent occurrence of cyanobacterial blooms, thereby increasing the risk of exposure to their associated toxins. Among these toxins, microcystin-LR (MC-LR) and β-N-Methylamino-L-alanine (BMAA) are of particular concern due to their potential adverse effects on the nervous system, despite having distinct mechanisms of action. The available evidence indicates that MC-LR and BMAA may induce cellular damage in the nervous system and highlights the need to investigate the molecular events underlying their neurotoxic effects, as well as their potential significance as environmental risk factors. Therefore, elucidating the neurotoxic effects of these toxins at the cellular and molecular levels is of great importance for assessing environmental risks and developing effective preventive strategies to protect public health. The findings of this study suggest that exposure to cyanotoxins may contribute to the induction of neurodegenerative processes in neuroblastoma cells.

Keywords: Cyanotoxins, Apoptosis, Cellular Damage

ETHNOBOTANICAL STUDY AND ESSENTIAL OIL CONTENT OF MELISSA OFFICINALIS L. DISTRIBUTED IN THE ZAQATALA–BALAKAN REGION

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ABSTRACT

Introduction: The plant Melissa officinalis L. has been used in Azerbaijan as an ethnobotanical medicinal plant in traditional medicine from ancient times to the present day, particularly as an antispasmodic for gastrointestinal pain. Its leaves are also used as a spice.
Known locally as “honey mint” in the Zaqatala–Balakan region, Melissa officinalis L. (lemon balm) has a wide natural distribution in the middle- and low-mountain forest zones, shrublands, and moist areas along rivers on the southern slopes of the Greater Caucasus. It occurs naturally in the forest-adjacent areas of the Zaqatala and Balakan districts, in the Katekhchay valley, and around foothill villages. The species is distributed from the lowland belt at sea level to the middle-mountain zones. **Materials and Methods:** Plant material was collected from the Zaqatala–Balakan region of the Greater Caucasus. In general, drying is based on the dehydration of plant material. Under conditions where free water is absent, microorganisms cannot develop. For the analysis, a 20 g sample of dried plant material was taken, essential oil was extracted, and its component composition was investigated. Hydrodistillation and gas chromatography–mass spectrometry (GC–MS) were used to determine the composition of the obtained essential oil. **Results:** The total essential oil yield was 0.30%. The following major components were identified: geraniol – 27.11%, β-citronellal – 10.27%, 1-octen-3-ol – 1.20%, β-ocimene – 1.12%, linalool – 4.33%, 3-carene-2-one – 1.21%, β-caryophyllene oxide – 12.52%, humulene epoxide – 0.75%, menthone – 1.01%, citral A – 18.01%, germacrene – 3.35%, bornyl acetate – 0.73%, and piperitone – 1.24%. Among the identified components in the essential oil of the studied sample, the highest proportion was recorded for geraniol (27.11%). These results indicate that the chemical composition of the essential oil is characterized mainly by oxygenated monoterpenes and sesquiterpene derivatives. According to the literature, Melissa officinalis is also rich in flavonoids, fixed oils, vitamins C, B1, and B2, carotene, coumarins, tannins, and aromatic compounds. The principal components of its essential oil include citral and citronellal, which are responsible for its characteristic lemon-like aroma. The plant contains phenolic compounds and flavonoids with antioxidant activity, including apigenin, cosmosiin, luteolin, cynaroside, and rhamnocitrin, as well as phenolic carboxylic acids such as gentisic, salicylic, p-hydroxybenzoic, vanillic, and protocatechuic acids. Among its vitamins are B1, B2, C, and β-carotene. Its macroelements include potassium, calcium, magnesium, and iron, while its microelements include manganese, copper, zinc, molybdenum, chromium, and selenium. The study species, M. officinalis L., has been reported to possess antioxidant, antibacterial, antifungal, antiviral, sedative, hypotensive, choleretic, hemostatic, vasoconstrictive, analgesic, laxative, and anti-inflammatory properties. It is an important component of sedative medicinal preparations. It has also been reported to alleviate dyspnea and cardiac pain and to stimulate and strengthen the nervous system. The high therapeutic efficacy of the plant is associated with its essential oil content. Lemon balm

regulates gastric secretion, reduces spasms, alleviates enzyme deficiencies, and improves metabolism. It is traditionally used in cases of neurosis, weakness, vegetative–vascular dystonia, intestinal dyskinesia and intestinal colic, cholecystitis, cholangitis, kidney stones, urinary tract disorders, angina pectoris, and menopausal syndromes. When applied externally, the plant has been reported to have beneficial antibacterial and antiviral effects and is used for conditions such as furunculosis, herpes, stomatitis, and periodontosis. Lemon balm tea is also traditionally used in the treatment of cold sores. Due to its antioxidant constituents, creams containing lemon balm extract have been reported to be effective in the treatment of herpes, promoting faster healing and reducing the progression of the condition. Hot teas prepared from lemon balm are traditionally used to relieve headaches and dizziness. Lemon balm, when used in combined preparations such as extracts and infusions, exhibits sedative, antispasmodic, analgesic, and hypotensive effects. Lemon balm infusion is also traditionally consumed as a tea for lowering blood pressure. At present, dried lemon balm herb is produced by various companies in Azerbaijan in the form of herbal mixtures and is commercially available.

Keywords: hydrodistillation, pharmacology, experimental, flavonoid, antioxidant, ethnobotany

ADVANCES IN THE DEVELOPMENT AND CHARACTERIZATION OF BIO-COMPOSITES WITH BIODEGRADABLE REINFORCEMENT

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ABSTRACT

The increasing demand for sustainable materials that combine mechanical strength with reduced environmental impact has placed bio-composites at the center of contemporary materials research. Composites, by definition, are created by combining two or more distinct constituents, producing systems with properties that surpass those of their individual components. Their ability to achieve both light weight and high resistance has made them indispensable in engineering and manufacturing, with applications ranging from aerospace and automotive to construction and consumer products. Traditionally, synthetic fibers such as glass have been employed as reinforcements; however, natural fibers—including jute, hemp, flax, and sisal—are now attracting significant attention because of their ecological advantages, cost efficiency, and non-abrasive nature. Recent investigations emphasize the importance of optimizing fiber content and processing conditions to balance durability, strength, and sustainability. Natural fibers not only reduce environmental burdens but also align with the principles of green engineering and circular economy systems. In this study, natural fillers were incorporated into high-density polyethylene at varying loadings (0, 10 wt%, 20 wt%, and 30 wt%), both chemically treated and untreated. The results reveal clear correlations between filler parameters and the mechanical, physical, and rheological performance of the bio-composites. Specifically, the influence of fiber treatment and content strongly determined improvements in strength, stiffness, and wear resistance. These findings underline the potential of bio-composites as environmentally responsible alternatives to conventional materials. By tailoring reinforcement strategies, researchers can design polymeric composites that meet demanding performance requirements while simultaneously advancing sustainability goals. This dual achievement opens new pathways for innovation across multiple industrial sectors.

Keywords: PEHD, Natural fibers, Surface treatment, Mechanical behavior, Physical properties.

EXTRACTION, PHYSICOCHEMICAL, THERMAL AND INTERFACIAL CHARACTERIZATION OF POLYSACCHARIDES FROM OPUNTIA CLADODES

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ABSTRACT

The present study aims to extract, characterize, and evaluate the functional properties of polysaccharides obtained from cladodes of Opuntia (Cactaceae), with a view toward their potential valorization in industrial applications. Particular emphasis was placed on elucidating their thermal stability, physicochemical composition, and interfacial behavior, which are critical parameters for their use in cosmetic, pharmaceutical, and packaging systems.
Polysaccharides were isolated via hot water extraction, followed by liquid separation and precipitation steps. Two fractions were obtained and designated MUIS and MUET. MUIS exhibited an extraction yield of 23.2 % and was particularly rich in uranic acid, arabinose, and galactose, whereas MUET (19 %) was characterized by a predominance of hexoses. These compositional differences suggest variations in molecular architecture and potential functional behavior. Thermal properties were investigated using thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). The results demonstrated that both polysaccharide fractions possess significant thermal stability over a defined temperature range. However, MUET exhibited superior thermal resistance, with a degradation (pyrolysis) temperature of approximately 310 °C, likely attributed to its higher hexose content. In contrast, MUIS showed thermal decomposition at around 260 °C, indicating comparatively lower thermal stability. Interfacial properties were further assessed through measurements of surface tension and particle size distribution as a function of polysaccharide concentration. The findings revealed a marked decrease in surface tension with increasing polysaccharide concentration, highlighting their potential as surface-active agents. Additionally, the average particle size ranged from 17 to 400 μm, reflecting the influence of concentration and structural characteristics on dispersion behavior. Overall, the results demonstrate that Opuntia cladode-derived polysaccharides exhibit tunable physicochemical and functional properties governed by their monosaccharide composition and structural features. These attributes make them promising candidates for diverse industrial applications, particularly as natural stabilizers, thickeners, or bio-based functional ingredients.

Keywords: Opuntia, mucilage, polysaccharide, thermal resistance

EFFECT OF CARBON NANOTUBE INCORPORATION ON THE IMPROVEMENT OF MATERIAL PROPERTIES FOR FOOD PACKAGING

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ABSTRACT

The food industry has been developing innovative nanomaterial-based solutions for several years, primarily in the field of food packaging. Their use improves both product preservation and traceability. Nanoparticles have long been employed in the food sector, either because they are naturally present in certain foods or because they are incorporated as food additives.
In recent years, the development and application of hydrogel matrix nanocomposites have attracted increasing attention, particularly as a new class of biomaterials that combines the advantages of nanofillers and polymer matrices. These nanocomposites exhibit enhanced mechanical and biological properties, making them promising candidates for a wide range of biomedical applications. The objective of this study is to reinforce materials using carbon nanotubes. The incorporation of carbon nanotubes into polymer matrices such as starch, xanthan gum, and other biopolymers enhances the mechanical strength of packaging materials by improving their elastic properties, as confirmed by rheological analyses. Improved packaging strength enables the production of thinner packaging materials, thereby reducing raw material consumption as well as transportation and storage costs. Furthermore, the human body absorbs nutrients such as vitamins and enzymes more efficiently when they are encapsulated. For this reason, several compounds with therapeutic and nutritional benefits have been encapsulated within nanoscale delivery systems to improve their stability and effectiveness. Enhanced bioavailability was demonstrated through dissolution studies.

Keywords: nanotechnologies, carbon nantubes, materials, packaging, proprieties

DEVELOPMENT OF A CELLULOSE NANOCRYSTAL BASED CARRIER SYSTEM TO ENHANCE THE BIOAVAILABILITY OF BERBERINE

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ABSTRACT

Berberine, an isoquinoline alkaloid isolated from Berberis plants, exhibits potent therapeutic anti-inflammatory and antidiabetic activities, yet its clinical efficacy is heavily restricted by poor water solubility (0.000354 mg/mL) and low oral bioavailability. To overcome these pharmacokinetic limitations and bypass the complex processing of conventional nanocarriers, this study develops an innovative oral drug delivery platform utilizing cellulose nanocrystals (CNCs) synthesized from industrial poplar wood (Populus alba) sawdust waste. The design relies on the electrostatic self-assembly between the permanent positive charge of cationic berberine and the dense, anionic surface sulfate ester groups ($–OSO3^-$) of the synthesized CNC carrier matrix. The methodology encompasses the multi-step isolation of alpha-cellulose via alkali treatments, followed by controlled sulfuric acid hydrolysis (64% H2SO4) to yield rod-like nanocrystals. Structural and morphological tracking across all production stages is conducted using Fourier-transform infrared spectroscopy (FT-IR), electron microscopy (SEM/TEM), thermogravimetric analysis (TGA), dynamic light scattering (DLS), and Zeta Potential measurements. Sequential in vitro dissolution testing in simulated gastric fluid (pH 1.2) and simulated intestinal fluid (pH 7.4) evaluates gastric stability and controlled intestinal release behaviors. The drug loading capacity of the synthesized carrier system was determined as 6%, and the cumulative drug release was calculated to be 40%. Release kinetics are mathematically simulated using different kinetic models to fully elucidate the transport mechanism. Ultimately, this research delivers a comprehensive framework for a CNC-based drug delivery system that optimizes oral bioavailability while advancing sustainable biomass valorization within a circular bioeconomy.

Keywords: Berberine, biomass valorization, cellulose, cellulose nanocrystal, drug delivery

EVALUATION OF THE EFFECTIVENESS OF PLANT-BASED BUILDING MATERIALS IN TERMS OF RESOURCE AND ENERGY EFFICIENCY

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ABSTRACT

The sustainability of a clean and healthy environment is directly linked to the protection of ecosystems and biodiversity. In this context, the use of environmentally friendly materials has become increasingly important in the construction sector. In today's widely adopted green building certification systems, energy efficiency, resource utilization, and material selection are among the primary evaluation criteria. As the naturalness of construction materials increases and the level of processing decreases, their energy efficiency also improves. Research indicates that plant-based materials should be prioritized in building design and construction to minimize energy consumption. Plant-based building materials with low embodied energy and derived from renewable resources represent a significant alternative to conventional materials. Accordingly, the use of bio-based and bio composite materials is steadily increasing in the construction industry within the framework of sustainable building practices. Plant-based materials stand out due to their natural, environmentally friendly, and sustainable characteristics. Their renewable nature, ability to reduce carbon footprints, positive contribution to occupant health, and excellent thermal insulation performance provide considerable potential for their widespread application as construction materials worldwide. For these reasons, plant-based building materials are regarded as an important step toward achieving sustainability goals in the construction industry. Promoting the research, development, and application of these materials is of great importance for sustainable building design. The aim of this study is to evaluate the effectiveness of plant-based building materials in terms of resource and energy efficiency. Within this scope, the role of plant-based building materials in sustainable construction and their relationship with the Life Cycle Assessment (LCA) approach are examined. Furthermore, the study investigates the place of these materials within national and international regulations, green building certification systems (such as BREEAM, LEED, CASBEE, and GBTool), and life cycle assessment tools to assess their potential contribution to the sustainable construction sector.

Keywords: Plant-based building materials, Life cycle assessment, Green building certificate systems, Energy use, Embodied energy.

DUAL SPINNERET ELECTROSPINNING AS A PLATFORM FOR THE DESIGN OF CHITOSAN-BASED FIBROUS MATERIALS CONTAINING ROSMARINIC ACID AND LIDOCAINE

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ABSTRACT

Dual spinneret electrospinning has been applied for the preparation of novel multifunctional fibrous materials composed of fibers from poly(L-lactide) (PLA)/lidocaine hydrochloride (LHC) and from poly(vinyl alcohol) (PVA)/chitosan (Ch)/rosmarinic acid (RA) (PLA/LHC + PVA/Ch/RA). This was achieved by simultaneous dual spinneret electrospinning of PLA/LHC and PVA/Ch/RA solutions. Both types of fibers are present on the surface and in the bulk of (PLA/LHC + PVA/Ch/RA) materials as evidenced by confocal laser scanning microscopy. RA and LHC are in an amorphous state in the fibers as demonstrated by X-ray diffraction analysis. The newly developed materials possessed adequate mechanical properties, making them suitable for use in wound dressing applications. The *in vitro* release of RA and/or LHC was monitored by UV-vis spectrophotometry in PBS (pH 7.4) at 37°C. The RA-containing fibrous mats displayed pronounced radical-scavenging activity, and the incorporation of LHC further increased their antioxidant potential. The newly developed materials are promising as multifunctional wound dressings with antioxidant, antimicrobial and local anesthetic activities.

Acknowledgments: Financial support from the Bulgarian National Science Fund (Grant KP-06-N89/9/2024) is kindly acknowledged.

Keywords: chitosan; poly(L-lactide), dual spinneret electrospinning, rosmarinic acid, lidocaine, mechanical performance, antioxidant activity

ROSMARINIC ACID-LOADED MULTIFUNCTIONAL FIBROUS POLYMER MATERIALS WITH ANTIOXIDANT, ANTIBACTERIAL AND ANTIFUNGAL ACTIVITIES

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ABSTRACT

Electrospun fibrous materials loaded with bioactive compounds have emerged as promising candidates for biomedical applications owing to their ability to combine several desirable properties, such as adequate hydrophilicity and mechanical performance, and antioxidant and antimicrobial activities. In this study, novel multifunctional fibrous materials from poly(vinyl alcohol) (PVA), polylactide (PLA), chitosan (Ch), and natural bioactive polyphenolic acid rosmarinic acid (RA) were successfully fabricated. This was achieved through simultaneous dual-spinneret electrospinning of two separate solutions differing in composition. The morphology of the newly developed materials and their chemical composition were investigated by SEM, TEM and ATR–FTIR spectroscopy. Confocal laser scanning microscopy confirmed the presence of fibers from both PVA/Ch/RA and PLA throughout the bulk and on the surface of the materials. The improved hydrophilicity combined with adequate tensile performance of the prepared fibrous materials significantly expands their potential biomedical applications, especially in wound healing. The prepared RA-loaded mats exerted high antioxidant activity. These materials manifested good antibacterial and antifungal efficacy against pathogenic bacteria and fungi. Therefore, the obtained novel multifunctional electrospun materials are promising candidates for variety of applications in the biomedical field, e.g. in wound healing applications and as systems for local drug delivery.

Acknowledgments: Financial support from the Bulgarian National Science Fund (Grant KP-06-N89/9/2024) is kindly acknowledged.

Keywords: dual spinneret electrospinning, poly(vinyl alcohol), poly(L-lactide), chitosan, rosmarinic acid, antioxidant activity, antibacterial and antifungal efficacy

EFFECT OF ROSMARINIC ACID LOCALIZATION ON THE RELEASE BEHAVIOR AND ANTIMICROBIAL ACTIVITY OF PEC-COATED ELECTROSPUN PLA FIBERS

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ABSTRACT

Multifunctional wound dressings with controlled release and antimicrobial activity remains an important objective in wound care. In this study, electrospun poly(L-lactide) fibrous materials coated with chitosan/hyaluronic acid polyelectrolyte complex (PEC) were developed to investigate the effect of rosmarinic acid (RA) localization on RA release behavior and antimicrobial activity. RA was incorporated either into the fibers or within the PEC coating, generating fibrous materials with different architectures and spatial distribution of the bioactive compound. TEM confirmed the presence of a continuous PEC coating surrounding the fibers and CLSM demonstrated the localization of RA within the fibrous structures. RA was in an amorphous state as shown by X-ray diffraction analysis. In vitro release studies showed that RA localization affected the release profile of the bioactive compound. The microbiological screening against Gram-positive, Gram-negative bacteria, and fungi demonstrated that the localization of RA influenced the antimicrobial activity of the developed fibrous materials, highlighting their potential for wound dressing applications.

Acknowledgments: Financial support from the Bulgarian National Science Fund (Grant KP-06-N89/9/2024) is kindly acknowledged.

Keywords: chitosan, hyaluronic acid, poly(L-lactide), electrospinning, polyelectrolyte complex, antimicrobial activity

GREEN FORMULATION OF WATER-BASED DRILLING MUD WBM WIYH LOW COST: SUBSTITUTION OF POLYMERS BY AGRICULTURAL WASTES LBG

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ABSTRACT

Currently in the field of oil well drilling, research tends to use new technologies including alternative components for drilling fluids. Among the compounds that can be used in drilling fluids, carob nuts. The aspect of this project has been inserted into a section for the recovery of agricultural waste in order to minimize the degradation of the natural environment. This part of the work focused on the development of a biopolymer derived from carob nuts because of its techno-functional properties (stabilizer, thickener, binder and gelatinizer). In order to enhance the carob grains, preliminary treatments were carried out: Acid shelling (maceration), washing, soaking, drying and grinding operations. During this work, we wanted to check the conformity and study the performance of locust bean gum, which is a biodegradable biopolymer of plant origin derived from biomass, obtained locally, that we are substituting for other conventional products in the field of water-based Muds drilling fluids. In particular we have studied the effect of carob gum as a filtrate reduction instead of polyanionic cellulose (PAC LV), and as a viscosifying instead of Xanthane gum which are imported biopolymers. These polymers often increase the cost price of a drilling operation. Finally a water-based drilling mud formulated using environmentally friendly and low-cost locust bean gum has been developed by substituting total and partial biopolymer of Xanthan Gum (PAC LV) giving better rheological properties and flow control. Fluid loss requirements necessary for proper oil well drilling operation.

Keywords: drilling, drilling fluids, biopolymers, agricultural wastes

DIGITALIZATION AND CARBON FOOTPRINT IN MANUFACTURING: THE ROLE OF RENEWABLE ENERGY SYSTEMS IN INDUSTRY 4.0

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ABSTRACT

Industry 4.0 has accelerated digital transformation across manufacturing sectors, bringing significant gains in economic productivity and operational efficiency through technologies such as data centers, artificial intelligence, big data analytics, and interconnected digital devices. However, these technological advancements carry a substantial and frequently underestimated environmental cost, particularly in terms of rising energy consumption and carbon emissions. While a growing body of literature acknowledges the operational benefits of digitalization, existing studies consistently fall short of providing a comprehensive analysis of the carbon related organizational challenges companies must overcome and the systemic institutional changes required to address them effectively. Current research tends to prioritize technological performance outcomes, especially within manufacturing contexts, while largely neglecting the carbon governance complexities faced by large corporations. Unlike SMEs, which have received comparatively more attention in the sociotechnical literature, large manufacturing firms operate within expansive global supply chains, rigid hierarchical structures, and formalized decision making processes that significantly hinder their ability to implement agile, sustainability driven strategies. Consequently, despite possessing greater resources and emission reduction capacity, these organizations often struggle to leverage digital tools effectively for greenhouse gas monitoring, reporting, and reduction purposes. Renewable energy systems emerge as a critical countermeasure, simultaneously enhancing energy security and reducing the carbon footprint associated with coal dependent industrial production. Through a systematic review of national and international academic literature, this study evaluates the multifaceted environmental implications of digitalization from a renewable energy integration perspective. This study concludes that evaluating digitalization solely through economic and technological lenses is fundamentally insufficient. A transition toward energy-efficient technologies, expanded renewable energy adoption, and circular economy principles is essential to reconciling digital advancement with environmental responsibility. By examining the intersection of the digital economy and carbon emissions through a renewable energy lens, this study offers a holistic contribution to the existing literature and calls for a more balanced and sustainability-conscious approach to industrial digitalization.

Keywords: Digitalization, Carbon Footprint, Renewable Energy Systems

EXTRACTION OF LIGNIN FROM OLIVE HUSK FLOUR BY MICROWAVE AND ULTRASOUND-ASSISTED METHODS FOR THE SYNTHESIS OF LIGNIN NANOPARTICLES

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ABSTRACT

Olive pomace is an abundant agro-industrial by-product generated during olive oil production, especially in Mediterranean regions. Although its disposal may create environmental concerns, this lignocellulosic residue represents a valuable renewable source of lignin, a natural aromatic biopolymer with strong potential for the development of high-value materials. Because of their polyphenolic structure and reactive functional groups, LNPs may exhibit interesting antioxidant and UV-shielding properties, making them promising for biodegradable packaging, including food packaging, as well as protective coatings and certain polymer systems. After further biocompatibility and safety studies, they may also become relevant in the biomedical field, particularly for active-molecule delivery and controlled-release systems. The present study aims to valorize olive husk flour by extracting lignin and converting it into lignin nanoparticles (LNPs). Lignin is extracted from olive husk flour by microwave-assisted extraction. This method was selected because microwave heating can enhance heat and mass transfer during the extraction process while reducing processing time. The extracted lignin is then recovered, purified, and used as a natural precursor for LNP synthesis. The nanoparticles are synthesized using an ultrasonic probe through a sonication-assisted nanoprecipitation process, where acoustic cavitation promotes rapid mixing, nucleation, and the formation of uniform lignin nanostructures. This research follows a circular-economy approach by transforming an abundant agricultural residue into renewable lignin-based nanomaterials. The expected results will provide a scientific basis for future investigations into the use of LNPs as functional fillers in biodegradable polymer matrices and durable biocomposites. Overall, this work may contribute to the valorization of olive-processing residues, the reduction of their environmental impact, and the development of environmentally friendly materials with industrial potential.

Keywords: olive pomace, lignin, microwave-assisted extraction, lignin nanoparticles, ultrasonic probe, biodegradable packaging, biocomposites, circular economy, olive husk flour.

A DFT STUDY ON THE INTERACTION MECHANISM OF IOPROMIDE CONTRAST AGENT ON FULLERENE SURFACES

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ABSTRACT

The interaction between iopromide and MnB39 is an important research area with implications for drug delivery and imaging applications. In this study, the adsorption behaviour of the iopromide contrast agent on the surface of the Mn-doped boron fullerene B40 (MnB39) was investigated. DFT calculations were performed to characterise the interactions between iopromide and the fullerenes. We investigated adsorption behaviour, charge transfer, and the nature of interactions between iopromide and MnB39, including the non-covalent interaction (NCI) index with reduced density gradient (RDG) analysis and the electron localisation function (ELF) graphs. HOMO-LUMO analysis, density of states (DOS) and electronic properties, along with quantum molecular descriptors, were obtained to assess the sensor ability of the MnB39 fullerene. The adsorption energies (Eads), recovery time values, and thermodynamic analysis (ΔH, ΔG) of iopromide/MnB39 complexes in the gas phase were calculated for different adsorption sites and doping configurations to assess the drug-delivery and drug-carrier capabilities of Mn doped boron fullerenes. For imaging applications, nonlinear optical (NLO) properties such as dipole moment, isotropic polarizability (α), anisotropic polarizability ($\Delta\alpha$) and first hyperpolarizability (β) were calculated. The notable change in NLO properties has been interpreted as the NLO response of MnB39. It was proposed that MnB39 is a candidate nanoplatform for detecting, sensing and imaging for drug delivery and sensor applications.

Keywords: Boron fullerene, Iopromide, Contrast agent, Drug delivery, Biosensor, DFT

DOPING EFFECT ON BIPHENYLENE NANOTUBES: A DFT STUDY

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ABSTRACT

Biphenylene nanotubes (BPNTs) have recently emerged as promising one-dimensional carbon nanostructures owing to their unique non-hexagonal topology. BPNTs are carbon allotropes composed of alternating four-, six-, and eight-membered carbon rings. BPNTs offer a clear alternative to Carbon Nanotubes (CNTs) because their high surface reactivity is well suited to sensor applications. This study aims to comprehensively evaluate the potential of pristine BPNTs and Al-, Si-atom-doped BPNTs (Al-BPNTs) and (Si-BPNTs) for nanosensor applications by examining their structural, electronic, and quantum-chemical properties using Density Functional Theory (DFT) calculations. As reported, pristine BPNTs are semi-metallic, irrespective of their chirality. Changes in the electronic band gap (Eg), the density of states (DOS) of pristine BPNT, and the charge density difference (CDD) due to Al-, Si- atom doping have been observed in both gas and water phases. The results reveal that the BPNT exhibits intrinsic metallic behaviour with a high density of states at the Fermi level, making it a highly sensitive platform for nanosensor applications. Doping effects are dominant. A widening of the band gap is observed with Si- atom doping. The Fermi energy level and HOMO-LUMO energies change slightly, and the sensor signal remains detectable. These findings demonstrate that atomic doping provides a practical strategy for tuning the electronic properties of BPNTs for future nanosensor designs.

Keywords: Metal -Doped Biphenylene Nanotubes (BPNTs), Sensors, DFT

BACTERIA-GENIC SILVER NANOPARTICLES (AGNPS): GREEN SYNTHESIS, CHARACTERIZATION, AND ACUTE TOXICITY ASSESSMENT USING ARTEMIA SALINA (BRINE SHRIMP) AS A MODEL ORGANISM

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ABSTRACT

AgNPs are among the most important nanomaterials in the field of nanotechnology due to their unique physicochemical properties and wide range of applications in medicine, food technology, textiles, water treatment, and other industrial sectors. However, conventional physical and chemical methods for AgNP synthesis often involve toxic reagents, high energy consumption, and complex procedures, which may generate hazardous by-products and pose environmental concerns. Consequently, increasing attention has been directed toward green synthesis approaches that employ biological resources, including microorganisms, plant extracts, and natural biomolecules, as reducing and stabilizing agents. The present study aimed to investigate the green synthesis of AgNPs using silver nitrate as the precursor and the cell-free filtrate (CFF) of Brevibacillus parabrevis OW4 as a biological reducing and capping agent. The biosynthesized AgNPs were physicochemically characterized and their acute toxicity was evaluated using Artemia salina (Linnaeus, 1758) larvae as a model organism. The results confirmed the successful biosynthesis of AgNPs under optimized conditions. Physicochemical characterization revealed the formation of crystalline, spherical AgNPs, with a strong surface plasmon resonance peak at around 420 nm. The acute toxicity assay demonstrated a concentration-dependent effect, with a 24-h LC_{50} of 280 µg/mL. The observed toxicity was relatively low compared with the reference toxicant potassium dichromate ($K_2Cr_2O_7$) under the tested conditions. These findings highlight the potential of B. parabrevis OW4-mediated AgNP synthesis as an eco-friendly approach and suggest that the resulting AgNPs may be promising candidates for water treatment applications, particularly in view of their relatively low acute toxicity.

Keywords: green synthesis, silver nanoparticles, nanotechnology, Artemia Salina , Toxicity.

EFFECT OF NITROGEN SOURCES ON GROWTH, LIPID CONTENT, AND PIGMENT PRODUCTION IN SCENEDESMUS SP.

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ABSTRACT

Microalgae represent a promising resource for the production of high value-added molecules, attracting increasing interest for applications in biofuels, pharmaceuticals, nutraceuticals, and environmental biotechnology. This study aims to optimize the growth and lipid production of the freshwater microalga Scenedesmus sp., isolated from the estuary of Oued Cheliff (Algeria). The strain was cultivated for 12 days at 25 °C in Erlenmeyer flasks under continuous aeration, in order to evaluate the effect of different nitrogen sources on its physiological and biochemical responses. Five nitrogen treatments were tested: ammonium chloride (NH_4Cl), ammonium hydroxide (NH_4OH), sodium nitrate ($NaNO_3$), urea, and a mixture of all sources at equal concentrations. The results revealed that the nature of the nitrogen source significantly influences algal growth, pigment synthesis, and lipid accumulation. The highest growth rate (1.701 day^{-1}) and pigment content (2.46% chlorophyll a, 4.47% chlorophyll b, and 0.15% protective carotenoids) were obtained when $NaNO_3$ was used as the nitrogen source. In contrast, the highest total lipid content (38.69%) was recorded in cultures supplemented with the mixed nitrogen sources, suggesting a metabolic shift toward lipid storage under these conditions. These findings demonstrate that nitrogen availability and chemical form play a key role in regulating metabolic pathways in Scenedesmus sp., influencing both biomass productivity and biochemical composition. Therefore, the selection of an appropriate nitrogen source represents an effective strategy to orient microalgal cultivation toward either enhanced growth or increased lipid production, depending on the targeted application. This study provides valuable insights for the optimization and sustainable biotechnological valorization of Scenedesmus sp. in various industrial sectors.

Keywords: Scenedesmus sp., nitrogen source, growth rate, total lipids, pigments.

INTEGRATED CYTOGENETIC APPROACHES FOR THE ANALYSIS OF CHROMOSOMAL DIVERSITY IN THE ALGERIAN FLORA

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ABSTRACT

Introduction: Cytogenetics is a fundamental tool for studying the organization and variability of genomes in angiosperms. The analysis of chromosome number and structure provides a better understanding of the mechanisms involved in the diversification and evolution of plant species. In this context, the present work aims to investigate the chromosomal diversity of several species of Algerian flora using both classical and molecular cytogenetic approaches.
Materials and Methods: The cytogenetic study focuses on natural populations belonging to angiosperm species sampled in Algeria. Chromosome analysis in mitosis and meiosis is based on several staining techniques, including banding methods (C-bands, Giemsa staining), the Feulgen reaction, and lactopropionic orcein staining. Fluorescence in situ hybridization (FISH) is also performed using the RT Copia probe, amplified in Hordeum murinum ssp. glaucum, as well as probes targeting the two rDNA loci (5S and 45S), in order to highlight their distribution in diploid and tetraploid taxa of the Hordeum murinum L. complex. **Results:** The analysis of root meristems enabled chromosome counting in the studied species and led, in particular, to the identification of two new cytotypes within the genus Medicago. Karyotypes and karyograms were also established, allowing the characterization of Algerian samples and the assessment of their chromosomal variability. Meiotic analysis revealed various abnormalities, including cases of aneuploidy, the presence of micronuclei, chromatin bridges, asynchronous divisions, and multipolar spores. These irregularities, resulting from gene or chromosomal mutations, constitute a natural reservoir of genetic variation that may promote species adaptation to continuously changing environments. Molecular cytogenetic approaches (FISH) were used to determine the origin of polyploids and to map transposable elements on the chromosomes of the Hordeum murinum L. complex. **Conclusion:** The cytogenetic analyses carried out reveal notable chromosomal variability within the studied species, particularly illustrated by the identification of new cytotypes and the presence of meiotic abnormalities. These results highlight the dynamic nature of plant genomes and contribute to a better understanding of the chromosomal diversity of Algerian flora.

Keywords: Plant cytogenetics, Flora of Algeria, Polyploidy, Meiotic anomalies, Karyotype, FISH, Genetic Variability, Medicago L., Hordeum, Oxalis L.

GENETIC DIVERSITY ANALYSIS OF FIVE ANNUAL MEDICAGO L. SPECIES IN ALGERIA: MEIOTIC AND PALYNOLOGICAL APPROACHES

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ABSTRACT

Introduction and Objectives: The genus Medicago L. includes species of major agronomic and ecological interest, particularly for the improvement of cultivated alfalfa (Medicago sativa). Knowledge of the genetic diversity of wild species, especially their cytogenetic behavior, is essential for breeding programs. The Soummam Valley (Northeast Algeria) constitutes a biodiversity reservoir for these species. This study aims to characterize the genetic variability of natural populations of this genus by combining meiosis analysis, pollen viability assessment, and pollen grain size measurement. **Materials and Methods:** Five species were sampled: M. rugosa, M. scutellata, M. orbicularis, M. secundiflora, and M. lupulina. Meiosis was analyzed on 1000 pollen mother cells per species after staining with lactopropionic orcein. Pollen viability was estimated on 15 flowers per population using cotton blue staining. The surface area of pollen grains was measured using ImageJ software. Statistical tests were used to compare the studied parameters between species. **Results:** The analysis revealed two cytotypes: a diploid cytotype (2n = 16) in M. lupulina, M. secundiflora, and M. orbicularis, and a tetraploid cytotype (2n = 30) in M. rugosa and M. scutellata. Chromosomal pairing appeared regular, with the formation of only bivalents. However, meiotic abnormalities (cytomixis, chromatin bridges, asynchronous divisions, micronuclei) were present in all species, with a cumulative rate of 15.7% to 22.5%, cytomixis being the most frequent. chromatic bridges and multipolar cells were exclusive to tetraploids ($p < 0.005$). The pollen viability rate was greater than 85%. This rate is lower in M. scutellata (85.6 ± 8.3%) and shows a negative correlation with the rate of abnormalities ($R = -0.895$; $p = 0.04$). Tetraploids have a larger pollen grain surface area, ranging from 764 to 961 µm². That of diploids ranges from 379 to 588 µm². **Discussion and Conclusion:** For the first time, Algerian samples belonging to five species of the genus Medicago were analyzed to characterize their meiotic behavior and palynology. This revealed significant cytogenetic diversity in the Béjaïa region, with a relationship between ploidy and pollen size. Chromosomal pairing was regular (bivalents), a sign of genetic stability, but meiotic abnormalities, primarily cytomixia, were observed. Combined with reduced pollen viability in M. scutellata, these anomalies suggest interspecific differences in reproductive stability. They could be a source of genetic variability and explain the heterogeneity of pollen viability and size. Their correlation with decreased fertility underscores their impact on reproductive success. The populations of the Soummam Valley constitute a biodiversity reservoir, a valuable resource for improving cultivated alfalfa. This original data on the reproductive biology of wild species in North Africa provides a useful basis for the management and conservation of local plant genetic resources.

Keywords: Medicago, cytogenetics, meiosis, pollen study, biodiversity, Algeria.

COASTAL DUNES UNDER ANTHROPOGENIC PRESSURE: A CASE STUDY OF THE EASTERN ALGIERS LITTORAL

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ABSTRACT

Coastal dune complexes constitute fundamental biodiversity reservoirs, providing essential ecosystem services such as geomorphological stabilization and buffering against marine transgression. Despite their vital ecological significance, these fragile psammophilous ecosystems are currently subjected to severe environmental constraints. This research investigates the synergistic impacts of intensifying anthropogenic forcing—including peri-urban sprawl, agricultural encroachment, and uncontrolled tourism—compounded by contemporary mesological shifts, edaphic degradation, and climate variability. The study delineates the ecological trajectory of dune systems in Eastern Algiers through a multi-site diachronic analysis spanning a twelve-year period (2006–2017). Adopting a comparative framework across four study sites characterized by distinct disturbance gradients (El Kadous, Zemmouri El Bahri, Ben Younes, and Mandoura), we quantified the structural evolution of plant communities. The assessment focused specifically on the spatio-temporal variations in floristic composition, the reorganization of biological spectra, and the statistical fluctuation of alpha-diversity indices. Our findings demonstrate a generalized decline in biodiversity, characterized by a contraction in taxonomic richness and a significant ruderalization of the flora, where nitrophilous and opportunistic species progressively displace specialist taxa. Although these degradations result from the deleterious interaction between climatic factors and anthropozoic pressures, the results highlight a notable degree of ecosystemic resilience. This is evidenced by the persistence of the keystone architect species, Ammophila arenaria (L.) Link, as well as the potential spontaneous recruitment of temporarily eclipsed pioneer phytocenoses. In conclusion, this work proposes integrated management and multidisciplinary ecological restoration protocols aimed at mitigating habitat fragmentation and ensuring the long-term sustainability of this vulnerable natural heritage within the Mediterranean bio-geographical context.

Keywords: Ammophila arenaria, Coastal ecology, spatiotemporal analysis, Diversity indices, Anthropization, Ecosystem conservation

CONSERVATION AND UTILIZATION OF CROP WILD RELATIVES IN BULGARIA TO MITIGATE THE EFFECTS OF CLIMATE CHANGE

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ABSTRACT

Climate change is a reality in today's world and, together with the unprecedented increase in world population, highlights the looming problem of food security. The increase in global demand for food, the depletion of natural resources and the potential impacts of climate change have created an increased need to search for strategies to combat it. One such is the untapped genetic diversity in the wild relatives of cultivated plants. Growing concern about the potentially devastating impacts of climate change on biodiversity and food security, taken together with a growing world population, means that taking action to conserve the diversity of crop wild relatives (CWR) is no longer an option, but an urgent priority. Wild relatives of crop plants have the potential to contribute to the improvement of crops to biotic and abiotic stresses, leading to improved yield and resilience under climate change. Conservation of CWRs is a complex and technically difficult interdisciplinary process. The aim of the study is to develop in situ CWR national lists including specimen data and transfer selected CWR data to a central accessible online database EURISCO. This aims to make visible the extent of CWR diversity in the country and to suggest means of identifying the most suitable populations for active conservation. EURISCO's CWR in situ extension is created by including in EURISCO a subsection of each CWR's data corresponding to those populations that are 'actively conserved' and could potentially be made available to users. The identification of this subsection will be at the discretion of each country in order to offer the public a list of populations for which it is possible to identify the owner/managing institution and the institution that can be approached about the possibility of obtaining genetic material. In other words, these are lists of populations, a sample of which can in principle be made available to users.

Keywords: coservation, CWR, climate change, transfer to EURISCO

EXOGENOUS GLUTATHIONE MEDIATED REGULATION OF SEED GERMINATION IN CERATONIA SILIQUA UNDER ABIOTIC STRESS

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ABSTRACT

Tricholaena teneriffae (L.f.) Link is a declining tropical C4 perennial grass occurring in the arid regions of Tunisia, particularly in Bou Hedma National Park. As part of restoration and reintroduction efforts, this study aimed to assess the effects of temperature, water stress, and salinity on seed germination and early seedling growth. Caryopses were subjected to different temperature regimes (10–35 °C), water potentials (0 to −2 MPa induced by PEG 6000), and salinity levels (0–200 mM NaCl). Germination responses were analyzed using thermal time, hydrotime, and log-logistic models, together with several stress tolerance indices. Germination was significantly affected by temperature ($p < 0.001$), with an optimum range between 25 and 30 °C. The thermal time model estimated a base temperature (Tb) of 15.5 °C, an optimum temperature (To) of 25.9 °C, and a ceiling temperature (Tc) of 46.1 °C. The hydrotime model revealed a median base water potential Ψb (50) of −0.76 MPa, indicating moderate tolerance to water deficit. Germination progressively declined under water stress but was far more severely affected by salinity, with an EC50 of 79 mM NaCl and almost complete inhibition above 100 mM. At comparable water potentials, salinity reduced germination much more than PEG-induced water stress, highlighting the additional impact of ionic toxicity. Seedling growth was significantly reduced under both stresses, particularly under PEG treatment, with a marked increase in root allocation relative to shoot growth. These findings indicate that T. teneriffae exhibits an adaptive strategy typical of arid-environment species,characterized by opportunistic germination, moderate drought tolerance, and high sensitivity to salinity. The identified germination thresholds and stress responses provide valuable information for the conservation, reintroduction, and ecological restoration of degraded arid and semi-arid ecosystems

Keywords: Ceratonia siliqua, exogenous glutathione, hydrotime model, seed germination, salt stress, water stress

Modeling germination and early establishment of Tricholaena teneriffae (L.F) under abiotic stress conditions

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ABSTRACT

Tricholaena teneriffae (L.f.) Link is a declining tropical C4 perennial grass occurring in the arid regions of Tunisia, particularly in Bou Hedma National Park. As part of restoration and reintroduction efforts, this study aimed to assess the effects of temperature, water stress, and salinity on seed germination and early seedling growth. Caryopses were subjected to different temperature regimes (10–35 °C), water potentials (0 to −2 MPa induced by PEG 6000), and salinity levels (0–200 mM NaCl). Germination responses were analyzed using thermal time, hydrotime, and log-logistic models, together with several stress tolerance indices. Germination was significantly affected by temperature ($p < 0.001$), with an optimum range between 25 and 30 °C. The thermal time model estimated a base temperature (Tb) of 15.5 °C, an optimum temperature (To) of 25.9 °C, and a ceiling temperature (Tc) of 46.1 °C. The hydrotime model revealed a median base water potential Ψb (50) of −0.76 MPa, indicating moderate tolerance to water deficit. Germination progressively declined under water stress but was far more severely affected by salinity, with an EC50 of 79 mM NaCl and almost complete inhibition above 100 mM. At comparable water potentials, salinity reduced germination much more than PEG-induced water stress, highlighting the additional impact of ionic toxicity. Seedling growth was significantly reduced under both stresses, particularly under PEG treatment, with a marked increase in root allocation relative to shoot growth. These findings indicate that T. teneriffae exhibits an adaptive strategy typical of arid-environment species,characterized by opportunistic germination, moderate drought tolerance, and high sensitivity to salinity. The identified germination thresholds and stress responses provide valuable information for the conservation, reintroduction, and ecological restoration of degraded arid and semi-arid ecosystems

Keywords: Tricholaena teneriffae, temperature, water potential, salinity, arid zone

CONTRIBUTION OF THE STUDY OF RARE AND THREATENED FLORA IN ALGIERS COASTAL SUB SECTOR: A BIBLIOGRAPHIC INVENTORY AND BIOGEOGRAPHICAL ANALYSIS

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ABSTRACT

Rare and threatened flora represent a major focus in conservation biology due to their exceptional heritage value and vulnerability to anthropogenic and climatic pressures. In Algeria, the remarkable floristic richness is intrinsically linked to a high ecosystem and landscape diversity. Developing an accurate baseline assessment of this natural heritage is fundamental to guiding sustainable management and biodiversity conservation strategies. This study presents a strictly bibliographic approach, based on the critical analysis, synthesis, and updating of documentary data addressing threatened Algerian flora. The foundational taxonomic and historical reference relies on the seminal work of Quézel and Santa (1962–1963), supplemented by subsequent scientific contributions. The primary objective is to delineate and characterize the rare floristic component within the Algiers coastal sub-sector (designated as A1). The investigations carried out led to the recording of a rigorous total of 589 taxa, structured into 76 botanical families and 309 genera. This entire critical flora is organized in the form of a detailed systematic catalogue. For each taxonomic entity, this catalogue integrates essential ecological and biogeographical descriptors, such as the degree of rarity, conservation status, phytogeographical origin, and updated classification. The analysis of the biogeographical element highlights the significance of the endemism rate within the study area. The catalogue reveals a marked predominance of North African endemic taxa, represented by 58 taxa, followed by strict Algerian endemics with 31 taxa. In contrast, the Ibero-Mauritanian element appears to be the least represented, accounting for only 12 taxa. These findings underscore the biogeographical singularity of the Algiers coastline and reaffirm the urgent need to implement targeted conservation measures for these species of high heritage value.

Keywords: Biodiversity conservation, Phytogeography, Taxonomic diversity, heritage value, North African endemism,

QUALITY CONTROL OF OLIVE OIL FROM TWO VARIETIES(HAMRA) AND (BOUKAILA FROM TWO DIFFERENT AREAS IN THE JIJEL PROVINCE

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ABSTRACT

Olive oil is one of the oldest vegetable oils, obtained from the fruit of the olive tree solely through physical processes, without any refining stages. The absence of refining allows olive oil to retain all its antioxidants; it is the only oil that can be consumed in its raw form without prior treatment. These benefits have been attributed partly to its fatty acid composition – in which oleic acid is the main component – and partly to the presence of minor biomolecules, such as vitamins and natural antioxidants. The high demand for good-quality virgin olive oil is due not only to its health benefits but also to its organoleptic properties. Our study is based on the identification of the variety and its morphological characteristics, and a comparison between two olive oils from two varieties in Hamra and Boukaila in terms of their physico-chemical and organoleptic characteristics. The samples were collected from two different regions of the wilaya of Jijel (Taher and Oudjana); to ensure the oil complies with IOC standards, certain physical parameters (water content, colour) and chemical parameters (acidity, peroxide value, saponification value, phosphatide value) must be determined. The results obtained showed that two of the olive oil samples studied (the Hamra and Boukaila varieties) exhibited physico-chemical characteristics in line with the 2018 COI standard, except that the water content of the Hamra variety was higher than that of the Boukaila variety and than the COI and CA standards.

Keywords: Olive tree,Variety,Olive Oil,physico-chemical,Standard et Characterisation

NUTRITIONAL COMPOSITION AND EXPANSION PROSPECTS OF LOCAL (ENDEMIC) HAZELNUT (CORYLUS AVELLANA L.) VARIETIES IN GEORGIA

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ABSTRACT

Hazelnut (Corylus avellana L.) cultivation plays an important role in Georgian agriculture, contributing substantially to domestic consumption, export revenues, and rural economic development. In western Georgia, hazelnut production has expanded considerably over the past decade owing to increasing domestic and international demand and favorable market prices. The genus Corylus includes approximately 20 species, of which 11 occur naturally in Georgia. Three species (C. imeretica, C. kachetica, and C. colchica) are endemic to Georgia, whereas two (C. iberica and C. pontica) are endemic to the Caucasus region. The country's diverse climatic conditions and heterogeneous soils have contributed to the development of genetically diverse hazelnut populations exhibiting considerable morphological, agronomic, and biochemical characteristics. Long-term traditional selection has resulted in approximately 40 superior endemic varieties and forms, 28 of which are currently conserved in the hazelnut germplasm collection of the Institute of Phytopathology and Biodiversity. The aim of this study was to evaluate the nutritional composition and microelement profile of selected local (endemic) hazelnut varieties and to compare them with an introduced cultivar. 8 local varieties (Anakliuri, Shveliskura, Chincha, Gulshishvela, Chkhikvistava, Vanis Tsiteli, Dedoflis Thiti and Giresun) and one introduced variety (Tonda di Giffoni) were analyzed. The samples were collected from hazelnut orchards in the Adjara region. Oil content was determined using Soxhlet extraction, protein content by the Kjeldahl method, microelement concentrations were assessed using chromatographic method. All measurements were performed in triplicate to ensure analytical precision and reproducibility. Significant inter-varietal differences were observed in both biochemical composition and mineral element content. These differences are likely associated with genetic characterristics, environmental conditions, soil properties, orchard age, and crop management practices. The endemic Georgian varieties generally exhibited higher nutritional value than the introduced cultivar. The highest oil content was recorded in Vanis Tsiteli (71.0–72.5%), followed by Chkhikvistava (69.0–71.0%) and Dedoflis Thiti (67.0–69.0%), whereas Tonda di Giffoni contained approximately 60% oil. Protein content was likewise higher in several endemic varieties (14.9% in Dedoflis Thiti, 14.0% in Shveliskura). The results of multielement analysis demonstrated a well-balanced composition of both macro-and microelements. The overall order of elemental accumulation was K>Ca>P>Mg>Na>Fe>Zn. Potassium, phosphorus, magnesium, and calcium were the predominant mineral elements, indicating the high nutritional quality of the studied hazelnut varieties. Potassium concentrations ranged from 2,720 to 9,400 mg/L, with the highest levels detected in Shveliskura (9,400 mg/L), Dedoflis Thiti (8,740 mg/L), and Gulshishvela (5,430 mg/L), compared with 3,320 mg/L in Tonda di Giffoni. Calcium concentrations varied between 885 and 4,370 mg/L, with the highest levels in Shveliskura (4370 mg/L), Dedoflis Thiti (2260

mg/L) and Gulshishvela (1570 mg/L). Magnesium ranged from 948 to 5040 mg/L, with peak values in Shveliskura (5040 mg/L) and Gulshishvela (1410 mg/L). Zinc content ranged from 11.3 to 27.5 mg/L, with the highest concentrations in Shveliskura (27.5 mg/L) and Gulshishvela (18.4 mg/L). The sodium concentrations varied between 87.7 and 415 mg/L, being highest in Gulshishvela (415 mg/l) and Shveliskura (305 mg/l), and lowest in Anakliuri (87.7 mg/l). The highest Iron content was found in the Gulshishvela (214 mg/L) and Dedoflis Thiti (94 mg/L), although relatively high levels were also observed in the introduced variety. No heavy metals or other toxic elements were detected, confirming the ecological safety and high quality of the analyzed nuts. The endemic hazelnut varieties of Georgia are comparable to internationally cultivatedcommercial cultivars in terms of nutritional quality while demonstrating superior adaptation to local environmental conditions and, in several cases, greater productivity. Conservation and sustainable utilization of these valuable genetic resources will contribute to the development of climate-resilient hazelnut production systems and increase the competitiveness of Georgian hazelnuts in international markets.

Keywords: Hazelnut, endemic varieties, microelements, genetic resources, agroecological potential, Georgia

FAUNA AND FLORA ASSOCIATED WITH POSIDONIA SEAGRASS BEDS ON THE ALGERIAN COAST

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ABSTRACT

Posidonia oceanica meadows, an endemic Mediterranean seagrass, constitute one of the key ecosystems of the Mediterranean basin, playing an essential role in sustaining marine biodiversity, stabilizing coastal seabeds, and sequestering blue carbon. Despite their recognized ecological and socio-economic importance, data on their distribution along the Algerian coastline remain insufficient and fragmentary, hindering the implementation of effective conservation measures. This study aims to address this gap by establishing a reference baseline based on an exhaustive bibliographic compilation covering the period 1951-2023 (theses, dissertations, scientific articles, reports and posters). The methodology involved a systematic documentary analysis, data processing through structured Excel databases, taxonomic updating via the World Register of Marine Species (WoRMS), and mapping using QGIS software. The results allowed the identification of 95 P. oceanica meadow sites distributed across twelve coastal provinces (wilayas) and three geographical sectors: East (45%, 43 sites), Center (30%, 29 sites) and West (25%, 23 sites), a west-to-east increasing gradient attributed to the influence of colder, less saline Atlantic waters entering through the Strait of Gibraltar. The total surface area of Algerian meadows is estimated at approximately 4,072 ha, an intermediate value compared to other Mediterranean countries (Tunisia and Italy hosting the largest meadows). The inventory of associated fauna and flora identified, after removing duplicates, 653 species distributed across four kingdoms: Animalia (478 species, 73%), Plantae (110, 17%), Chromista (63, 9%), and Bacteria (2, 0.3%). Arthropods dominate the associated fauna while Rhodophyta dominate the flora, with markedly higher biological diversity recorded in the central sector. The study also highlighted significant exposure of these meadows to anthropogenic pressures (metal pollution, coastal development, anchoring), particularly pronounced near major urban centers. All collected data have been integrated into the national marine biodiversity database BANBIOM, hosted at ENSSMAL, thereby contributing to the consolidation of national knowledge on this priority ecosystem. This work represents the first comprehensive bibliographic synthesis on the distribution of P. oceanica and its associated biodiversity in Algeria, providing an updated cartographic and taxonomic baseline essential for guiding future management, monitoring and conservation actions for this sentinel ecosystem, facing growing climate change impacts and anthropogenic pressures in the southwestern Mediterranean.

Keywords: Posidonia oceanica, Algerian coast, mapping, associated biodiversity, BANBIOM, Mediterranean Sea

POPULATION FLUCTUATIONS OF WATERBIRDS AT A RAMSAR SITE

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ABSTRACT

The wetland complex of northeastern Algeria comprises several freshwater and brackish water bodies, most of which provide essential habitats for numerous waterbird species during the wintering season. Monthly surveys of waterbird populations were conducted at Lake Tonga (northeastern Algeria), a Ramsar site recognized as one of the most important wetlands for wintering and breeding waterbirds in North Africa. The objectives of this study were to evaluate seasonal fluctuations in waterbird populations and assess their interannual variation. Waterbird abundance and species composition were monitored monthly throughout 2025 using standardized census methods, and diversity indices were calculated to characterize seasonal changes in the waterbird community. Over the one-year study period, a total of 25 waterbird species belonging to nine families were recorded. Resident species accounted for 48% of the assemblage, wintering species represented 44%, while the remaining species were classified as non-breeding visitors. The Eurasian Coot (Fulica atra) and the Cattle Egret (Bubulcus ibis) were the most abundant species recorded during the study period. The results revealed that Lake Tonga supported a remarkably high abundance of waterbirds in 2025, with a total of 69,110 individuals recorded, confirming its importance as a key wintering and breeding site for waterbirds in North Africa. These findings emphasize the need for continued monitoring and conservation measures to preserve its biodiversity and ecological functions.

Keywords: Waterbirds, Lake Tonga, Ramsar site, Wetlands, fluctuation, Wintering.

IMPACT OF NOISE POLLUTION ON HERONS' DISTRIBUTION IN LAKE TONGA (EL TARF -ALGERIA)

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ABSTRACT

Herons are among the most disturbance sensitive waterbirds, particularly during breeding and wintering periods when habitat quality and environmental stability are critical for their survival and reproductive success. Anthropogenic noise generated by road traffic, construction activities, tourism, and other human disturbances can alter their behavior by increasing stress levels, reducing foraging efficiency, and disrupting nesting activities. Prolonged exposure to elevated noise levels may consequently affect both the distribution and abundance of heron populations. Understanding the relationship between noise pollution and heron ecology is therefore essential for the development of effective conservation and management strategies in wetland ecosystems. In the present study, we investigated the influence of environmental noise on heron communities at Lake Tonga, a Ramsar wetland of international importance. The results revealed a significant negative relationship between species richness and noise levels during both the breeding season ($r = -0.85$, $p = 0.002$) and the wintering season ($r = -0.65$, $p = 0.05$). Likewise, heron abundance was negatively correlated with noise during the breeding season ($r = -0.70$, $p = 0.02$) and the wintering season ($r = -0.76$, $p = 0.04$). These findings demonstrate that increasing anthropogenic noise adversely affects heron diversity and abundance, highlighting the importance of minimizing human disturbance and implementing effective conservation measures to preserve the ecological integrity of wetlands and ensure the long-term persistence of heron populations.

Keywords: Noise, Herons, Tonga Lake, correlation, El Tarf.

THE DISTRIBUTION OF LARGE WADERS AND SHOREBIRDS IN BIRDS LAKE (NORD -EAST ALEGRIA)

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ABSTRACT

The distribution of large waders and shorebirds is highly complex and dynamic, being influenced by a combination of ecological, environmental, and anthropogenic factors. Habitat availability, food resources, breeding requirements, hydrological conditions, and migration patterns all play a fundamental role in determining the spatial and temporal distribution of these bird communities. Seasonal fluctuations in water levels and habitat quality can directly affect the availability of feeding and nesting sites, thereby influencing species composition and diversity. Understanding the relative importance of these factors is essential for the effective conservation and sustainable management of waterbird populations and their wetland habitats. In the present study, seasonal variations in the richness and abundance of large waders and shorebirds were investigated at Birds Lake, an important wetland in northeastern Algeria. The results demonstrated that species richness differed significantly among the three seasons ($F(2,7) = 14.86$, $p = 0.003$), indicating marked seasonal changes in community composition. In contrast, no significant seasonal variation was detected in the total abundance of individuals ($F(2,7) = 2.24$, $p = 0.176$). These findings suggest that while the number of individuals remained relatively stable throughout the study period, seasonal environmental conditions influenced the occurrence of different species. Consequently, maintaining habitat heterogeneity and ecological integrity is crucial for supporting the seasonal diversity of large waders and shorebirds and for ensuring the long-term conservation of wetland ecosystems.

Keywords: Waterbirds, Large Waders, Shorebirds, Birds Lake.

EVALUATING LITTLE EGRET HABITAT CHARACTERISTICS IN TWO FRESHWATER LAKES OF NORTHEASTERN ALGERIA THROUGH REMOTE SENSING

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ABSTRACT

Wetlands provide essential habitats for waterbirds owing to their high habitat diversity, ecological complexity, and biological productivity. They are characterized by shallow water, waterlogged soils, and a mosaic of submerged, floating, and emergent vegetation that offers feeding, nesting, and sheltering opportunities for numerous bird species. Among these, the Little Egret (Egretta garzetta) is one of the most widespread and abundant waterbirds in northern Algeria and has also been recognized as a valuable bioindicator of environmental quality and trace element contamination. This study aimed to investigate the spatial distribution of the Little Egret and evaluate the influence of environmental factors in two freshwater lakes located in northeastern Algeria during the breeding season. Remote sensing techniques were employed to derive the Normalized Difference Vegetation Index (NDVI), which served as an indicator of vegetation abundance and habitat condition. The relationship between NDVI and Little Egret abundance was examined using correlation analysis. The results revealed a significant positive correlation between NDVI and the abundance of Little Egrets ($r = 0.43$, $p < 0.05$), indicating that areas with denser vegetation supported higher numbers of individuals. These findings suggest that vegetation cover is an important driver of the spatial distribution of the species and highlight the usefulness of combining field observations with remote sensing to identify suitable habitats and support wetland conservation and management strategies in northeastern Algeria.

Keywords: Little Egret, NDVI, remote sensing, Habitats, Northeast Algeria.

AQUATIC INSECT DIVERSITY AND COMMUNITY STRUCTURE IN LAKE TONGA, A RAMSAR WETLAND OF NORTHEASTERN ALGERIA

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ABSTRACT

Mediterranean wetlands are among the most valuable freshwater ecosystems, providing essential habitats for biodiversity while facing increasing anthropogenic and environmental pressures. Aquatic insects constitute a major component of freshwater communities and are widely recognized as effective bioindicators of ecological conditions. This study aimed to assess the diversity and structure of aquatic insect assemblages in Lake Tonga, a Ramsar wetland located within El Kala National Park (northeastern Algeria).Sampling was conducted during the spring of 2026 at three representative stations distributed along the littoral zone of the lake. Specimens were collected using a hand net and identified to the lowest possible taxonomic level using standard identification keys. Community structure was evaluated through taxonomic richness, relative abundance, Shannon diversity, Pielou's evenness, and Margalef richness indices. The results revealed a diverse aquatic insect assemblage dominated by members of the orders Coleoptera and Hemiptera. The families Corixidae, Dytiscidae, Hydrochidae, and Pleidae were among the most abundant taxa recorded. Diversity analysis indicated a relatively high level of taxonomic richness and a balanced distribution of individuals among taxa, reflecting a well-structured community. The predominance of pollution-sensitive and moderately tolerant groups suggests that Lake Tonga currently maintains favorable ecological conditions capable of supporting diverse aquatic insect populations. These findings highlight the ecological importance of Lake Tonga as a refuge for freshwater biodiversity and demonstrate the usefulness of aquatic insects as reliable indicators for ecological assessment and long-term biomonitoring. The study provides valuable baseline data for future conservation and management programs targeting Mediterranean wetlands of international importance.

Keywords: Aquatic insects, biodiversity, bioindicators, Lake Tonga, Ramsar wetland, ecological assessment.

BIODIVERSITY CONSERVATION OF FLORA IN EASTERN POLAND: ACTIVE PROTECTION OF ENDANGERED BOREAL RELICTS WITHIN THE GENUS SALIX

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ABSTRACT

Active protection of species particularly threatened with extinction: *Salix lapponum* and *S. myrtilloides* was carried out in peatland areas in Eastern Poland. Reintroduction was chosen as the method of establishing new populations. To increase the numbers of existing populations, they were supplemented with individuals from ex situ cultivation. Species translocation were carried out in 2018-2020 and 2023 in cycles covering several stages of experiment. First, an appropriate number of genotypes of each species were introduced into in vitro cultures, and then plantlets suitable for introduction into the natural environment were obtained from them. After acclimatization of the plants in laboratory and field conditions, they were transferred to previously selected locations and planted in a peat bogs. In total, over 6,200 *S. lapponum* and 1,500 *S. myrtilloides* plants were introduced into the natural habitats. Regular monitoring, consisting of counting the plants that survived the following years and started growing, allowed us to establish the translocation success in 2026 at the level of >40% in the case of *S. lapponum* and *S. myrtilloides*. Unfortunately, over the 8-year period, few flowering individuals of both species were observed (*S. lapponum* there were both female and male individuals. Despite careful selection of both substitute habitats and plants individuals and their acclimatization, mortality in the natural sites was quite high. It was found that maintaining stable hydrological conditions in the habitat is a key factor determining the reintroduction success of the studied species. Insufficient soil water resources, combined with advanced tree and shrub succession, significantly impact the short- and long-term survival of *S. lapponum* and *S. myrtilloides.*

Keywords: Salix lapponum, Salix myrtilloides, reintroduction, monitoring, peatland, habitats

THE IMPACT OF HYDROLOGICAL STRESS ON THE FUNCTIONING OF AQUATIC ORGANISMS IN SHALLOW PEAT PONDS (POLESIE NATIONAL PARK, EASTERN POLAND)

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ABSTRACT

Climate change models point to a possible rise in air temperature, ranging from 2 °C to 4 °C. Global changes will therefore have a particularly pronounced effect on the functioning of peat ponds - habitats formed after peat extraction in peatlands. However, the extent of this impact is still unknown. The main objective of the study was to determine the impact of water level and water physicochemical properties on the functioning of selected groups of aquatic organisms in peat ponds of different origins. The study was conducted in spring, summer and autumn of the years 2024 and 2025, in 10 peat ponds with different trophic status and typology, located in the Polesie National Park in eastern Poland. Considerable fluctuations in water levels, resulting from a scarcity of precipitation, accelerated the drying out and overgrowth of peat ponds, particularly the alkaline and acidic types. Within the zoocoenotic communities, a significant decline in the abundance of planktonic species and an increase in the abundance of littoral or periphytic species were recorded. Regarding trophic structure, an increase in the abundance of mixotrophic species and a decrease in the abundance of top-level predators were observed. Hydrological changes were reflected in an increase in species richness and abundance of communities of organisms with broad ecological tolerance (mainly ciliates), and a decrease in the number of species and abundance of planktonic crustaceans and macroinvertebrates. The RDA model explains over 84% of the total variability, indicating excellent model fit to the data and a strong correlation between environmental variables and species composition. Based on p values: water level, temperature, COD, and pH were selected as significant variables, with conductivity and concentrations of Ptot demonstrating less statistical significance. Peat ponds ecosystems can serve as an excellent model system for studying the impact of intensifying climate change on the functioning of shallow water bodies.

Keywords: peatlands; peat ponds; hydrology; zooplankton; macroinvertebrates

DIVERSITY AND ECOLOGICAL ROLES OF MOTH ASSEMBLAGES (LEPIDOPTERA: HETEROCERA) IN SEMI-ARID AGROECOSYSTEMS OF ALGERIA

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ABSTRACT

This study contributes to improving knowledge of moth assemblages (Lepidoptera: Heterocera) inhabiting semi-arid agroecosystems in northeastern Algeria. Moths represent an important component of terrestrial biodiversity and play key ecological roles as pollinators, herbivores, and prey for numerous vertebrate and invertebrate species. Understanding their diversity and distribution is therefore essential for evaluating the ecological quality of agricultural landscapes. Field surveys were conducted in four contrasting crop habitats, including an olive grove, a pomegranate orchard, a plum orchard, and a lawn. Species were identified, and their abundance and distribution were compared among habitats to assess the influence of vegetation type on moth communities. A total of 166 individuals belonging to 27 species, 25 genera, and 8 families were recorded. The family Noctuidae was the most diverse and abundant, comprising 20 species and 58 individuals. Ophiusa tirhaca was the dominant species, representing 22.28% of all collected specimens. The lawn habitat supported the highest species richness and abundance, accounting for 66.27% of the total individuals and harboring all recorded species. This pattern is likely associated with its greater floristic diversity, which provides a wider range of food resources and oviposition sites. These findings highlight the importance of habitat heterogeneity in maintaining moth diversity and provide valuable information for biodiversity conservation and the sustainable management of semi-arid agricultural ecosystems.

Keywords: Lepidoptera, Heterocera, moth diversity, agroecosystems, semi-arid habitats, Tiaret, Algeria.

ECOLOGICAL INTERACTIONS BETWEEN DIURNAL BUTTERFLIES (LEPIDOPTERA) AND FLOWERING PLANTS IN SOUTHWESTERN ALGERIA

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ABSTRACT

Our study conducted in the Ksar Chellala region aimed to analyze the relationships between diurnal butterflies and flowers Sampling carried out from winter to spring 2023 allowed the identification of 14 flowering plant species and 12 butterfly species distributed among four families 7 Pieridae 2 Lycaenidae 2 Nymphalidae and 1 Papilionidae May proved to be the richest month with 61 species recorded In terms of species richness the ITELV station recorded 10 species followed by Ben Hamed with 8 species while Djefalla and INSID each had 7 species Abundance data showed a clear dominance at ITELV with 67 individuals (33.33%) followed by Ben Hamed with 63 individuals (31.34%) Djefalla with 39 individuals (19.40%) and INSID with 32 individuals (15.92%) The Shannon diversity index exceeded 2 across all stations indicating moderate diversity with the highest value at ITELV (3.08 bits) followed by Ben Hamed (2.84) INSID (2.62) and Djefalla (2.42) The maximum diversity index ranged from 3.32 bits at ITELV to 2.81 bits at INSID and Djefalla reflecting inter-station variability Evenness values remained high, ranging from 0.86 to 0.95 suggesting a balanced distribution of individuals among species Overall these results highlight notable species diversity and ecological balance with a marked dominance of the ITELV station.

Keywords: Diurnal Butterflies, Flowering Plants, Biodiversity, Ecology, Southwestern Algeria.

SEASONAL VARIATION AND DIVERSITY OF THE PHYTOPLANKTON FLORA AND ITS RELATIONSHIP WITH WATER QUALITY IN İNCÜVEZ STREAM (BULANCAK)

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ABSTRACT

In this study, water samples were collected monthly between August 2024 and July 2025 to examine the seasonal variation of the phytoplankton flora in İncüvez Stream (Bulancak). The seasonal changes in algae were determined by identifying and counting the water samples taken periodically from the selected stations. A total of 59 taxa belonging to the divisions Bacillariophyta (47 taxa), Chlorophyta (5 taxa), Cyanobacteria (3 taxa), Euglenophyta (3 taxa) and Charophyta (1 taxon) were identified in the phytoplankton flora of İncüvez Stream. In addition, temperature, pH, electrical conductivity and dissolved oxygen measurements were determined monthly and chlorophyll-a levels were calculated monthly for each station. It was determined that chlorophyll-a levels showed a variation parallel to the biomass of phytoplankton. Clustering Analysis and Shannon-Weaver Diversity Index were calculated from the obtained counting results. Principal Component Analysis (PCA) was applied to evaluate the relationships between phytoplankton composition and environmental variables. The water quality status was also assessed using the calculated Water Quality Index (WQI). The findings have shown that the phytoplankton composition in İncüvez Stream varies seasonally and that water quality parameters are influential in this variation. Furthermore, the identified indicator species and environmental data indicate that the stream may be affected by anthropogenic pressures during certain periods. When the data from the study area are evaluated together, it is concluded that İncüvez Stream is under anthropogenic influence during certain periods and carries pollution pressure on the aquatic ecosystem.

Keywords: Incüvez Stream, phytoplankton, ecology, seasonal changes, water quality.

STUDY OF ARBUSCULAR COLONIZATION OF AN ENDEMIC THYME FROM MOROCCO: TOWARDS BETTER INTEGRATION INTO SUSTAINABLE DEVELOPMENT STRATEGIES

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ABSTRACT

Arbuscular mycorrhizal fungi (AMF) play a key role in plant nutrition, adaptation, and resilience to abiotic stresses. This study investigates the arbuscular mycorrhizal colonization of an endemic Thymus species growing in the transition zone between the Rif and the Middle Atlas Mountains by assessing the mycorrhizogenic infectivity potential (MIP) of rhizosphere soils and characterizing the morphological diversity of AMF communities. Rhizosphere and control soil samples collected from several sites across the study area revealed a high mycorrhizogenic infectivity potential, reaching 80% in rhizosphere soils compared with 60–80% in control soils, together with a diverse assemblage of AMF morphotypes. These findings contribute to a better understanding of plant–fungus interactions involving this endemic Thymus species and provide promising perspectives for the selection of native AMF strains for bio-inoculation programs. This approach supports broader strategies aimed at biodiversity conservation, sustainable management of natural resources, and the valorization of endemic aromatic and medicinal plants, in line with the Sustainable Development Goals under the current context of climate change.Arbuscular mycorrhizal fungi (AMF) play a key role in plant nutrition, adaptation, and resilience to abiotic stresses. This study investigates the arbuscular mycorrhizal colonization of an endemic Thymus species growing in the transition zone between the Rif and the Middle Atlas Mountains by assessing the mycorrhizogenic infectivity potential (MIP) of rhizosphere soils and characterizing the morphological diversity of AMF communities. Rhizosphere and control soil samples collected from several sites across the study area revealed a high mycorrhizogenic infectivity potential, reaching 80% in rhizosphere soils compared with 60–80% in control soils, together with a diverse assemblage of AMF morphotypes. These findings contribute to a better understanding of plant–fungus interactions involving this endemic Thymus species and provide promising perspectives for the selection of native AMF strains for bio-inoculation programs. This approach supports broader strategies aimed at biodiversity conservation, sustainable management of natural resources, and the valorization of endemic aromatic and medicinal plants, in line with the Sustainable Development Goals under the current context of climate change.

Keywords: AMF, Endemic Thymus, Mycorrhizogenic infectivity potential, Rif–Middle Atlas transition zone, Sustainable development.

BIODIVERSITY AND DISTRIBUTION OF BEETLE FAMILIE (INSECTA: COLEOPTERA) AT TWO SITES IN THE TELLIAN ATLAS (MEDEA, ALGERIA)

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ABSTRACT

The fauna of the Tellian Atlas remains poorly documented, particularly in the Medea region. Although a small number of surveys have been undertaken in certain areas, their scope remains limited. Against this background, a preliminary study was conducted to assess the diversity and distribution of beetle families at two sites located in two adjoining municipalities, Benchicao and Si Mahdjoub. Site 1 (ITAFV, Benchicao) lies at 36°38′09″ N, 2°57′01″ E, at an altitude of 1,133 m and 15 km south-west of Medea; Site 2 (EAI, Si Mahdjoub) lies at 36°11′09″ N, 2°50′55″ E, at an altitude of 1,100 m and 30 km south-west of Medea. The regional climate is characterised by a total annual rainfall of 630 mm, with mean monthly temperatures ranging from 12.3 °C in December to 31.6 °C in July. Sampling was carried out using pitfall (Barber) traps, emptied at monthly intervals throughout the summer period from May to August over the years 2022–2024. At Site 1, a total of 16 beetle families were recorded, the most abundant being the Tenebrionidae (27.89%), the Elateridae (19.04%) and the Dermestidae (8.16%). At Site 2, 20 families were recorded, the most abundant being the Tenebrionidae (28.48%) and the Scarabaeidae (16.45%), followed by the Buprestidae and the Dermestidae (8.86% each). An improved understanding of the bioecology and population dynamics of these species is an essential prerequisite for devising effective control strategies against pest species.

Keywords: Coleoptera, pitfall traps, biodiversity, Tellian Atlas, Medea, Algeria.

HERBARIUM-BASED TAXONOMIC AND BIOGEOGRAPHICAL ANALYSIS OF THE GENUS LYTHRUM L. (LYTHRACEAE) IN UZBEKISTAN

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ABSTRACT

This study examines the herbarium specimens of the genus Lythrum L. preserved in the National Herbarium of Uzbekistan (TASH). All available specimens were inventoried, digitized, and analyzed using herbarium label data and standardized according to the Plants of the World Online (POWO) database. A total of 246 specimens representing seven identified species and one unidentified taxon were documented. Lythrum salicaria was the most represented species, while most collections were made between 1928 and 1938. The results highlight the scientific importance of the TASH herbarium for documenting the diversity, distribution, and collection history of Lythrum in Uzbekistan. Digitization of the collection improves data accessibility and supports future taxonomic, floristic, and biodiversity research.A similar trend is observed in collector activity, where classical botanists played a dominant role, while recent decades show limited involvement of local researchers in Lythrum-focused studies. The development of such catalogues and their analytical interpretation is essential for identifying poorly studied regions and taxonomic groups, as well as for improving research planning within the National Herbarium. Overall, these findings highlight the importance of herbarium-based studies not only for biodiversity documentation but also for guiding future systematic research. Strengthening such investigations will support large-scale floristic studies and contribute to capacity building among emerging botanists in Uzbekistan

Keywords: Lythrum, TASH, herbarium digitization, taxonomy, biodiversity, Uzbekistan.

BLACK FLIES (SIMULIIDAE) OF NORTHEASTERN ALGERIA: BIODIVERSITY, ECOLOGICAL PATTERNS, AND HEALTH RISKS ASSOCIATED WITH CLIMATE CHANGE

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ABSTRACT

Simuliidae (black flies) are hematophagous dipterans ranked among the most important disease vectors and are currently expanding throughout the Mediterranean Basin. They are characterized by high species diversity and remarkable ecological plasticity. Female black flies play a key role in the transmission of pathogens affecting both humans and animals and are involved in the spread of diseases such as onchocerciasis and leucocytozoonosis. Their distribution and vectorial capacity are closely associated with environmental factors, particularly the physicochemical characteristics of aquatic habitats. Despite their medical and economic importance, studies focusing on this group remain limited in Algeria. To address this gap, a study was conducted at several sampling stations in northeastern Algeria over an 18-month period. Species were systematically identified in order to assess their diversity, abundance, and potential role as parasite vectors. Several Simuliidae species were recorded during the study, some of which are recognized as vectors of pathogens responsible for vector-borne diseases. The abundance and distribution of these species varied among sampling sites and appeared to be strongly influenced by ecological and meteorological factors, particularly temperature, water oxygenation, and local climatic conditions. This study highlights the diversity of Simuliidae and the potential risk of disease transmission, emphasizing the need for further investigations in Algeria. The findings also provide valuable information for improving our understanding of the ecology of black flies and for assessing the potential impact of environmental changes on their distribution and vectorial capacity.

Keywords: Simuliidae, Biodiversity, Climate change, Spatiotemporal dynamics, Vector-borne diseases.

PHLEBOTOMINE SANDFLIES ASBIOINDICATORS OF BIODIVERSITY AND ECOSYSTEM HEALTH IN ALGERIA

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ABSTRACT

Within the framework of integrated ecosystem managementin Algeria, biodiversity is a key indicator of ecosystem functioning andresilience. Phlebotomine sandflies (Diptera: Psychodidae) are smallhematophagous insects whose females feed on the blood of vertebrate hosts toobtain nutrients necessary for egg development. They are among the mostimportant insect taxa because of their ecological role and their public healthsignificance. In addition to serving as bioindicators of environmental qualityand ecosystem changes, they are the proven biological vectors of Leishmaniaparasites, the causative agents of leishmaniasis. Their sensitivity toenvironmental conditions makes them valuable indicators for assessing habitatintegrity, while their role in pathogen transmission highlights theirimportance in both biodiversity conservation and public health. This st udy aims to investigate the diversity, spatialdistribution, and seasonal population dynamics of phlebotomine sandflies indifferent ecological habitats of northeastern Algeria. The research focuses onassessing species composition, abundance, and temporal fluctuations in sandflypopulations across rural, peri-urban, and natural environments, with theobjective of identifying ecological factors that influence their distribution.Sandflies were collected using CDC light traps and sticky traps deployed inselected sampling sites during the active transmission season. Capturedspecimens were preserved and subsequently identified to the species levelthrough morphological examination under a microscope, based on the taxonomickeys established for Algerian phlebotomine fauna. The generated data willcontribute to a better understanding of the ecology of sandflies innortheastern Algeria, provide updated information on the distribution of vectorspecies, and support epidemiological surveillance and the development ofeffective vector control strategies against leishmaniasis in the region. Preliminary observat ions revealed significant variationsin sandfly species composition, abundance, and diversity according to habitattype and local environmental conditions. Rural, peri-urban, and naturalhabitats exhibited distinct community structures, reflecting differences invegetation cover, microclimatic conditions, host availability, and the degreeof anthropogenic disturbance. These findings suggest that ecological factors,including temperature, humidity, altitude, and land-use patterns, together withhuman-induced environmental changes such as urbanization, agriculturalexpansion, and habitat fragmentation, play a major role in shaping sandflypopulations and their spatial distribution. Since several sandfly species arerecognized as sensitive indicators of environmental change, their presence andabundance can provide valuable information on ecosystem integrity and habitatquality. Furthermore, understanding the ecological requirements and seasonaldynamics of vector species is essential for predicting changes in theirdistribution under ongoing environmental and climatic pressures. Integratingentomological, ecologi cal, and environmental data into ecosystem management andconservation strategies can therefore improve biodiversity monitoring, supportthe

assessment of habitat restoration programs, and strengthen surveillancesystems for vector-borne diseases. Such an interdisciplinary approach not onlycontributes to the conservation of natural ecosystems but also enhances publichealth preparedness by promoting sustainable vector management and reducing therisk of leishmaniasis transmission in northeastern Algeria and other Mediterranean regions.

Keywords: Leishmaniasis vectoriel écosystème biodiversity sand files Algeria

IMPACT OF REPRODUCTIVE CONSTRAINTS ON THE NATURAL REGENERATION OF PINUS NIGRA SUBSP. MAURETANICA

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ABSTRACT

Pinus nigra subsp. mauretanica is an endangered endemic subspecies restricted to the Djurdjura National Park, facing a high risk of extinction due to a prolonged absence of natural regeneration. This research examines whether this regeneration failure is directly linked to internal reproductive constraints and compromised seed quality. Laboratory analyses were performed on materials collected in the Park to assess reproductive success: seed quality was determined through the proportion of filled versus empty seeds per cone, germination capacity was tested under controlled environmental parameters, and pollen viability was examined via cytological techniques. Field assessments confirmed a critical demographic decline, with a population limited to fewer than 500 individuals, heavily threatened by recurrent wildfires. However, laboratory and cytological analyses revealed that external threats are compounded by severe internal reproductive constraints: filled seed production was extremely low, estimated at only 9% per cone, alongside a low germination rate of 37%, a compromised pollen viability of only 24.9%, and associated morphological abnormalities. These dysfunctions directly compromise the production of viable offspring and likely represent one of the main factors explaining the persistent regeneration difficulties observed in this natural population. Consequently, urgent science-based conservation measures must integrate targeted reproductive monitoring, seed-enhancement techniques, and strategic reforestation to protect this unique endemic resource from irreversible loss.

Keywords: Pinus nigra subsp. mauretanica, Djurdjura National Park, natural regeneration, reproductive constraint, conservation.

MORPHOLOGICAL AND CYTOGENETIC DIVERSITY OF ALGERIAN POPULATIONS OF VICIA MONARDII BOISS. & REUT

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ABSTRACT

Vicia monardii Boiss. & Reut. is a wild forage legume of considerable interest for the conservation and valorization of Mediterranean plant genetic resources. This study aimed to characterize the morphological and cytogenetic diversity of four Algerian populations collected from contrasting ecological habitats and to assess their potential as genetic resources for forage production and breeding. Morphological characterization was conducted during a single growing season using a set of phenological, morphological, and agronomic traits. Statistical analyses revealed highly significant differences among populations for most of the traits studied, demonstrating substantial phenotypic variability within the species. Multivariate analyses effectively discriminated the populations according to their morphological characteristics and revealed patterns of differentiation associated with their ecological origins, suggesting adaptation to diverse environmental conditions. Cytogenetic analyses based on mitotic and meiotic chromosome observations revealed marked chromosomal polymorphism among the studied populations. Three diploid chromosome numbers were identified, namely 2n = 12, 14, and 16, corresponding to haploid numbers of n = 6, 7, and 8, respectively. The confirmation of these chromosome numbers through meiotic observations provides additional evidence of intraspecific cytogenetic diversity. Karyometric analyses further revealed variations in chromosome size and morphology, providing new insights into the cytotaxonomy and chromosomal evolution of Vicia monardii. Overall, the results demonstrate that Algerian populations of Vicia monardii constitute an important reservoir of morphological and cytogenetic diversity. This study provides original information for the conservation and sustainable utilization of plant genetic resources and highlights the potential of this species for forage development and genetic improvement under Mediterranean environmental conditions.

Keywords: Vicia monardii, morphological diversity, cytogenetics, karyotype, plant genetic resources.

SOIL MICROBIAL DIVERSITY FOLLOWING A MEADOW FIRE IN WESTERN BULGARIA

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ABSTRACT

The increasing frequency and intensity of wildfires associated with climate change may have long-lasting effects on the structure and functioning of grassland ecosystems. Soil microbial communities are central to nutrient cycling, organic matter decomposition, and post-fire ecosystem recovery. However, the response of soil microbial diversity may vary depending on fire severity, environmental conditions, and the time elapsed after the disturbance. This study evaluated soil microbial diversity in a meadow ecosystem affected by fire near Ponor village in Western Bulgaria. Soil samples were collected from a burned area and a corresponding unburned control area at two sampling points, in April and June, representing periods before and after the development of active vegetation. Microbial communities, including bacteria and fungi, were investigated using shotgun metagenomic sequencing. Alpha diversity was evaluated to compare within-sample microbial richness and diversity between the burned and control areas and between the two sampling periods. Although variations in microbial community profiles were observed across the studied areas and sampling months, the alpha-diversity analysis revealed no statistically significant differences between the burned and control soils or between the sampling periods. These results suggest that the local richness and evenness of the soil microbial communities remained relatively stable during the investigated period despite the fire disturbance and seasonal vegetation development. Further analysis of taxonomic composition and beta diversity is required to determine whether fire caused shifts in community structure without substantially changing overall within-sample diversity.

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Keywords: wildfire, soil microbiome, shotgun metagenomics, alpha diversity, microbial resilience, grassland ecosystem, post-fire recovery

PESTICIDE-INDUCED BIOLOGICAL AND BIOCHEMICAL RESPONSES IN THE LAND SNAIL EOBANIA VERMICULATA: IMPLICATIONS FOR TERRESTRIAL BIODIVERSITY CONSERVATION

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ABSTRACT

Pesticide use in agricultural ecosystems can represent an important pressure on non-target organisms and may contribute to the alteration of terrestrial biodiversity. Terrestrial gastropods are particularly relevant in this context because they interact closely with vegetation and soil and can accumulate environmental contaminants. The present study aimed to investigate the biological and biochemical effects of two pesticides, Ampligo 150 ZC and Akari 500 SC, on the land snail Eobania vermiculata, with particular emphasis on their potential implications for non-target terrestrial biodiversity and the use of this species as a bioindicator of environmental stress. The study was conducted in Batna, northeastern Algeria, from November 2024 to April 2025. A total of 189 sub-adult individuals of Eobania vermiculata, collected from a non-agricultural area distant from apple orchards, were used in the experiment. The snails were randomly distributed into three experimental groups: an untreated control group and two pesticide-exposed groups. Each group consisted of nine replicates, with seven snails per replicate. Following an acclimation period under controlled laboratory conditions, the snails were exposed for six weeks through consumption of pesticide-treated food. The pesticides were applied according to the recommended agricultural use rates indicated for their respective products, in order to simulate a dietary exposure pathway corresponding to the consumption of contaminated vegetation under agricultural conditions. Body weight, mortality, and catalase (CAT) response were subsequently evaluated. The results revealed a slight increase in body weight in all groups. Mean weight gain was 1.554 g in the control group, 1.612 g in the Ampligo-treated group, and 1.705 g in the Akari-treated group. However, this increase should not necessarily be interpreted as enhanced or normal growth, as pesticide exposure may alter physiological processes, including water balance and tissue fluid retention. Mortality differed among treatments, with the highest mortality recorded in the Ampligo group 26%, compared with 9.5% in the control group, while mortality in the Akari group remained close to the control level. Catalase measurements also revealed a marked alteration in the antioxidant response following pesticide exposure. At 120 seconds, ΔA/min values were approximately 0.035 in the control, −0.060 in the Ampligo group, and −0.140 in the Akari group, indicating a pronounced disturbance of the catalase-related response compared with untreated snails. Overall, the findings demonstrate that exposure to Ampligo 150 ZC and Akari 500 SC can induce biological and biochemical disturbances in Eobania vermiculata. The increased mortality observed with Ampligo and the marked alteration of catalase response under both pesticide treatments highlight the vulnerability of terrestrial non-target organisms to pesticide exposure. These

findings support the potential use of Eobania vermiculata as a bioindicator of pesticide-related environmental stress and emphasize the importance of incorporating non-target terrestrial organisms into strategies for sustainable pesticide management and biodiversity conservation in agricultural ecosystems.

Keywords: Eobania vermiculata, pesticides, terrestrial biodiversity, catalase, oxidative stress, bioindicator

NUTRITIONAL POTENTIAL OF HALOPHYTIC FODDER SHRUBS AND SOIL CHARACTERISTICS IN SOUTH-EASTERN ALGERIA: A STUDY OF ATRIPLEX HALIMUS AND TAMARIX AFRICANA

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ABSTRACT

In the arid regions of Algeria, prolonged drought and soil salinity are major constraints to plant biodiversity and forage production. Under these harsh environmental conditions, halophytic shrubs represent valuable and sustainable fodder resources for grazing livestock. This study aimed to evaluate the nutritional potential of two dominant halophytic species, Atriplex halimus and Tamarix africana, growing in the El Haouch area (Biskra, south-eastern Algeria), and to characterize the physicochemical properties and mineral status of the associated soils. The study area is characterized by an arid climate, low annual rainfall, high temperatures, and alkaline saline soils with limestone and salt accumulations. Chemical analyses of the forage focused on organic matter, crude protein, ether extract, fiber fractions, and macro- and trace-mineral contents. The results showed that both halophytic shrubs constitute valuable forage resources, providing appreciable energy, protein, and mineral contents capable of contributing to the nutritional requirements of grazing small ruminants, particularly sheep. Soil analyses confirmed the saline and alkaline conditions under which these species successfully thrive. In addition to their nutritional value, these perennial shrubs contribute to soil stabilization by reducing wind and water erosion and enhancing the productivity of marginal lands. The sustainable management and rational utilization of these halophytic resources could improve livestock feeding while promoting the conservation and resilience of arid rangeland ecosystems.

Keywords: Arid area, halophytic shrubs, Atriplex halimus,Tamarix africana drought, soil characteristics

LADYBIRD DIVERSITY ACROSS AGRICULTURAL AND NON-AGRICULTURAL HABITATS IN NORTH-CENTRAL ALGERIA

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ABSTRACT

This study investigates ladybird (Coleoptera: Coccinellidae) communities across four contrasting habitats in North-Central Algeria : forest, fruit-crop, cereal-crop, and urban park, with the aim of assessing how habitat characteristics, prey availability, and seasonality influence their diversity, abundance, and community structure. From January to October 2025, a total of 203 surveys were conducted, resulting in the collection of 3 580 adult individuals belonging to 23 species. Diversity patterns were assessed using Hill numbers and iNEXT coverage-based rarefaction and extrapolation, while habitat and environmental effects on abundance and community composition were evaluated using generalized linear models and multivariate analyses. The assemblage was dominated by Hippodamia variegata (33.8%), followed by Chilocorus bipustulatus (17.9%), Novius cardinalis (11.6%), and Oenopia doublieri (10.9%). The forest supported the highest species richness, with 20 species recorded, whereas agrosystems exhibited the greatest abundances, reaching up to 86.8 ± 76.2 individuals per survey. In contrast, the urban park supported a markedly poorer assemblage, with only four species accounting for 2.2% of all captures. Ladybird activity was strongly seasonal, peaking in May–June (46.7%) and with 88% of individuals recorded between March and August. Among the 10 strictly aphidophagous species, representing 54.7% of all individuals, aphid presence was associated with increased ladybird abundance, whereas the tested abiotic variables showed no detectable effect. Community composition also differed strongly among habitats, with the urban park exhibiting a distinctly structured assemblage. These findings highlight the importance of habitat heterogeneity, prey availability, and seasonal dynamics in maintaining ladybird communities and their associated ecosystem services. The high abundance of aphidophagous species in agricultural habitats highlights their potential as natural enemies and suggests that conserving and promoting ladybird communities could contribute to the development of biodiversity-based and sustainable pest management strategies in North-Central Algerian agroecosystems.

Keywords: Coccinellidae, Biodiversity, Agroecosystems, Habitat heterogeneity, North-Central Algeria

DISTRIBUTION OF ORIGANUM VULGARE L IN ALBANIA, HABITATS THREATS AND USAGE

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ABSTRACT

Albania has a rich biodiversity of medicinal and aromatic plant species, yet only limited information is currently available on the population distribution, size and their actual habitat threats. Origanum vulgare L. is a medicinal species of the Lamiaceae family widely used as spice and in traditional medicine for the treatment of several diseases, reflecting its broader ethnobotanical significance within local communities. According to IUCN criteria is classified as EN (A1b), making the development of appropriate conservation strategies essential to safeguard its wild populations. This study aimed to evaluate the distribution, habitat characteristics, and main threats affecting wild O. vulgare L. populations in Albania and document its traditional usage. Field studies were conducted during 2024 - 2026 to assess their actual habitats threats and risks. The methodological approach combined systematic field surveys, GPS mapping and data processing, enabling a comprehensive assessment of the species' ecological niche across different altitudinal zones and habitat types throughout the country. A total of 80 populations were surveyed, they were distributed across most phytogeographic regions occurring from hilly to mountainous areas at elevations ranging 30 - 2200 m a.s.l. The species inhabits a variety of sunny habitats, including dry grasslands, pastures, rocky slopes, roadsides and forest margins. Among the anthropogenic pressures affecting the species, overharvesting and inadequate harvesting practices were identified as the predominant threat, followed by habitat fragmentation, while urbanization had a minor impact. Furthermore, climate change is expected to alter ecological conditions in the long term, therefore studies on predicting the habitat suitability and modeling of its population distribution should be carried out as part of future conservation planning. The present study provided data on current threats and risk of habitats of wild O. vulgare L. populations in Albania as implication for its future conservation, habitat management, and the sustainable use of the species.

Keywords: Origanum vulgare, Albania, Habitat, Conservation

NEW RECORDS OF ANEMONE BLANDA SCHOTT & KOTSCHY IN ALBANIA

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ABSTRACT

Anemone blanda Schoot & Kotschy is a perennial geophyte of the Ranunculaceae family, it is northeastern Steno Mediterranean species of Balkan Peninsula. It is native and registered in the Albanian National Herbarium and in Flora of Albania v.1, as grown in a single locality, Bzhet/ Malesi e Madhe, in Northern Albania. According to IUCN categories this species is classified as endangered EN (A1B) and listed in National Red List. During field surveys in March 2026 on two protected areas of Dajti and Qafshtama Mountain, two new records of the species were discovered at the distance of 161 km and 144 km from the previously known site, respectively. The current findings comes from Fagus sylvatica and mixed Fagus sylvatica, Pinus nigra and Erica carnea communities, on calcerous well drained substrat, where typical ecological conditions of mountain belt of Dajti and Qafe-Shtama were favorable for this species growth. In this contribution, new data concerning the distribution of native species A. blanda in Albania are presented. These findings extend the known range of A. blanda in the country and suggest that the species may be more widespread than previously documented, contributing to more comprehensive mapping of rare and endangered species within Albania.

Keywords: Anemone blanda, Albania, distribution range, national park

CRUSTACEAN COMMUNITY STRUCTURE AND SEASONAL DYNAMICS ALONG THE HIMARA COAST: A COMPARISON BETWEEN PORTO PALERMO AND QEPARO

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ABSTRACT

Crustaceans are an important component of benthic communities and can provide valuable information on environmental conditions and ecological change in marine ecosystem. This study investigates the structure and seasonal dynamics of crustacean assemblages along the Himara coast, comparing the Porto Palermo protected area with the Qeparo coastal area. Sampling was conducted during four periods: autumn 2023, spring 2024, autumn 2024, and spring 2025. At each site and sampling period, three transects and three sampling areas were surveyed. A total of 58 crustacean taxa were recorded, and their abundance was quantified. In addition, the abundance and percentage cover of four balanid species (Cirripedia) were assessed to provide further information on the structure of the sessile crustacean community. Community composition and seasonal variation were analyzed using multivariate statistical approaches, including PERMANOVA, together with analyses of taxonomic richness and abundance. The study aims to determine whether crustacean assemblages differ significantly between Porto Palermo and Qeparo, whether community structure varies among seasons, and whether the magnitude and pattern of spatial differences change seasonally. The results will provide baseline information on the composition, abundance, and seasonal dynamics of crustacean assemblages and identify common and characteristic taxa in the two coastal areas. This information will contribute to the long-term ecological assessment of the Porto Palermo protected area and Qeparo coastal site.

Keywords: benthic community, crustaceans, biodiversity, protected areas, seasonal variation, multivariate statistical analyses.

ELUCIDATING OXYGEN-CENTERED INTERACTIONS IN EUGENOL ADSORPTION ON ZN-DOPED BIPHENYL NANOPARTICLES

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ABSTRACT

The interaction of bioactive molecules with functionalized aromatic nanostructures is of significant interest for applications in drug delivery and nanoscale sensing. In this study, the adsorption behavior of eugenol on Zn-doped biphenyl nanoparticles was investigated using density functional theory (DFT) calculations. Fully optimized geometries and energy analyses were performed to determine the preferred binding configurations and to elucidate the nature of the interaction mechanisms. The results reveal that the adsorption process is predominantly governed by interactions involving the oxygen-containing functional groups of eugenol, particularly the hydroxyl (-OH) moiety, which exhibits strong affinity toward the Zn active sites. This interaction is characterized by partial coordination between the oxygen atom and the Zn center, accompanied by charge transfer from the eugenol molecule to the nanoparticle surface. The calculated interaction energies indicate the formation of stable complexes, suggesting a favorable adsorption process. Such metal–oxygen interactions in doped nanostructures have been widely reported as key contributors to enhanced binding affinity and stability. Furthermore, electronic structure analysis demonstrates significant redistribution of electron density and modification of frontier molecular orbitals upon adsorption, indicating potential changes in the electronic properties of the system. These findings are consistent with previous studies highlighting the role of heteroatom doping in tuning adsorption characteristics and enhancing molecular interactions in aromatic nanomaterials. Overall, this study provides detailed molecular-level insight into eugenol adsorption on Zn-doped biphenyl nanoparticles and supports their potential application as effective carriers for bioactive compounds.

Keywords: Eugenol Adsorption, bioactive molecules, Nanoparticles, Zn-Doped Biphenyl

SELF-EXPANDING BIODEGRADABLE IMPLANTS ENABLED BY 4D PRINTING: FROM PROGRAMMABLE MATERIALS TO MINIMALLY INVASIVE DEPLOYMENT

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ABSTRACT

Conventional implants are generally designed as static structures, although their implantation often requires extensive surgical exposure to accommodate their final geometry. Four-dimensional printing offers a different paradigm in which an implant can be temporarily compacted, introduced through a smaller surgical opening, and subsequently recover its intended shape after placement. This keynote presents the development of biodegradable, self-expanding implant systems for mandibular and spinal reconstruction, highlighting the combined roles of material composition, functional grading, internal architecture, and activation strategy. In the mandibular application, a biomimetic shell–core implant was fabricated using a stiff PLA/PEG 95/5 cortical shell and a more compliant PLA/PEG 70/30 trabecular core. Five internal architectures were investigated under clinically relevant buccolingual compression. The hexagonal structure provided the highest load-bearing capacity, reaching approximately 1227 N, while the gyroid architecture offered the most balanced response by combining a load capacity of approximately 1057 N, progressive deformation, rapid recovery within approximately 120 s, and a shape-recovery ratio of 83.76%. Cell-viability results further supported the potential of gyroid and hexagonal architectures for biodegradable mandibular reconstruction. A complementary spinal application involved 4D-printed PLA/PCL cages reinforced with graphene oxide. The implants were programmed into a reduced-width configuration for minimally invasive insertion and subsequently activated using controlled heating and radio-frequency stimulation. Shape-fixity ratios of approximately 97.4%–98.4% were achieved, while recovery reached up to 89.8% in heated water and 98.7% under radio-frequency activation. Mechanical testing and finite-element analyses demonstrated that the programmed cages retained sufficient structural integrity under axial, lateral, and flexion–extension loading. Together, these case studies demonstrate that self-expanding implant performance is governed not only by the shape-memory polymer but also by the interaction between material distribution, lattice topology, loading direction, and activation method. The findings establish a design framework for patient-specific implants that can be delivered in a compact form and expanded in situ, supporting the future development of less invasive and anatomically adaptive reconstructive procedures.

Keywords: 4D printing, self-expanding implants, shape-memory polymers, biodegradable implants, minimally invasive surgery, mandibular reconstruction, spinal cages

OPTIMIZING GOAT SPERM CRYOPRESERVATION: A TRADE-OFF BETWEEN KINEMATICS AND MEMBRANE INTEGRITY

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ABSTRACT

The process of cryopreserving goat sperm has quite a few challenges. One major issue is how sensitive the sperm's plasma membrane is to cold shock and oxidative stress. When the sperm cools down from body temperature to about 5 °C, it experiences cold shock, which can cause lasting damage to the membrane. At the same time, oxidative stress happens because there's too much production of Reactive Oxygen Species (ROS), and the sperm doesn't have enough antioxidants to handle it. This excessive ROS can lead to lipid peroxidation, messing with the membrane's fluidity and permeability. In the end, this all affects the sperm's ability to function properly. Caprine sperm has some unique biological traits that make it sensitive. The sperm from bucks has a special lipid makeup, with an unsaturated to saturated fatty acid ratio of about 0.33. This low ratio makes goat sperm more vulnerable to cold shock and lipid peroxidation. Plus, when cholesterol is reduced in the plasma membrane during freezing, it can worsen the damage from cold shock. To address these issues, recent studies have come up with targeted approaches for goats. One effective method is using cholesterol-loaded cyclodextrins (CLC) to help stabilize the plasma membrane, which greatly improves sperm quality after thawing. Also, adding antioxidants like melatonin or vitamins to the freezing media has been shown to lower ROS production, helping to maintain sperm motility and keep the membrane intact in goats. Experimental analysis on processing methods has shed some light on how to improve cryopreservation. The results showed that the overall quality of cryopreserved sperm—whether washed or unwashed—was pretty much on par with fresh sperm. When looking at motility parameters like total motility, progressive motility, and linearity, there weren't any significant differences between the two groups. But, interestingly, kinetic analysis indicated that not washing the sperm before cryopreservation actually led to better velocities after thawing, with a notable increase in average path velocity (VAP). On the flip side, when it came to viability, the washed sperm group had significantly higher viability values compared to those that were unwashed.

Keywords: Cryopreservation, Caprine sperm, Seminal plasma, Sperm motility, Membrane integrity

BIOTECHNOLOGICAL VALORIZATION OF POTATO PEELS AS A SUBSTRATE FOR CELLULASE PRODUCTION BY BACTERIAL FERMENTATION

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ABSTRACT

The valorization of agri-food waste has become a priority in the development of sustainable biotechnological processes, especially in the context of reducing environmental impact and promoting circular bioeconomy models. Among the various agro-industrial residues generated worldwide, potato peels represent an abundant, inexpensive, and largely underexploited lignocellulosic biomass. Rich in carbohydrates, structural polysaccharides, and minor amounts of proteins and minerals, this by-product offers promising potential as a fermentation substrate for the production of industrial enzymes, particularly cellulases. The present study aimed to evaluate the suitability of potato peels as a low-cost substrate for cellulase production through bacterial fermentation using two Bacillus strains, Bacillus subtilis and Bacillus cereus. The potato peels were first subjected to pretreatment steps including washing, drying, and grinding in order to obtain a homogeneous powder suitable for microbial cultivation. A physicochemical characterization of the raw material was then performed to determine its main nutritional and structural components. The results highlighted a composition favorable to bacterial growth and enzyme synthesis, mainly due to the significant carbohydrate content and the presence of nutrients required for microbial metabolism. Fermentation experiments were carried out in culture media supplemented with potato peel powder as the principal carbon source. Both Bacillus subtilis and Bacillus cereus showed the ability to grow efficiently on this substrate and to produce cellulolytic enzymes capable of degrading the cellulose fraction of the biomass. This enzymatic activity demonstrates the capacity of these bacterial strains to convert an agricultural residue into value-added bioproducts. Overall, the results confirm that potato peels constitute an effective and economical substrate for cellulase production. This work supports the development of environmentally friendly bioprocesses based on the recycling of agri-food residues and highlights the potential of bacterial fermentation as a practical tool for the sustainable valorization of agricultural by-products.

Keywords: cellulase, potato peels, bacterial fermentation, Bacillus subtilis, Bacillus cereus, waste valorization, biotechnology.

COMBINED VACCINE–F(ab)'$_2$ THERAPY ENHANCES PROTECTION AGAINST SEVERE SCORPION ENVENOMATION

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ABSTRACT

Scorpion envenomation remains a life-threatening medical emergency in endemic regions, particularly in North Africa and the Middle East. Despite the availability of F(ab')$_2$-based antivenoms, treatment efficacy is often limited by delayed administration and incomplete neutralization of circulating toxins. In parallel, experimental vaccination strategies using detoxified or irradiated venoms have demonstrated the ability to induce partial protective immunity against severe envenomation. This study explores an immunosynergistic approach combining active vaccination and passive immunotherapy using F(ab')$_2$ fragments to counteract the severe effects of *Androctonus australis hector* (Aah) venom. An experimental vaccine formulation was developed using detoxified Aah-FtoxG50 antigens adsorbed onto an alum-based adjuvant. Mice were immunized according to a predefined schedule. Three months after the final immunization, they were challenged with a lethal dose of native venom (8 LD_{50}). At 1 and 2 hours post-envenomation, vaccinated mice received anti-FtoxG50 F(ab')$_2$ antibody fragments. The inflammatory response was evaluated by measuring neutrophil and eosinophil counts, as well as the enzymatic activities of myeloperoxidase (MPO) and eosinophil peroxidase (EPO). In addition, heart and lung tissues were examined histologically to assess tissue damage. Vaccinated mice challenged with 8 LD_{50} of Aah venom showed a moderate inflammatory response, characterized by regulated infiltration of inflammatory cells and controlled increased MPO and EPO activity. Although mild histological alterations were detected in the heart and lungs, these changes were markedly less pronounced than those observed in non-immunized mice exposed to sublethal venom doses (
This immunosynergy strategy offers a promising pathway for the prevention and management of scorpion stings in high-risk areas.

Keywords: Aah FtoxG50 toxoid vaccine, Anti-FtoxG50 F(ab)'2 antibody, Immunosynergy therapy, Inflammation, Histology, Cardiovascular-respiratory axis

THROMBOLYTIC PROPERTIES OF A METALLOPROTEINASE PURIFIED FROM CERASTES CERASTES VENOM: PROSPECTS FOR USE IN THE TREATMENT OF THROMBOTIC DISORDERS

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ABSTRACT

Thromboembolic disorders, such as deep vein thrombosis, pulmonary embolisms, and myocardial infarctions, present a serious health risk worldwide. Most current therapies for these conditions include anticoagulants in order to prevent further clot formation. However, these medications may not be able to address existing thrombi effectively. It is therefore essential to find new thrombolytic and fibrinolytic agents that can dissolve thrombus and fibrin clots directly, restoring blood flow and preventing associated complications. Indeed, they have been used in diagnosis of some clotting disorders and employed as template molecules for the development of novel thrombolytic drugs. Snake Venom Metalloproteinases (SVMPs) interact in a specific way with platelet surface proteins resulting in an alteration of platelet function. CcMP-II, a P-II metalloproteinase (35 kDa) isolated from Cerastes cerastes snake venom, was obtained by a combination of gel filtration, ion-exchange and affinity chromatographies. The enzyme is a single protein chain composed of 162 amino acid residues with a isoelectric point of 5.6. The multiple alignments with existing protein sequences in the National Center for Biotechnology Information (NCBI) databases, using the BLAST search Program, revealed that the amino acid sequence of CcMP-II displayed high levels of homology with those of the members of class P-II of SVMPs. Moreover, bioinformatic analysis of the CcMP-II indicates that the mature protein contains a metalloproteinase domain, with the characteristic zinc-binding motif (HEXXHXXGXXH) followed by the sequence CIM at the Met-turn. In the disintegrin domain, the tripeptide sequence RGD motif found in many disintegrins. This configuration confers flexibility to CcMP-II recognition and binding to its substrate. Furthermore, CcMP-II presents also a thrombolytic activity. The obtained results showed approximately 60 % of digestion upon clot with 50 µg of CcMP-II and 100 µg lysed 100 % of clot mass. In conclusion, CcMP-II is a zinc-dependent metalloproteinase, belongs to the P-II class of SVMPs, with fibringenolytic and thrombolytic activity. This study may contribute to understanding functional mechanisms of the metalloproteinases. It may be useful in the development of therapeutic agents related to thrombotic disorders.

Keywords: Snake Venom Metalloproteinase, Thrombolytic effect, Fibrinolytic activity, Modelisation, Thromboembolic Disorders

BIOSAFETY CONSIDERATIONS AND TECHNICAL ADVANCES IN THE PREPARATION OF SARS-COV-2 SPIKE PSEUDOVIRUSES

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ABSTRACT

The COVID-19 pandemic created an urgent need for experimental platforms that could support the safe and efficient study of SARS-CoV-2 entry, neutralization, and antiviral inhibition under more accessible laboratory conditions. In this context, spike-pseudotyped viral systems emerged as powerful alternatives to assays based on authentic SARS-CoV-2 because they reproduce the viral entry step while lacking full replication competence. This feature enabled their broad use in biosafety level 2 (BSL-2) laboratories and expanded research capacity beyond highly specialized high-containment facilities. Over time, SARS-CoV-2 pseudovirus systems evolved from emergency-response tools into versatile experimental platforms for neutralization assays, entry inhibitor screening, variant comparison, vaccine evaluation, and mechanistic studies of spike biology. Their increasing value has been driven by two major developments: first, biosafety-oriented improvements in vector architecture and packaging design, including multi-plasmid strategies, self-inactivating transfer systems, and refined lentiviral backbones; and second, technical advances that improve production efficiency, assay sensitivity, and biological relevance, such as optimized spike constructs, reporter-based readouts, host-cell engineering, and variant-adapted assay conditions. Recent studies have further demonstrated that these systems are scalable, applicable in resource-limited laboratory settings, and useful not only for neutralization analysis but also for investigating spike biogenesis and intracellular processing. Comparisons among HIV-1-, MLV-, and VSV-based backbones have also shown that platform choice can directly influence yield, workflow, and experimental interpretation. In addition to the broader literature, thesis-based laboratory implementation and chapter-based conceptual work from our group support the practical and methodological relevance of these platforms in SARS-CoV-2-related experimental design. Overall, the available evidence indicates that SARS-CoV-2 spike pseudovirus technology has become a mature, flexible, and indispensable framework for viral entry research, translational virology, and early-stage antiviral discovery.

Keywords: SARS-CoV-2, pseudovirus, spike protein, biosafety, lentiviral vector, VSV, neutralization assay

EFFECTS OF DIFFERENT GRAPHENE QUANTUM DOTS DELIVERY TECHNIQUES ON CHILI (CAPSICUM FRUTESCENS) GROWTH UNDER LOW-LIGHT CONDITIONS

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ABSTRACT

Suboptimal light conditions limit photosynthetic efficiency and crop yield. While graphene quantum dots (GQDs) have been proposed to enhance plant light harvesting capabilities, the optimal delivery mechanisms under light stress remain unclear. This study evaluates the efficacy of four GQD delivery techniques including foliar spray, soil application, seed coating, and hydroponics in mitigating low light stress in chili (*Capsicum frutescens*). GQDs were synthesized via a microwave assisted method and characterized, exhibiting a strong absorption peak at 300 nm, blue luminescence at 434.5 nm, and a relative quantum yield of 5.33%. *C. frutescens* were treated and monitored over 60 days under controlled indoor (116 μmol m-2s-1) and outdoor (80.9 μmol m-2s-1) low light conditions. The efficacy of GQD delivery was dependent on the growth environment. Under indoor low light conditions, foliar spray significantly increased plant height (21.7 ± 1.02 cm) and leaf area (32.00 ± 2.97 cm^2) compared to controls. Indoor soil application significantly increased chlorophyll *b* content ($p = 0.0070$). In outdoor low light environments, soil application was the most effective method, leading to the greatest plant height (23 ± 1.45 cm) and leaf area index (0.28 ± 0.029). The varied growth responses indicate that optimal GQD application is environment specific. The effectiveness of soil application outdoors is associated with efficient root uptake and the protective buffering of the soil against environmental degradation. Selecting appropriate GQD delivery methods provides a viable and data supported strategy for improving crop growth under low light conditions.

Keywords: nanotechnology, graphene quantum dots, growth parameters, low light, delivery method

ENZYMATIC VALORIZATION OF CEREAL STRAW INTO XYLOOLIGOSACCHARIDES USING RECOMBINANT XYLANASE FROM BACILLUS SONORENSIS

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ABSTRACT

Cereal straw is an abundant agricultural residue with considerable potential as a renewable feedstock for the production of value-added bioproducts. In this study, wheat (Triticum aestivum L.), rice (Oryza sativa L.), barley (Hordeum vulgare L.), and oat (Avena sativa L.) straw were evaluated as substrates for the enzymatic production of xylooligosaccharides (XOS) using a recombinant xylanase from Bacillus sonorensis. Enzymatic hydrolysis was performed at 40 °C and pH 7.0 using enzyme loadings of 200–400 U g^{-1} and a stepwise enzyme addition strategy (60/40). Hydrolysis efficiency was influenced by both substrate type and enzyme loading. Increasing enzyme loading significantly enhanced sugar release from wheat, rice, and oat straw, whereas barley straw showed a limited response. The highest XOS yield was obtained from wheat straw (40.08 ± 2.17 g kg^{-1}), followed by barley (36.87 ± 0.86 g kg^{-1}), oat (32.33 ± 1.18 g kg^{-1}), and rice straw (27.55 ± 1.86 g kg^{-1}). Thin-layer chromatography indicated that xylobiose (X2) and xylotriose (X3) were the predominant hydrolysis products, with X2 as the major fraction. FTIR and ^{1}H NMR analyses confirmed the carbohydrate nature of the hydrolysates and supported the presence of β-linked xylooligosaccharides, while SEM revealed substrate-dependent structural modifications following enzymatic treatment. These findings demonstrate the potential of recombinant B. sonorensis xylanase for the sustainable bioconversion of cereal straw into value-added xylooligosaccharides and support the development of enzyme-based strategies for the efficient utilization of agricultural residues.

Keywords: cereal straw, xylooligosaccharides, recombinant xylanase, Bacillus sonorensis, agricultural residues, enzymatic bioconversion

HUMAN PLATELET AGGREGATION INHIBITOR PURIFIED FROM CERASTES CERASTES VENOM: CANDIDATE TO SUBSTITUTE MISSING FACTORS IN BLOOD DISEASES

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ABSTRACT

Viperidae and Crotalidae venoms are a potent bio-source of various bioactive components. Cerastes cerastes venom as a typical representative of Viperidae venoms in North Africa is rich in Snake Venom Metalloproteinases (SVMP). These multi-domain enzymes interact in a specific way with platelet surface proteins resulting in an alteration of platelet function. However, the exact mechanism of venom-induced hemorrhage is not yet fully understood.
The P-I class SVMP, CcH1, was purified from Cerastes cerastes venom by a combination of gel filtration, ion exchange, affinity and RP- HPLC chromatography. This SVMP CcH1 is a 25 kDa weakly hemorrhagic metalloproteinase causing a variety of local tissue damage. In this study, we report the functional characteristics of CcH1 on platelet aggregation and we evaluated the effect of CcH1 on extracellular matrix components. CcH1 was able to preferentially hydrolyze the α-chain of fibrinogen and fibrin. Proteolytic activity of the enzyme was completely inhibited by metal chelating agents but not by other typical protease inhibitors. Furthermore, inhibition of platelet aggregation leads to bleeding and contributes to hemorrhage formation through leaky blood vessels. The effect of CcH1 on ADP-induced human platelet aggregation was analysed. Obtained results showed that activation of platelet aggregation by the addition of agonist "ADP" at 2 mg/ml induces 70% of aggregation. However, the CcH1 did not induce platelet aggregation, but causes an inhibition of platelet aggregation induced by ADP in a dose-dependent manner with an IC50 value of 3.2 µg/mL. These findings suggest that the hemorrhagic mechanism of CcH1 could be summarized as follows. i), CcH1 is able to hydrolyze fibrinogen key molecule in blood coagulation and platelet aggregation. ii), this molecule has proteolytic activity on extracellular matrix proteins which are critical components in structure-function of the vascular basement. It is possible to hypothesize that the metalloprotease domain of CcH1 could contribute to the hemorrhagic activity of the enzyme. Such hypothesis can be strongly supported by the reports that the class P-III metalloproteases usually exhibit more hemorrhagic activity than the class P-I metalloprotease containing only a metalloprotease domain. **In conclusion,** the P-I metalloproteinase CcH1 presents a fibrinolytic activity and inhibits also ADP-induced human platelet aggregation. This study contributes to the understanding of the functional mechanisms of metalloproteinases. Furthermore, the weak hemorrhagic of CcH1, could be used as a therapeutic tool in the treatment and prevention of thrombotic diseases.

Keywords: Cerastes cerastes venom, CcH1, Human platelet aggregation inhibitor, Blood diseases

IMMUNOSENESCENCE AND VACCINE RESPONSE: COMPARATIVE ANALYSIS OF IMMUNE AND INFLAMMATORY RESPONSES TO ATTENUATED SCORPION TOXOID

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ABSTRACT

Age is the main factor affecting the immune profile after vaccination, having a considerable impact on the effectiveness of vaccination. Older adults have a reduced response to vaccination and an increased susceptibility to diseases due to biological changes that lead to immunosenescence inducing an alteration in the functions of innate and adaptive immunity. The aim of this study was to investigate how age affects innate and adaptive immune response in vaccinated mice with attenuated scorpion antigen. Young adult (7 weeks) and aged (13 months) mice were immunized subcutaneously with three doses of vaccine preparation at one-month intervals. The inflammatory response was evaluated by assessing two inflammatory cells and their enzymatic markers (neutrophils, eosinophils, MPO and EPO) in vaccinated mice. In addition, the antibody titer, lymphocyte level, thymic and splenic index were then evaluated after immunization schedule. Obtained results showed that the vaccination strategy triggered weak neutrophilic and eosinophilic leukocytosis as MPO and EPO activities in immunized aged mice. In contrast, an enhanced, but not exacerbated, inflammatory response was observed in immunized young adult mice. Furthermore, an increase in the level of lymphocytes followed by the production of specific antibodies was observed in both immunized aged and young mice. This humoral response remains weak in immunized aged mice compared to that induced in immunized young mice. Thymic and splenic index was increased in immunized young animals compared to than the older mice. We demonstrate that age affects the inflammatory and antibody response in vaccinated mice to envenomation. These age-induced differences need to be considered when developing vaccination strategies for different age groups.

Keywords: Attenuated scorpion antigen, Vaccination, Inflammatory and humoral response, Thymic and splenic index

HIGH-THROUGHPUT PHENOTYPING WITH AI SUPPORT IN ARABIDOPSIS THALIANA: CURRENT APPROACHES

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ABSTRACT

Arabidopsis thaliana is one of the most widely used model organisms in plant genetics, molecular biology, developmental biology, and plant biotechnology research due to its short life cycle, small genome, ease of transformation, and rich collection of mutants. Recent advances in imaging technologies have enabled high-throughput phenotyping (HTP) systems to rapidly, accurately, and reproducibly evaluate the morphological, physiological, and developmental characteristics of plants. However, analyzing the large volumes of image and phenotype data obtained from these systems is a time-consuming and labor-intensive process using traditional methods. Therefore, artificial intelligence-based approaches, particularly machine learning, deep learning, and computer vision techniques, have become a significant research area in plant phenotyping studies. The aim of this study is to evaluate AI-assisted high-throughput phenotyping approaches in Arabidopsis thaliana by reviewing scientific studies published in Web of Science, Scopus, and PubMed databases between 2020 and 2026, and to highlight current developments in this field. In this context, prominent image analysis methods, deep learning-based approaches, and high-throughput phenotyping platforms in the literature have been examined. The studies reviewed evaluated artificial intelligence applications for leaf and root phenotyping, plant growth monitoring, image analysis, and determination of abiotic stress responses; current software and platforms developed for this purpose were summarized. In addition, the contributions of AI-assisted phenotyping approaches to revealing genotype-phenotype relationships, more accurate assessment of plant development, and efficient analysis of large-scale phenotype data were discussed. **In conclusion,** it is assessed that AI-assisted high-throughput phenotyping approaches accelerate data analysis processes in Arabidopsis thaliana research, increase the accuracy of phenotypic assessments, and have broad application potential ranging from basic plant biology to sustainable agriculture and plant biotechnology. With the development of artificial intelligence algorithms and the widespread adoption of high-throughput phenotyping systems, it is predicted that these technologies will be used more effectively in plant research in the future and will make significant contributions to the development of new research areas.

Keywords: Arabidopsis thaliana, artificial intelligence, high-throughput phenotyping, deep learning, plant phenotyping

EVALUATION OF ARONIA MELANOCARPA (MICHX.) ELLIOTT CELL SUSPENSION CULTURE AS POTENTIAL SOURCE OF CELLULAR NUTRITIONAL SUPPLEMENTS

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ABSTRACT

Black chokeberry (Aronia melanocarpa (Michx.) Elliott) is one of the richest sources of antioxidants among berries. The plant is known to accumulate high amounts of anthocyanins, flavonoids and phenolic acids (especially chlorogenic acid). In response to the recent trends for development of sustainable and ecofriendly production systems, the cellular agriculture revealed the potential of plant cell culture technology as a new alternative sources for valuable plant-derived products with application as food supplements. In this study, we demonstrated that Aronia melanocarpa cell suspension culture could be used as an alternative source of antioxidant rich biomass with potential application for development of new cellular nutritional supplements. The analyses of nutritional values showed, that the dried biomass from Aronia cell suspension has higher energy value (327.08±23.20 kcal/100g), compared to the dried berries (312.27±22.39 kcal/100g). Moreover, the in vitro cell biomass showed higher protein (9.10±0.14 %) and lower sugars (27.55±1.01 %), when compared to dried berries (6.02±0.14 % and 44.14±2.31 %, respectively). The presented data could be used as a preliminary study on potential application of Aronia cell suspension biomass as an alternative of Aronya dry berries in development of food supplements with antioxidant activities in foods.

Acknowledgements: This work was supported by the Bulgarian National Science Fund, Bulgarian Ministry of Education and Science, under the contract KP-06-H66/14; BG-175467353-2022-04-0214-C01.

Keywords: Cellular agriculture, Plant cell suspension culture, Black chokeberry, Nutritional value, Antioxidants

POTENTIAL APPLICATION OF LAB LYSATE AS ELICITOR OF BIOMASS ACCUMULATION AND SECONDARY METABOLITES PRODUCTION BY ARONIA MELANOCARPA (MICHX.) ELLIOTT CELL SUSPENSION CULTURE

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ABSTRACT

Elicitation with abiotic and biotic elicitors is one of the most effective aproache for increasing the secondary metabolite accumulation in plant in vitro systems. Aronia melanocarpa (Michx.) Elliott, known as “black chokeberry” is an amazing source of natural antioxidants, including phenolic acids, flavonoids and anthocyanins. Following the recent trend of cellular agriculture, plant cell suspension of Aronia has been initiated and adapted for growth in nutrient medium without artificial growth regulators. In this study, a lysate from Lactobacillus delbrueckii subsp. bulgaricus (LB) was used as “natural” elicitor in order to increase the production of valuable secondary metabolites and to improve the antioxidant capacity of produced Aronia cell biomass. The results showed that LB lysate has strong positive effect on biomass accumulation when added at the beginning of cultivation (ADB=11.45±0.91 g/L, compared to ADB=8.40±0.20 g/L of control) and also increase the DPPH radical scavenging activities to 6.56±0.41 μM TE/g DW, compared to 5.06±1.05 μM TE/g DW of control. The reported data outline the LB lysate as potential natural elicitor of valuable metabolites, produced by Aronia melanocarpa cell suspension culture.

Acknowledgements: This work was supported by the Bulgarian National Science Fund, Bulgarian Ministry of Education and Science, under the contract KP-06-H66/14; BG-175467353-2022-04-0214-C01.

Keywords: Cellular agriculture, Antioxidants, Lactic acid bacteria, Black chokeberry, Flavonoids

TECHNOLOGICAL VALORIZATION OF BITTER ORANGE (CITRUS AURANTIUM) PEELS INTO A FUNCTIONAL POWDER FOR FOOD FORMULATION APPLICATIONS

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ABSTRACT

In Morocco, where the citrus sector is of strategic importance, bitter orange (*Citrus aurantium)* peels represent a biomass exceptionally rich in bioactive compounds (fibers, polyphenols, antioxidants) with high technological and nutritional potential. The valorization of these residues as a stable functional powder aligns with a circular economy approach and the development of high-value-added ingredients. This work aims to develop an optimized protocol for the preparation of a functional powder from bitter orange peels collected in the Rabat region, to perform its comprehensive physicochemical and biochemical characterization, and to evaluate its potential for incorporation into the development of food formulations, specifically confectionery and biscuits. The conducted study involved the dehydration of the peels via freeze-drying, a method selected to prevent the fungal contamination observed during oven-drying trials (45°C). The resulting powder underwent rigorous analytical profiling, including: pH, moisture and ash content, water absorption capacity (WAC), oil absorption capacity (OAC), DPPH antioxidant activity, total polyphenols, total flavonoids, total sugars (phenol-sulfuric method), and insoluble dietary fiber (crude cellulose via the Weende method). Finally, three food applications were formulated: hard candies, marshmallows, and shortbread biscuits. This work demonstrates that bitter orange peels constitute a functional source of exceptionally high potential. Their transformation into a freeze-dried powder is technically feasible and allows for the natural enrichment of various food matrices with fibers, antioxidants, and bioactive compounds without altering their technological or organoleptic properties, opening concrete industrial perspectives for the valorization of citrus by-products in Morocco.

Keywords: Citrus aurantium, valorization, formulation, peels, powder

TOXICITY AND REPELLENCY OF ESSENTIAL OILS FROM THREE SPICES AGAINST THE STORED GRAIN PEST TRIBOLIUM CONFUSUM (COLEOPTERA: TENEBRIONIDAE)

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ABSTRACT

Tribolium confusum is one of the main insect pests of stored food products, as it significantly affects their quality and quantity, leading to substantial economic losses. The control of this pest is mainly based on the use of pesticides, which are not only expensive but also harmful to human health and the environment. Given these limitations, the search for natural control methods is emerging as a sustainable alternative. In this context, our study aims to evaluate the toxicity and repellent effect of three essential oils extracted by hydrodistillation from garlic (Allium sativum), cinnamon (Cinnamomum cassia), and ginger (Zingiber officinale) on adult T. confusum under laboratory conditions. The toxic and repellent effects of these essential oils were assessed through fumigation and repellency tests on adults aged between 1 to 7 days. Three repetitions were performed for all tests. Chromatographic analysis of the tested essential oils revealed that the major compounds were diallyl sulfide (54.22%), cinnamaldehyde (82%) and α-zingiberene (18.64%) in the essential oils of garlic, cinnamon and ginger, respectively.
Our results indicate that A. sativum essential oil exhibits significant fumigant toxicity against adult T. confusum, causing 100% mortality after 24 hours at a dose of 20 µl. In contrast, the other two oils did not show any significant toxic effects. However, all three oils demonstrated notable repellent activity against this pest, with repellency rates of 38.33%, 45.83%, and 64.16% for C. cassia, Z. officinale, and A. sativum essential oils, respectively. Therefore, A. sativum essential oil could be used as an effective bioinsecticide to significantly reduce losses caused by this pest in stored products, but tests at a larger scale are necessary to confirm our results.

Keywords: Tribolium confusum, essential oils, extraction; toxicity, repellency

THE EFFECT OF MURASHIGE AND SKOOG MEDIA STRENGTHS ON IN VITRO SHOOT AND ROOT REGENERATION FREQUENCIES OF BAMBARA GROUNDNUT (VIGNA SUBTERRANEA (L.) VERDC.) GENOTYPES

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ABSTRACT

Bambara groundnut *(Vigna subterranea (L.) Verdc.)* is a vital indigenous African leguminous crop valued for its drought tolerance, adaptability to poor soils, and nutritional composition. Despite its valuable agricultural importance, the crop remains under-utilized because of inadequate regeneration systems and limited genetic enhancement programs. The development of efficient *in vitro* regeneration protocols is hence crucial for genetic transformation, germplasm conservation, and rapid multiplication of Bambara groundnut. The optimization of basal medium composition is crucial for developing efficient regeneration systems in *V. subterranea,* precisely for applications involving genetic transformation and micropropagation. This study investigated the effects of different strengths of Murashige and Skoog (MS) medium on the shoot and root frequencies of five Bambara groundnut landraces (Ci1–Ci5). Explants were cultured on MS media at 1×, ¾×, ½×, and ¼× strengths, and regeneration responses were evaluated. Data were analysed using ordinary two-way analysis of variance (ANOVA) in GraphPad Prism. Shooting frequency was significantly influenced by genotype ($F_{4,\ 40} = 76.63$, *P P P* = 0.3903). Rooting frequency was significantly affected by genotype ($F_{4,\ 40} = 95.80$, *P P P* = 0.0107). Full-strength (1×) MS medium promoted optimal shoot induction, whereas half-strength (½×) MS medium enhanced root formation. Among the genotypes, Ci2 consistently exhibited superior regenerative performance. These findings provide vital insights for the development of efficient *in vitro* regeneration protocols for *V. subterranea* enhancement programs.

Keywords: GraphPad Prism, Bambara groundnut, Vigna subterranea, MS medium strengths, shoot regeneration, root induction, tissue culture.

MOLECULAR DOCKING STUDY ON THE INTERACTION OF CAFFEIC ACID, CAFFEIC ACID PHENETHYL ESTER (CAPE) AND GENISTEIN MOLECULES WITH SULFITE EFFLUX PUMP SSU1 AND SUBTILISIN-LIKE PROTEASE 1 PROTEINS

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ABSTRACT

Dermatophytosis is the most common infection worldwide, affecting the stratum corneum of the skin, nails, and hair with a high recurrence rate. This fungal infection is caused by dermatophytes, which are filamentous fungi that can infect keratinized tissues in both animals and humans, particularly Trichophyton mentagrophytes, T. rubrum, T. tonsurans, Microsporum canis, Nannizzia gypsea, and Epidermophyton floccosum. Propolis is a resinous substance produced by honeybees and has been utilized in traditional medicine for centuries due to its numerous biological properties. Propolis resin contains a variety of phenolic compounds. In both humans and animals, these compounds demonstrate a variety of biological activities, including antibacterial, antifungal, antiviral effects. In our previous study, we evaluated the in vitro antifungal activity of a propolis extract collected from the Muğla region against M. canis and N. gypsea. We found that propolis effectively inhibited mycelial growth in all tested dermatophyte field isolates at every concentration assessed. In this study, we investigated the interaction between caffeic acid, caffeic acid phenethyl ester (CAPE), and genistein—major phenolic compounds in the propolis extract—and certain virulence-related factors of the M. canis and N. gypsea fungus species using molecular docking method. According to the data obtained, it was determined that the Sulfite efflux pump SSU1 virulence factor of M. canis showed a binding energy of -7.3 kcal/mol with genistein, -6.4 kcal/mol with CAPE, and -6.2 kcal/mol with caffeic acid. It was determined that the subtilisin-like protease 1 virulence factor of N. gypsea showed binding energies of -6.0 kcal/mol with genistein, -5.4 kcal/mol with caffeic acid, and -5.3 kcal/mol with CAPE. The findings suggest that caffeic acid, CAPE, and genistein molecules can show significant binding affinity to SSU1 and subtilisin-like protease 1 proteins and may be potential inhibitory molecules in M. canis and N. gypsea dermatophytosis cases.

Keywords: Molecular docking, M. canis, N. gypsea, SSU1, SUB1, caffeic acid, CAPE, genistein

MOLECULAR INSIGHTS INTO EGFR TARGETING BY GLYCYRRHIZIN AND ITS GLYCYRRHETINIC ACID DERIVATIVES: A COMPARATIVE DOCKING STUDY

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ABSTRACT

Cancer remains one of the leading causes of morbidity and mortality worldwide, highlighting the urgent need for the discovery of novel therapeutic agents with improved efficacy and reduced adverse effects. Among the molecular targets involved in cancer progression, the epidermal growth factor receptor (EGFR) plays a central role in regulating cell proliferation, survival, differentiation, angiogenesis, and metastasis. Aberrant activation of EGFR signaling contributes to tumor development and resistance to anticancer therapies. Therefore, the identification of natural compounds capable of interacting with EGFR represents an important strategy in modern drug discovery. Natural products have attracted considerable attention due to their diverse biological activities and potential therapeutic applications. Glycyrrhizin (GL), the major bioactive compound of Glycyrrhiza glabra, exhibits a broad spectrum of pharmacological effects, including anti-inflammatory, antioxidant, antiviral, immunomodulatory, and anticancer activities. Previous studies have demonstrated that glycyrrhizin can regulate apoptosis, oxidative stress, and inflammatory signaling pathways associated with tumor progression. Its main metabolites, 18α-glycyrrhetinic acid and 18β-glycyrrhetinic acid, retain the pentacyclic triterpenoid structure but differ in stereochemical configuration and physicochemical properties, which may influence their molecular interactions with therapeutic targets. The aim of this study was to evaluate and compare the binding characteristics of glycyrrhizin, 18α-glycyrrhetinic acid, and 18β-glycyrrhetinic acid toward the EGFR tyrosine kinase domain using molecular docking analysis and to determine the influence of structural differences on ligand–protein interactions. The crystallographic structure of the EGFR tyrosine kinase domain (PDB ID: 1M17) was obtained from the Protein Data Bank, while three-dimensional structures of the investigated ligands were retrieved from the PubChem database. Molecular docking simulations were performed using AutoDock Vina. The receptor preparation, ligand optimization, and docking procedures were performed according to established computational approaches. The resulting complexes were analyzed using PyMOL and BIOVIA Discovery Studio Visualizer to characterize ligand–protein interactions, including hydrogen bonding, hydrophobic contacts, and van der Waals interactions. The molecular docking analysis revealed distinct differences in the interaction profiles of the investigated compounds. Glycyrrhizin demonstrated the strongest predicted binding affinity toward the EGFR kinase domain with a docking score of −10.1 kcal/mol. In comparison, 18α-glycyrrhetinic acid and 18β-glycyrrhetinic acid showed lower binding affinities of −4.1 kcal/mol and −3.6 kcal/mol, respectively. The docking pose of glycyrrhizin indicated favorable accommodation within the ATP-binding region through multiple non-covalent interactions that contribute to complex stabilization. Comparative analysis suggested that the presence of glucuronic acid residues in glycyrrhizin may enhance molecular recognition

and improve interaction with the EGFR catalytic region. The reduced binding performance observed for glycyrrhetinic acid derivatives indicates that structural modifications, including deglycosylation and stereochemical differences at the C-18 position, may affect ligand orientation and binding stability.

Keywords: Glycyrrhizin, EGFR, molecular docking, AutoDock Vina, glycyrrhetinic acid derivatives, natural compounds, anticancer drug discovery

DEVELOPMENT OF A HUMANIZED PLANT-BASED COVID-19 VACCINE MODEL

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ABSTRACT

Most currently available COVID-19 vaccines are designed to induce neutralizing immune responses against Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) spike (S) protein. However, next-generation vaccine strategies targeting additional conserved viral antigens remain important because of the continuous emergence of variants of concern. Plant-transient expression system is a promising alternative to the other vaccine development platforms particularly for emergency situations where rapid and high-scale production of recombinant proteins is needed. Nevertheless, differences between plant and human N-glycosylation remain a major challenge to produce therapeutic proteins. This study aimed to develop a humanized plant-based vaccine model by co-expressing nucleocapsid (N) and S proteins in glycoengineered (ΔXF) *Nicotiana benthamiana*, which lacks β-(1,2)-xylose and α-(1,3)-fucose residues on its N-glycans. In this system, the highly conserved N protein may enhance antigenic coverage, whereas the S protein facilitates the assembly of virus-like particles. For this purpose, N and omicron-derived S genes were transiently expressed in humanized plant leaves via *Agrobacterium tumefaciens*-mediated infiltration. Total proteins were extracted, filtered through double-layer Miracloth, purified by OptiPrep density gradient ultracentrifugation, desalted using PD-10 desalting columns, and concentrated with Amicon Ultra centrifugal filters. The expressions of both proteins were confirmed by western blotting and LC–MS/MS-based proteomic analysis. Transmission electron microscopy was employed to characterize the morphology of the purified particles. Future studies will evaluate the antigenicity of the humanized SARS-CoV-2 particles using sera from recovered COVID-19 patients. Overall, this study establishes a flexible plant-based platform for the production of SARS-CoV-2 antigens with improved human-compatible glycosylation.

Keywords: COVID-19, glycoengineered Nicotiana benthamiana, humanized SARS-CoV-2 particles, nucleocapsid, plant-based vaccine, omicron variant, spike.

AN INTEGRATED CASCADE APPROACH TO ZERO-WASTE VALORISATION OF WINERY AND AGRO-FOOD BY-PRODUCTS

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ABSTRACT

Moving toward climate-neutral, resource-efficient production calls for biorefinery designs that extract the fullest possible value from biomass while yielding several high-value products in parallel. The winery and agro-food sectors release considerable volumes of lignocellulosic residues and processing by-products, yet these are typically channelled into single, isolated uses, an approach that leaves much of the biomass potential untapped and resource efficiency low. The present work puts forward a Cascade Biorefinery Architecture (CBA), developed within the CERSUS Centre of Excellence, as an integrated technological framework that reshapes heterogeneous agro-industrial residues into interlinked value chains grounded in circular-bioeconomy principles. Instead of treating each by-product as a stand-alone feedstock, the architecture is built as a tiered cascade: every processing stage supplies the raw material for the next, so that waste is progressively minimised and the recovery of valuable compounds maximised. Operationally, the framework is assembled from sequential modules. It opens with biomass characterisation and pre-processing, after which green extraction methods recover polyphenol-rich fractions from grapevine pruning residues, grape pomace, grape seeds, apple pomace and tomato biomass. Selective purification then isolates target high-value molecules (e.g. resveratrol, lycopene and pectin) through advanced chromatographic and separation techniques. The resulting bioactive fractions feed the development of standardised extracts, grape-seed oil, nutrient-enriched grape-seed powder, aquaculture phytosupplements and biodegradable active packaging tailored to the wine industry. What sets this scheme apart from conventional biorefinery layouts is a closing circular-valorisation module: all remaining lignocellulosic fractions are routed toward biochar and advanced carbon materials, so that biomass is used in full and a zero-waste outcome is achieved. Underpinning the whole architecture is a combination of green-chemistry principles, advanced analytical characterisation (HPLC-MS/MS, LC-MS/MS, GC-MS, FTIR), statistical optimisation via Design of Experiments and Response Surface Methodology, and forward-looking sustainability appraisal through Life Cycle Assessment and Life Cycle Costing. Its modular design further supports scalability and transfer across different agro-industrial contexts. Taken together, the Cascade Biorefinery Architecture offers a transferable, systems-level template for circular-bioeconomy implementation, weaving agriculture, food processing, environmental engineering and sustainable-materials development into one integrated platform that can deliver environmental, economic and societal gains while advancing European Green Deal objectives.

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Keywords: agro-food by-product valorisation, cascade biorefinery, green extraction, circular bioeconomy

POLYPHENOL RECOVERY AND PESTICIDE RESIDUE SCREENING IN FERMENTED APPLE PEEL BY-PRODUCTS FROM A ROMANIAN CULTIVAR

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ABSTRACT

Apple processing generates substantial amounts of peel-rich by-products that still contain valuable phenolic compounds but may also retain pesticide residues, raising both valorisation and safety considerations. This study investigated an integrated approach for the bioprocessing, polyphenol recovery, and pesticide residue assessment of apple peel by-products obtained from a Romanian apple cultivar. The peels were subjected to a fermentation step and subsequently used as a plant matrix for conventional solid–liquid extraction by maceration. The influence of solvent type and concentration, extraction time, temperature, and solid-to-solvent ratio on total polyphenol recovery was evaluated. Total phenolic content was determined using the Folin–Ciocâlteu method and expressed as gallic acid equivalents, while experimental differences were assessed by one-way ANOVA followed by Tukey's multiple-comparison test. Among the solvents investigated, acetone provided the highest extraction efficiency, while aqueous acetone solutions of 50–65% showed comparable performance. A temperature of 60°C and an extraction time of 60 min provided an effective balance between polyphenol recovery and processing duration, as extending extraction to 240 min did not yield a significant improvement. Increasing the solvent volume progressively enhanced extraction efficiency, with a solid-to-solvent ratio of 1:100 producing the highest total phenolic content, reaching 12.74 mg GAE/g under the best tested conditions. These findings demonstrate the potential of fermented apple peel by-products as a source of recoverable bioactive compounds. To address the safety dimension of apple by-product valorisation, pesticide residues were evaluated using QuEChERS extraction followed by complementary GC–MS/MS and LC–MS/MS analyses. The multi-residue method covered 464 pesticides with different physicochemical properties, of which 25 were quantified above the limit of quantification in at least one apple sample. Residues of acetamiprid, boscalid, buprofezin, chlorpyrifos-ethyl, and propiconazole were among the compounds exceeding the applicable maximum residue limits in selected samples, highlighting the importance of raw-material screening before further processing. Overall, the study supports a safety-by-design strategy in which fermentation and optimised extraction are combined with pesticide monitoring to enable the sustainable and responsible valorisation of apple peel by-products within a circular bioeconomy framework.

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Keywords: apple peel by-products, fermentation, polyphenols, solid–liquid extraction, pesticide residues, circular bioeconomy

TARGETED EDITING OF DROUGHT-RESPONSIVE GENES IN POTATOES USING CRISPR/CAS9

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ABSTRACT

Drought tolerance in potatoes is a complex, quantitative trait influenced by the interaction between multiple genes and environmental conditions. Key mechanisms include osmotic regulation, stomatal development, and reactive oxygen species detoxification. Several important negative and positive regulators of drought tolerance have been identified, including the TRE, OST2, and EPF genes. Understanding the function of these genes is essential to developing drought-resilient potato plants. Genome editing using the CRISPR/Cas9 system has emerged as a powerful tool for precisely modifying plant genomes. However, applying this technology to tetraploid crops, such as potatoes, poses several challenges, including efficient delivery of editing components, the achievement of complete genome edits, the detection of targeted mutations, and the avoidance of off-target effects. Therefore, integrating genomic, molecular, and physiological approaches is critical for studying polygenic traits like drought tolerance. In this study, we optimized components of the CRISPR/Cas9 system and developed efficient delivery methods for editing the nuclear genome of potatoes. We engineered plant CRISPR/Cas9 vectors that contain the following components in one vector: plant codon-optimized Cas9 driven by the Ubi promoter, and a gRNA expression cassette controlled by the U6 promoter. We fused Cas9 with a nuclear localization signal to ensure nuclear import. To improve editing efficiency, we used potato-specific U6 promoter to drive guide RNA expression. With this vector, yellow fluorescent protein expression can be used to monitor and select Cas9-expressing cells. To minimize off-target mutations, we selected optimal guide RNA sequences using CRISPRdirect, CRISPR-P 2.0, and Cas-OFFinder. We performed genome editing using the protoplast-mediated transformation method and the Fast-TrACC method. We used Agrobacterium-mediated transformation as a control. We assessed delivery efficiency and editing accuracy using marker genes, PCR, sequencing, and CAPS analysis. The functional evaluation included a real-time PCR analysis of target gene expression, as well as an assessment of drought responses using physiological markers, such as chlorophyll content and electrical conductivity, and biochemical markers, such as MDA levels and catalase activity. This approach improved the efficiency of CRISPR/Cas9 in potatoes, revealed the molecular mechanisms underlying drought tolerance, and facilitated the development of drought-tolerant potato plants.

Keywords: CRISPR/Cas9, potato, genes, drought tolerance

NADES-BASED PROTEIN EXTRACTS AS POTENTIAL BIOSTIMULANTS FOR SUNFLOWER SEED GERMINATION AND EARLY GROWTH

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ABSTRACT

Valorizing agro-industrial by-products as biostimulants is a promising approach to improve crop establishment and support the circular bioeconomy. This study evaluated protein extracts recovered from sunflower and almond press cakes using a natural deep eutectic solvent (NADES) for sunflower seed priming. Protein extracts (6.7 mg mL^{-1}) were diluted 10-, 20-, and 50-fold and applied as priming solutions for 6 h. Hydroprimed seeds served as controls, while gibberellic acid, indole-3-acetic acid, and a commercial biostimulant were included as reference treatments. Germination performance was assessed through germination rate, germination speed, mean germination time, stress tolerance index, germination stress index. Seedling growth was evaluated by measuring hypocotyl and primary root length 12 days after germination. Sunflower protein extracts exhibited significantly greater biostimulant activity than almond extracts and the NADES control. The 50-fold diluted sunflower extract achieved 100% germination, the shortest mean germination time (2.6 days), the highest germination rate, and significantly improved seedling growth, producing the longest hypocotyls and primary roots. In contrast, almond extracts showed weaker effects, while NADES alone produced intermediate responses. Statistical analysis revealed organ-specific responses, with hypocotyl elongation mainly affected by treatment type, whereas root growth depended on treatment, extract concentration, and their interaction, indicating greater root sensitivity to extract composition and dosage. The superior performance of sunflower-derived extracts is likely related to the synergistic effects of protein-derived compounds, peptides, amino acids and the osmoprotective properties of the betaine-based NADES. These findings suggest the potential of NADES-derived extracts, particularly those obtained from sunflower press cake, as plant biostimulants and support their further optimization and biological validation.

Acknowledgement. This work was supported by the Ministry of Education and Research through project PN-IV-PCB-RO-MD-2024-0406 (PNCDI IV) and by the Ministry of Education and Research of the Republic of Moldova, project no. 25.80013.5107.27.

Keywords: natural deep eutectic solvents, protein extracts, biostimulants, eco-agriculture, sunflower

MOLECULAR MECHANISMS UNDERLYING DEFENSE RESPONSES OF POTATO (SOLANUM TUBEROSUM L.) AND EMPLOYING CRISPR/CAS TECHNOLOGY FOR THE IMPROVEMENT OF POTATO

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ABSTRACT

The potato (Solanum tuberosum L.) is the fourth most important food crop globally in terms of human consumption, following maize, wheat, and rice. It is cultivated in over 150 countries, and more than 50% of the total potato crop is grown in countries prone to drought and heat. Global production exceeds 370 million tons per year, with major producers including China, India, and Russia. Due to abiotic stress, total potato yield loss is expected to reach up to 32% by 2050. The potato's high yield, short growing cycle, and adaptability are essential for both subsistence and commercial agriculture. Nutritionally, potatoes are rich in carbohydrates, fiber, vitamin C, potassium, and antioxidants. They provide a low-fat, cholesterol-free dietary staple. As a crop, potatoes support all four pillars of food security, such as availability, accessibility, utilization, and stability. However, their productivity is highly susceptible to environmental stresses, which significantly affect crop performance, tuber quality, and overall food security.
This review describes the basic mechanisms, advantages and disadvantages of genome editing systems, such as ZFNs, TALENs, and CRISPR/Cas. Secondly, this article provides a comprehensive review of studies retrieved from academic databases focusing on the effects of various environmental stressors on potato growth, yield, and postharvest storage between 2015 and 2025. Thirdly, we discussed the mechanism genes associated with abiotic-biotic resistance, nutrient content, and post-harvest factors targeted utilizing the CRISPR/Cas system in potato. Thirdly, we provided our opinion about future perspectives on the application of CRISPR/Cas-based genome editing technologies on potato. We hope that this review provides fundamental information that will be useful for future breeding of tuber crops to develop novel cultivars.

Keywords: Solanum tuberosum, CRISPR/Cas, defense mechanisms, environmental stresses

ALLEVIATION OF DROUGHT-INDUCED GROWTH INHIBITION IN SUNFLOWER SEEDLINGS USING NOSTOC SP. EXOMETABOLITES

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ABSTRACT

Sunflower (*Helianthus annuus* L.) is a critical global oilseed crop. Although considered drought-tolerant, its productivity is frequently affected by the severe, persistent drought conditions observed in recent years. Consequently, the development of effective mitigation strategies is required. Microalgae and their metabolites represent a sustainable, ecological approach to alleviate the negative impacts of abiotic stress in modern agricultural systems. By acting as potent biostimulants, these organisms enhance crop resilience and productivity, offering a practical, environmentally conscious alternative to the excessive use of synthetic chemical fertilizers. This study investigated the potential of *Nostoc* sp. exometabolites to mitigate water-deficit stress in sunflower seedlings under controlled laboratory conditions. The experimental design examined the influence of irrigation regimes, seed inoculation methods including immersion in algal metabolites or pre sowing spraying, and supplementary foliar applications. Drought stress was induced on day 15 using a 15% polyethylene glycol (PEG 6000) solution and maintained for 7 days. The control plants were irrigated with tap water throughout the experiment. Morphological parameters, including seedling height, root length, and fresh and dry biomass, were measured at the end of the stress period. Hydric deficit significantly reduced the growth of untreated seedlings compared with well-watered controls. In contrast, seedlings treated with *Nostoc* sp. exometabolites exhibited an enhanced capacity to maintain growth under osmotic stress. The bioactive compounds present in *Nostoc* sp. exometabolites promoted the maintenance of growth processes under hydric deficit conditions. Compared with the PEG-stressed control, treated seedlings exhibited significantly improved morphometric parameters across all treatment variants, with increases of approximately 20-40% in plant height, 80-115% in root length, and 135-250% in fresh biomass. These findings demonstrate the biostimulant potential of *Nostoc* sp. exometabolites in mitigating the adverse effects of water deficit. By enhancing the growth performance of sunflower seedlings under osmotic stress, this biotechnological approach represents a promising strategy for improving crop establishment and productivity in water-limited environments.

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Keywords: Nostoc sp., sunflower, drought stress, biostimulant

COMPARATIVE ASSESSMENT OF SEED PRIMING TECHNIQUES FOR ENHANCING DROUGHT TOLERANCE IN BARLEY (HORDEUM VULGARE L.): GROWTH AND BIOCHEMICAL INSIGHTS

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ABSTRACT

Water stress is a major constraint significantly reducing cereal productivity in semi-arid environments like Tunisia. To mitigate these effects, seed priming has emerged as a promising physiological strategy to improve plant resilience by modulating metabolic activities before radicle emergence. This study compares the effectiveness of different biostimulants and priming agents in inducing tolerance to water stress in three barley varieties (OR1, OR2, and Rihane). Seeds were subjected to five treatments: hydropriming (distilled water), osmopriming (PEG 10% and 15 mM Proline), chimiopriming (140 ppm Gallic Acid), and hormopriming (10 −4M Gibberellic Acid) for 8 hours. Following treatment, seeds were exposed to varying levels of water stress simulated by PEG 6000 (5%, 10%, and 20%). Evaluation was based on germination kinetics, early growth parameters (dry weight, organ length, and water content), and biochemical markers (total polyphenols, flavonoids, and condensed tannins). The results indicate that severe water stress (20% PEG) drastically inhibits germination and growth across all genotypes. However, priming significantly improved the growth performance and vigor of the seedlings. Specifically, gibberellic acid and PEG 10% were the most effective in stimulating early growth and maintaining biomass under stress. Variety OR2 demonstrated the highest tolerance, while Rihane was the most sensitive. Biochemically, primed seedlings showed an increased accumulation of phenolic compounds, suggesting that priming strengthens the non-enzymatic antioxidant defense system to protect the plant from oxidative damage induced by water stress. Seed priming is a highly effective and sustainable technique to optimize barley growth and resilience in drought-prone regions. These findings support the use of hormonal and osmotic biostimulants as a practical tool for improving crop performance under water stress.

Keywords: Hordeum vulgare L., Water stress, Seed priming, Growth, Biostimulants, Polyphenols

HARNESSING THE NUTRACEUTICAL POTENTIAL OF SUNFLOWER THROUGH SUSTAINABLE BIOMASS VALORIZATION

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ABSTRACT

The growing interest in sustainable resource utilization has highlighted sunflower (*Helianthus annuus* L.) as a valuable source of bioactive compounds with potential nutraceutical applications. In this study, sunflower petals and pollen were valorized through the extraction of polyphenols, essential oils, and fatty acids for the development of functional oil-in-water (O/W) microemulsions. Polyphenols were recovered from sunflower petals by ultrasound-assisted extraction and characterized by RP-HPLC-DAD, while fatty acids extracted from sunflower pollen by Soxhlet extraction and essential oils isolated by ultrasound-assisted hydrodistillation were characterized by GC-MS. The recovered bioactive fractions were incorporated into stabilized O/W microemulsions containing glycerol, lecithin, and Tween 80, yielding two formulations: E1, supplemented with sunflower essential oil, and E2, without essential oil. The biological potential of the developed formulations was evaluated by determining their angiotensin-converting enzyme (ACE) inhibitory activity using the FAPGG spectrophotometric assay. ACE inhibition was measured over a concentration range of 0–100 mg/mL, and IC_{50} values were calculated by linear regression from inhibition curves. In addition, the cytocompatibility of E1 and E2 was assessed on mouse brain endothelial b.End3 cells using the MTT assay following 24 and 48 h exposure to concentrations ranging from 15 to 250 µg/mL. Cell viability was determined relative to untreated controls to evaluate the safety of the formulations for potential biological applications. The integration of green extraction technologies with advanced microemulsion systems demonstrates an effective strategy for transforming sunflower by-products into value-added nutraceutical formulations. These findings support the exploitation of sunflower-derived bioactive compounds as sustainable ingredients with potential antihypertensive activity, contributing to the development of innovative products within the framework of the circular bioeconomy.

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Keywords: Helianthus annuus L., Nutraceuticals, Polyphenols, Bioactive compounds, Sunflower by-products

ADMET PROFILING OF GLYCYRRHIZIN USING COMPUTATIONAL PREDICTION APPROACHES

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ABSTRACT

Glycyrrhizin (GL), the principal bioactive triterpenoid saponin isolated from Glycyrrhiza glabra (licorice root), has attracted considerable attention because of its broad spectrum of pharmacological activities, including anti-inflammatory, antiviral, antioxidant, hepatoprotective, immunomodulatory, and anticancer effects. Despite its extensive therapeutic potential, the successful development of glycyrrhizin as a pharmaceutical agent requires a comprehensive understanding of its pharmacokinetic behavior and safety profile. In recent years, in silico absorption, distribution, metabolism, excretion, and toxicity (ADMET) prediction has become an essential component of early-stage drug discovery, providing rapid and cost-effective evaluation of drug-likeness and pharmacological suitability while reducing the need for extensive experimental screening. The present study aimed to perform a comprehensive computational assessment of the ADMET properties of glycyrrhizin in order to evaluate its pharmacokinetic characteristics, toxicological profile, and pharmaceutical potential. The physicochemical properties of glycyrrhizin were obtained from the PubChem database and analyzed using validated computational ADMET prediction platforms. Drug-likeness was assessed according to Lipinski's Rule of Five together with complementary medicinal chemistry filters. Pharmacokinetic parameters included gastrointestinal absorption, blood-brain barrier permeability, water solubility, skin permeability, bioavailability score, P-glycoprotein substrate characteristics, and interactions with major cytochrome P450 isoenzymes. Toxicological evaluation comprised predictions of mutagenicity, carcinogenicity, hepatotoxicity, cardiotoxicity, skin sensitization, acute oral toxicity, and environmental toxicity. ADMET predictions for glycyrrhizin are presented in Figures 1–2 and Tables 1–5. Computational analysis demonstrated that glycyrrhizin possesses several favorable pharmaceutical characteristics together with predictable pharmacokinetic limitations arising from its complex molecular structure. Glycyrrhizin displayed low gastrointestinal absorption, which is consistent with its high molecular weight, elevated topological polar surface area, and extensive hydrogen-bonding capacity. Its aqueous solubility was predicted to be moderate to high; however, membrane permeability remained limited, suggesting reduced passive intestinal diffusion. The compound exhibited negligible blood-brain barrier penetration, indicating a very low probability of central nervous system activity. Glycyrrhizin was predicted to show minimal inhibition of the principal cytochrome P450 enzymes, suggesting a relatively low risk of clinically significant drug-drug interactions. Furthermore, computational models indicated favorable metabolic stability and an acceptable elimination profile. Toxicological predictions revealed a low probability of mutagenicity, carcinogenicity, hepatotoxicity, cardiotoxicity, and skin sensitization, supporting the established safety of glycyrrhizin reported in previous pharmacological studies. Although the compound violated several conventional oral drug-likeness criteria because of its molecular size and polarity, these characteristics are common among naturally occurring triterpenoid saponins and do not preclude therapeutic application, particularly when advanced drug-delivery systems or formulation strategies are employed to

improve bioavailability. Overall, the integrated in silico ADMET evaluation demonstrates that glycyrrhizin possesses a favorable safety profile and significant pharmaceutical potential despite limitations in oral absorption and membrane permeability. The predicted low toxicity, negligible blood-brain barrier penetration, limited interaction with drug-metabolizing enzymes, and acceptable pharmacokinetic characteristics support further preclinical and clinical investigation of glycyrrhizin as a promising natural therapeutic compound. These findings highlight the value of computational ADMET profiling as an effective strategy for accelerating the development and optimization of plant-derived bioactive molecules and provide a scientific basis for future experimental pharmacokinetic studies and formulation design.

Keywords: Glycyrrhizin, ADMET prediction, in silico analysis, pharmacokinetics, drug-likeness, toxicity.

LIGHT-DRIVEN BIOSYNTHESIS OF SILVER NANOPARTICLES BY ESCHERICHIA COLI: ENHANCED SYNTHESIS EFFICIENCY AND ANTIMICROBIAL ACTIVITY

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ABSTRACT

Controlling the rate and efficiency of microbial-based nanoparticle biosynthesis remains a major challenge in translating green nanotechnology into practical applications. Among the environmental factors influencing microbial-based synthesis, the role of light remains largely unexplored. This study investigated whether illumination could regulate the biosynthesis of silver nanoparticles (AgNPs) by Escherichia coli and evaluated the antimicrobial activity of the successfully synthesized nanoparticles. Silver ion reduction was carried out under light and dark conditions. Light strongly influenced the biosynthesis process, reducing the reaction time from 4 weeks in darkness to only 3 hours under light exposure. UV–visible spectroscopy revealed a distinct surface plasmon resonance (SPR) band centered at approximately 445 nm for the illuminated system, confirming the formation of AgNPs. In contrast, the dark-incubated reaction displayed a predominant absorption band near 340 nm, indicating that the absence of light markedly altered the reduction process and limited the formation of silver nanoparticles. The antibacterial activity of the biosynthesized AgNPs was evaluated against Escherichia coli, Enterococcus faecalis, and Bacillus subtilis using the agar well diffusion method, resulting in inhibition zones ranging from 6.67 ± 0.58 mm to 8.33 ± 0.50 mm. The lowest minimum inhibitory concentration (MIC) of AgNPs was observed against E. coli (97.60 µg/mL), followed by B. subtilis (197.66 µg/mL) and E. faecalis (390.60 µg/mL). Furthermore, the agar well diffusion assay demonstrated that Aspergillus fumigatus was sensitive to the biosynthesized AgNPs. These findings highlight light as an effective environmental factor capable of modulating E. coli-mediated silver nanoparticle biosynthesis and reveal the antimicrobial potential of the resulting AgNPs. This work provides insight into environmentally controlled microbial-based nanofabrication and offers a practical strategy for future biomedical and antimicrobial applications.

Keywords: Silver nanoparticles, Escherichia coli, Light-mediated biosynthesis, Microbial nanofabrication, Antimicrobial activity

EFFECTS OF 5-AZACYTIDINE ON THE ANTIOXIDANT SYSTEM AND SERK1 AND WEE1 GENE EXPRESSION IN MEDICAGO SATIVA L. CALLUSES UNDER IN VITRO CONDITIONS

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ABSTRACT

Plant tissue culture is an essential biotechnological approach that allows the study of plant development and stress responses under controlled conditions. Medicago sativa L., an agriculturally significant species, is widely used in agricultural production and plant biotechnology research due to its high nutritional value, high yield potential, and resistance to biotic and abiotic stresses. Recently, 5-azacytidine (5-azaC), used as a DNA methylation inhibitor, has become a recognized compound due to its ability to influence physiological and molecular processes in plant cells. However, studies systematically investigating the effects of 5-azaC on the SERK1 and WEE1 genes and the antioxidant system in M. sativa calluses are limited. Consequently, this study aimed to elucidate the biochemical and molecular changes caused by 5-azaC in M. sativa calluses at different doses and application durations. Accordingly, calluses obtained from leaf explants were cultured in MS medium containing 0.0125 mg/mL kinetin and 1 mg/mL 2,4-dichlorophenoxyacetic acid and exposed to 2.5 and 5 µM 5-azaC for 7, 14, and 21 days. Subsequently, MDA, H_2O_2, SOD, POD, proline, total protein, reducing sugars, and total phenolic compounds were determined, and SERK1 and WEE1 gene expression was analyzed by RT-qPCR. The data obtained showed that 5-azaC application altered biochemical and molecular responses depending on the dose and duration of application. A decrease in MDA and H_2O_2 levels was observed, while an increase in POD activity and proline content was determined. A decrease in SOD activity and total protein content was detected, whereas reducing sugar and total phenolic compound contents varied depending on the application conditions. Additionally, dose- and time-dependent differences in the expression levels of the SERK1 and WEE1 genes revealed that 5-azaC application can affect not only antioxidant defense mechanisms, but also molecular processes associated with development and the cell cycle. Therefore, this study contributes to the understanding of the biological effects of 5-azaC in plant tissue culture by evaluating the biochemical and molecular responses induced in M. sativa calluses.

Keywords: Alfalfa; 5-Azacytidine; Callus culture; DNA methylation; Oxidative stress; Gene expression

A CALLUS-BASED BIOTECHNOLOGY PLATFORM FOR PRODUCING COLCHICINE AND RELATED PHARMACEUTICAL ALKALOIDS FROM COLCHICUM AUTUMNALE L.

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ABSTRACT

Colchicum species are valuable medicinal plants and natural sources of tropolone alkaloids with considerable pharmaceutical importance. Colchicine is clinically used to treat gout, familial Mediterranean fever and recurrent pericarditis, while its derivatives and structurally related compounds are of interest for their anti-inflammatory and antimitotic activities and potential anticancer applications. This study aimed to establish plant biotechnology and bioprocessing approaches for Colchicum autumnale L. and to evaluate the potential of its callus cultures for the controlled production of pharmaceutically relevant tropolone alkaloids. The effects of culture-medium composition and cultivation conditions on callus induction, proliferation, regenerative capacity and biomass accumulation were assessed. The resulting callus cultures were maintained through periodic subculture to obtain stable and actively growing biomass suitable for subsequent bioprocess optimisation. Gas chromatography–mass spectrometry (GC–MS) was applied for targeted profiling of tropolone alkaloids in the callus biomass, enabling an assessment of the biosynthetic capacity of the established in vitro cultures. Particular attention was given to colchicine, N-formylcolchicine and demecolcine because of their established or prospective pharmaceutical applications. Callus cultures developed under different experimental conditions were comparatively evaluated to reveal culture-dependent variations in callus formation, biomass accumulation and tropolone-alkaloid production. The established in vitro cultures provide a plant-biotechnology platform for investigating the effects of nutritional, hormonal and environmental factors on tropolone-alkaloid biosynthesis. They also offer opportunities for further bioprocess development through elicitation, precursor feeding, controlled light treatments, cell-suspension cultivation and scale-up in bioreactor systems. Integrating plant-cell biotechnology, bioprocessing and GC–MS-based metabolite profiling represents a promising strategy for the sustainable and standardised production of colchicine and related tropolone alkaloids, independently of seasonal and geographical limitations. This approach could reduce harvesting pressure on natural Colchicum populations and support the development of renewable plant-based production systems for pharmaceutical research and applications.

Acknowledgements: This research was funded by the Bulgarian National Science Fund (BNSF), Grant No. KP-06-H66/5.

Keywords: plant biotechnology, bioprocessing, callus culture, in vitro cultivation. GC–MS metabolite profiling, N-formylcolchicine, demecolcine

COMPLETE GENOMIC AND MORPHOLOGICAL CHARACTERIZATION OF CPP_VARHS: A NOVEL LYTIC BACTERIOPHAGE INFECTING CLOSTRIDIUM PERFRINGENS

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ABSTRACT

Objective: In this study, the isolation and identification of a C. perfringens-specific bacteriophage CpP_VarHS from a wastewater sample were described. Then, the morphological characteristics using Transmission Electron Microscopy (TEM) and genomic analysis to assess its potential as a biocontrol agent against this pathogen were conducted. **Methods:** a novel lytic C. perfringens phage, designed as CpP_VarHS was isolated from wastewater and targeted the host C. perfringens. The phage was then characterized using TEM, molecular sequencing, and bioinformatics tools. **Results:** TEM analysis revealed that CpP_VarHS possesses a short, non-contractile tail and a regular icosahedral head, characteristic of the podovirus morphotype. Whole-genome analysis showed that the CpP_VarHS genome is 17,814 bp long, linear double-stranded DNA with a GC content of 28.30%. Among the 21 identified open reading frames, 12 were functional genes. Whole-genome sequence comparison showed 94.37 % and 94.31 % nucleotide identity with Clostridium phage vB_CpeP_HN02 and Clostridium phage CPS1. No tRNA, bacterial virulence gene, lysogenic gene, or antibiotic resistance gene was identified in the genome of CpP_VarHS. Phylogenetic analysis indicated that the phage represents a novel species within the genus Gregsiragusavirus of the family Guelinviridae. **Conclusion:** In conclusion, these findings suggested that phage CpP_VarHS has promising potential for preventing and controlling C. perfringens.

Keywords: antibacterial activity, Clostridium perfringens, lytic bacteriophage, transmission electron microscope, molecular sequencing

FISH ORGAN-SPECIFIC DATABASE FOR SURVEILLANCE, RISK ASSESSMENT, AND PREVENTION OF FISH-BORNE ZOONOTIC DISEASES: A ONE HEALTH APPROACH

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ABSTRACT

With the increasing food demand, fish has been an excellent nutritive and economically sustainable food source. Fish-borne zoonotic diseases are a significant challenge to public health, aquaculture sustainability, and global food security. There has been numerous databases developed which provided genetic information, phylogenetic analysis, molecular data on fish, however, these databases often lack the specificity and integration required for comprehensive organ-specific analyses. They generally do not provide detailed information on gene and protein expression profiles associated with specific organs or the context-specific changes associated with disease states, pathogen distribution, host susceptibility, and transmission dynamics in commercially important fish species. This paper proposes the development of a Fish Organ-Specific Molecular Electronic Database (FOMED) as a comprehensive decision-support platform for surveillance, risk assessment, and prediction and management of zoonotic diseases. The database is designed to integrate analysis of gene expression, gene mapping and annotation under various physiological and pathological conditions, disease diagnosis and management in aquaculture, environmental, and epidemiological information associated with individual fish organs, including the gills, skin, liver, kidney, intestine, spleen, brain, and reproductive tissues. The proposed framework incorporates data on bacterial, viral, fungal, and parasitic pathogens, molecular biomarkers, and diagnostic records collected from various major databases, to facilitate rapid disease detection and targeted management and intervention strategies. The database aligns with the One Health approach by connecting fish health, environmental monitoring, and surveillance, thereby strengthening interdisciplinary collaboration among researchers, veterinarians, aquaculture industries, and public health authorities. The implementation of an organ-specific fish disease information system has the potential to improve biosecurity, reduce zoonotic disease transmission, enhance food safety, support precision aquaculture, and contribute to sustainable fisheries management. The developed database represents an innovative digital infrastructure for organ specific fish health monitoring, ranking and management for protecting aquatic ecosystems from emerging fish-borne zoonotic threats.

Keywords: Fish Organ-Specific Database, Zoonotic Diseases, Disease Surveillance, Precision Aquaculture, Pathogen Detection, Biosecurity

TOWARDS CLIMATE-RESILIENT WHEAT: ESTABLISHING AN INTEGRATED MULTIPLEX CRISPR/CAS9 GENOME EDITING PLATFORM FOR TARGETED EDITING OF DROUGHT-RESPONSIVE GENES IN HEXAPLOID WHEAT (TRITICUM AESTIVUM L.)

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ABSTRACT

Climate change is intensifying drought stress, posing a growing threat to global wheat production and food security. Bread wheat (*Triticum aestivum* L.) possesses a complex hexaploid genome, which complicates functional gene characterization and limits conventional genome editing approaches that typically target single loci. Multiplex clustered regularly interspaced short palindromic repeats (CRISPR)/CRISPR-associated protein 9 (Cas9) systems, capable of simultaneously editing multiple genomic targets, offer a promising strategy to overcome this redundancy and accelerate functional genomics in polyploid crops. However, robust multiplex editing platforms tailored to wheat remain scarce, constraining progress toward climate-resilient cultivars. This study aims to establish and optimize a multiplex CRISPR/Cas9 genome editing platform for functional analysis of drought-responsive genes in bread wheat, focusing on the protein phosphatase 2C (PP2C) gene family, key negative regulators of abscisic acid signalling during water-deficit stress. Candidate PP2C genes were identified through comparative bioinformatic analyses across wheat subgenomes, followed by guide RNA (gRNA) design targeting conserved homoeologous regions to enable coordinated multi-gene editing. Multiplex CRISPR/Cas9 constructs were assembled, while in vitro regeneration protocols and Agrobacterium-mediated transformation procedures are currently being optimized to improve transformation efficiency and plant recovery. The phytoene desaturase (PDS) gene is being used as a visual reporter to validate editing efficiency and refine vector performance prior to targeting endogenous drought-responsive loci. By integrating bioinformatic target selection, multiplex vector engineering, and transformation optimization, this work establishes a methodological foundation for precise, homoeolog-specific genome editing in hexaploid wheat. The resulting platform is expected to enable systematic functional dissection of PP2C-mediated drought responses, supporting future breeding strategies aimed at enhancing water-use efficiency and drought tolerance, and contributing to climate-resilient, sustainable wheat production.

Keywords: CRISPR/Cas9, Multiplex genome editing, Bread wheat, Triticum aestivum, Drought tolerance, Functional genomics, Plant biotechnology, Climate resilience

ALOE VERA AS A NATURAL ANTICANCER AGENT: AN INVESTIGATION OF THE EFFECTS OF PEELED AND UNPEELED EXTRACTS ON THE SKMEL-30 MELANOMA CELL LINE

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ABSTRACT

Objective: Melanoma is an aggressive form of skin cancer that originates from epidermal melanocytes and has a high potential for metastasis. Because it can metastasize via lymphatic and hematogenous routes even in its early stages, it is one of the skin cancers with the highest mortality rates. The aim of this study was to investigate the cytotoxic effects of Aloe vera extracts with and without peel on SKMEL-30 melanoma cells and their effects on apoptosis and oxidative stress mechanisms. **Materials and Methods:** SKMEL-30 melanoma cells were treated with both peel-containing and peel-free Aloe vera extracts. Cytotoxic effects were assessed using the MTT assay after 24 hours. At the determined effective doses, the expression levels of genes associated with the cell cycle, apoptosis, and oxidative stress were analyzed using qRT-PCR. **Results:** Aloe vera peel extract exhibited a dose-dependent cytotoxic effect. At the highest dose, cell viability dropped to 29.84%, while at the second and third doses, it was determined to be 65.16% and 88.21%, respectively. Gene expression analyses revealed significant downregulation of the P53, P21, and P27 genes, while a significant increase was observed in the expression of the proapoptotic genes BAX (11.49-fold), CASP3 (10.13-fold), and TNF-α (13.41-fold). A decrease in the expression of the antiapoptotic BCL-XL gene was observed, while a decrease in SOD1 and GSH expression and an approximately 10.88-fold increase in CAT gene expression were detected. Findings obtained with the peel-free Aloe vera extract similarly demonstrated that the apoptotic response was induced and oxidative stress mechanisms were activated. **Conclusion:** The findings indicate that Aloe vera extracts exert a significant anticancer effect on SKMEL-30 melanoma cells. It was determined that the extracts increase oxidative stress by suppressing antioxidant defense and activate the TNF-α/BAX/Caspase-3-mediated mitochondrial apoptotic pathway. The results suggest that both peel-containing and peel-free Aloe vera extracts can be considered as supportive natural agents in the treatment of melanoma.

Keywords: Aloe vera, melanoma, SKMEL-30, apoptosis, oxidative stress.

HAPLOID AND DOUBLE HAPLOID PRODUCTION IN MELON (CUCUMIS MELO L.) VIA IRRADIATED POLLEN CURRENT APPROACHES

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ABSTRACT

Melon (Cucumis melo L.) is an economically important vegetable crop worldwide, and the development of new cultivars requires highly homozygous breeding lines. While the production of pure lines through conventional selfing methods requires several generations, haploid and doubled haploid (DH) technologies significantly shorten this process. DH lines enable the development of completely homozygous genotypes within a single generation and are widely utilized in hybrid breeding, genetic mapping, and molecular breeding studies. Among the methods used for haploid plant production in the Cucurbitaceae family, in situ parthenogenesis induced by irradiated pollen is considered one of the most successful approaches. In this technique, pollen grains are typically exposed to gamma irradiation and subsequently applied to female flowers. Although the pollen tubes are capable of reaching the embryo sac, radiation-induced damage to the generative nucleus prevents the paternal genome from participating in embryo development. Consequently, haploid embryos carrying only maternal genetic material are formed. Since a considerable proportion of these embryos fail to develop normally, embryo rescue techniques are employed to obtain haploid plants. Studies on haploid and DH production through irradiated pollen in melon have demonstrated that the success of the technique is strongly genotype dependent. Gonzalo et al. (2011) reported substantial variation among melon genotypes in terms of parthenogenetic response and DH line production efficiency. More recent studies have focused on improving embryo detection methods, increasing embryo rescue efficiency, and enhancing plant regeneration from haploid embryos. demonstrated that embryo production, plant regeneration, and doubled haploid line development are highly influenced by genotype. Furthermore, they showed that X-ray radiography is a rapid and effective tool for the detection of parthenogenetic embryos, thereby contributing to the optimization of embryo rescue procedures. These findings highlight the value of the irradiated pollen technique in melon breeding, while also emphasizing the significant effects of genotype and culture conditions on overall efficiency. **In conclusion,** the irradiated pollen technique represents an effective biotechnological approach that considerably reduces the time required to obtain completely homozygous lines in melon and supports modern breeding programs. Nevertheless, genotype-dependent variation in haploid embryo formation and plant regeneration remains one of the major limitations of the method. Moreover, relatively low embryo induction and regeneration rates indicate the need for further optimization of the production process. Future studies focusing on the improvement of embryo rescue protocols, the determination of optimal irradiation conditions, and a better understanding of factors influencing parthenogenetic response will contribute to a more efficient application of doubled haploid technologies in melon breeding.

Keywords: Haploid production, double haploids, irradiated pollen, in situ parthenogenesis, melon breeding

IN VITRO CULTURE AND SHOOT MULTIPLICATION FROM SEEDLING GERMINATION EXPLANTS OF ZYGOPHYLLUM ALBUM L.

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ABSTRACT

The aim of the present study was to determine the callus capability of *Zygophyllum album* L. for pharmaceutical application and subsequently, to find the best explant source linked with the optimum conditions for the high potentiality of shoot multiplication for ornamental applications. Seeds were germinated on ¼ strength MS medium and have been used as explant source for *in vitro* culture investigations. The results indicated that medium protocols and explants, and their interaction had significant differences in most *in vitro* traits under investigation (Callus induction efficiency %, Fresh wight 1 and Fresh wight 2, Dry wight and Dry matter content). The cotyledon explant gave higher values in callus induction (100%) and in dry wight (0.25g – 0.26g, respectively) on ½ MS supplemented with 0.5 mg/L 2,4 -D and 0.1 mg/L Kin, as well as on ½ MS supplemented with 0.5 mg/L NAA and 1 mg/L BAP. Compared to other explants. The results also revealed that the shoot tip explants cultured on either MS free hormone or MS supplemented with 0.2 mg/L BAP achieved the best uniform shoots under investigation traits (Number of shoots- Shoot length- Number of leaves). The results of HPLC analysis using the phenolic profiles of callus, shoots, and wild natural plant indicated that shoots cultured on 0.2 mg/L BAP gave the highest levels of chlorogenic acid (0.605 mg/g), and *p*-coumaric acid (0.767 mg/g). On the other hand, callus derived from cotyledon on medium containing o.5 mg/L 2,4-D gave the highest rutin content (0.704 mg/g).

Keywords: Zygophyllum album L., in vitro, Seed germination, Callus induction

HEAT SHOCK PROTEINS, CIRCADIAN CLOCK COMPONENTS, AND HEAT STRESS IN POULTRY: A REVIEW

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ABSTRACT

Heat stress is recognized as one of the most important factors limiting poultry production under a warming climate. Chickens (Gallus gallus) lack sweat glands and rely heavily on heat shock proteins (HSPs), particularly HSP70 and HSP90, for cellular thermotolerance; tissue-specific expression of these proteins in the heart, liver, retina, and skeletal muscle has been documented in numerous studies. Elevated HSP expression under heat stress has been associated with declines in egg production, feed intake, and immune function, and this relationship has predominantly been explained in the literature through oxidative stress and inflammatory pathways. As an independent line of research, the avian circadian system is known to be organized differently from the suprachiasmatic nucleus (SCN)-hierarchical architecture of mammals, instead forming a distributed retino–pineal–suprachiasmatic oscillator network with a dominant melatonin output; this network governs the core clock genes (Clock, Bmal1, Per, Cry) that regulate the timing of oviposition, feed intake, and immune function. Evidence for a co-occurrence of heat stress and altered clock gene expression in poultry is accumulating in the literature, yet these two lines of research have largely developed separately. In mammalian and Drosophila models, HSP90 has been shown to stabilize BMAL1 (Brain and Muscle ARNT-Like 1) through the SGT1–HSP90 chaperone mechanism: pharmacological inhibition of HSP90 (17-AAG, geldanamycin) shortens BMAL1 half-life, promotes its proteasomal degradation, and dampens circadian amplitude and phase, whereas acute heat shock has conversely been reported to reset the oscillator via the interaction between BMAL1 and heat shock factor 1 (HSF1). These findings indicate that the relationship between HSP90 and circadian clock components is a species- and tissue-dependent, multifaceted interaction; to our knowledge, this axis has not yet been directly examined in poultry. This review brings together the poultry thermotolerance and avian chronobiology literatures to discuss the potential relevance of HSP90–BMAL1 findings from mammalian and Drosophila models to avian production physiology. The concept of a limited-capacity chaperone pool being redistributed among different client proteins under stress conditions is discussed in the context of existing literature suggesting that heat stress may affect production performance in poultry not only through direct cellular damage but also through indirect effects on clock genes. This framework brings together current findings on why variables such as photoperiod regime and the time of day at which heat stress occurs may matter for husbandry practices, and outlines a research gap that remains to be addressed in the field.

Keywords: Heat shock protein 90, circadian rhythm, BMAL1, HSF1, chaperone, poultry, thermal stress

BIOTECHNOLOGICAL POTENTIAL OF ARTEMISIA ANNUA: IN VITRO REGENERATION FOR ARTEMISININ

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ABSTRACT

Artemisia annua L. is an important medicinal and aromatic plant and the primary natural source of artemisinin, a valuable bioactive compound used in antimalarial drug production. The production of pharmaceutical active ingredients from field-grown medicinal plants can be affected by seasonal and environmental fluctuations, as well as genetic variation, potentially resulting in inconsistencies in active compound content and biological activity. Therefore, tissue culture-based biotechnological systems offer an important approach for the controlled, genetically stable, standardized, and year-round production of plant-derived pharmaceutical active ingredients. In this study, the effects of genotype, culture medium, explant type, and light spectrum on the in vitro regeneration of two *A. annua* genotypes, 1-44 and 1-111, were investigated as a basis for developing an efficient micropropagation system for the production of uniform plant material with pharmaceutical potential. Seeds of both genotypes were surface sterilized and germinated on Murashige and Skoog (MS) medium. Sixty-day-old seedlings were used as explant sources, and shoot tip, nodal, and hypocotyl explants were cultured on MS and modified AR2–AR5 media under white and purple light conditions. Cultures were maintained at 24 ± 1 °C under a 16 h photoperiod, and regeneration responses were evaluated over three successive subculture periods. The results demonstrated clear genotype-, medium-, explant-, and light-dependent differences in regeneration performance. MS medium was identified as the most reliable medium for direct shoot regeneration in both genotypes. Shoot tip explants exhibited the highest and most consistent regeneration capacity, whereas nodal explants showed lower and more variable responses, frequently associated with callus formation. Hypocotyl explants displayed limited regeneration potential. Under purple light, shoot regeneration from shoot tip explants reached 82.35% in genotype 1-44 and 70.97% in genotype 1-111 on MS medium. In genotype 1-111, shoots produced under purple light showed superior growth, reaching a mean shoot length of 5.07 cm and 103.23% shoot formation per explant. Although AR2 and AR3 media provided high multiplication responses in some treatments, their regeneration performance was less consistent during subsequent subcultures. AR4 and AR5 predominantly promoted callus formation rather than direct shoot regeneration and purple light also enhanced rooting, particularly in genotype 1-111. Overall, the findings demonstrate that MS medium combined with shoot tip explants and purple light provides a promising platform for efficient in vitro regeneration and micropropagation of *A. annua*, supporting the establishment of biotechnological strategies for the propagation of elite plant material with potential for artemisinin production.

Acknowledgement: This study was supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK) -1004 Program (23AG022).

Keywords: Artemisia annua, artemisinin, in vitro regeneration, micropropagation, medicinal plant, light spectrum

FROM BULBS TO PLANTS: ADVANCING SUSTAINABLE GEOPHYTE PROPAGATION THROUGH IN VITRO BIOTECHNOLOGY

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ABSTRACT

Geophyte species belonging to the Amaryllidaceae family are recognized as important sources of bioactive Amaryllidaceae alkaloids, including galanthamine, a valuable compound with pharmaceutical potential. However, their natural propagation is generally slow and limited, highlighting the need for efficient biotechnological propagation and conservation strategies. In this study, an *in vitro* regeneration and micropropagation system was developed and optimized for geophyte species known to contain galanthamine, with particular emphasis on regeneration efficiency, rooting, and acclimatization. An efficient *in vitro* propagation protocol was developed for *Narcissus* L., focusing on regeneration, rooting, and acclimatization. For *in vitro* regeneration, bulb explants were cultured on three different media (G1, G2, and G3). G2 provided the highest regeneration rate, with 100% of the cultured explants responding, and predominantly promoted direct bulb formation (73.7%). In contrast, G1 exhibited the highest multiplication potential, producing 78 bulbs from 44 explants, corresponding to a total bulb formation rate of 177.27%, mainly through callus-mediated regeneration. Regenerated bulbs were subsequently transferred to two rooting media. R1 provided the highest rooting rate (55.1%), compared with 33.84% in R2. Furthermore, 65.21% of the plants rooted on R1 successfully acclimatized to soil, whereas the acclimatization rate was 41.17% for R2. Overall, the results demonstrate that medium composition strongly influences regeneration pathway and micropropagation efficiency in *Narcissus*. While G2 was the most suitable medium for efficient and direct regeneration, G1 provided the highest multiplication capacity. R1 was identified as the most effective medium for rooting and subsequent acclimatization. These findings establish an efficient platform for the rapid clonal propagation of galantamine-containing geophytes, providing a valuable basis for their sustainable production and future utilization as a natural source of galantamine, an important pharmaceutical active ingredient.

Acknowledgement: This study was supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK) 1004 Program (23AG022).

Keywords: Geophytes, Narcissus, galantamine, in vitro regeneration, micropropagation, acclimatization, biotechnology

EFFICIENT IN VITRO PROPAGATION OF PAEONIA LACTIFLORA 'SARAH BERNHARDT' FOR SUSTAINABLE PRODUCTION

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ABSTRACT

Paeonia lactiflora is an economically important ornamental plant with increasing demand in the floriculture and nursery industries. However, its conventional propagation is relatively slow and may not provide sufficient quantities of uniform and healthy planting material. This study aimed to develop an efficient in vitro micropropagation protocol for *Paeonia lactiflora* cv. 'Sarah Bernhardt', one of the most commercially important peony cultivars, with a particular focus on the production of high-quality planting material for the ornamental plant sector. Plant material was obtained from the Atatürk Central Research Institute of Horticultural Crops (Yalova, Türkiye). Underground and above-ground tissues were evaluated, including nodal segments, shoot tips, axillary buds, petioles, hypocotyls, internodes, rhizome tissues, and underground shoot buds. Following surface sterilization, explants were cultured on five different culture media and maintained at 24 ± 1°C under a 16:8 h photoperiod. The effects of explant type, rooting medium, activated charcoal, and white versus red-purple LED light spectra on regeneration and plant development were investigated. Multiple shoot formation was successfully achieved from all evaluated explant types, while underground shoot buds exhibited the highest regeneration potential. The underground shoot bud was also identified as the most promising explant source for rooting, with K3 medium providing the most successful rooting response. Activated charcoal further promoted root formation. In addition, red-purple LED illumination enhanced shoot development compared with white LED light. Overall, the developed protocol provides an efficient approach for the rapid clonal propagation of 'Sarah Bernhardt' and the production of healthy, uniform, and high-quality planting material. These findings may contribute to increasing the commercial propagation capacity and sustainability of peony production and provide a valuable reference for the micropropagation of other *Paeonia* species and cultivars.

Acknowledgement: This study was supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK) -1505 Program (5220136).

Keywords: Paeonia lactiflora, 'Sarah Bernhardt', micropropagation, in vitro regeneration, light spectrum

OPTIMISATION AND APPLICATION OF IPBS- RETROTRANSPOSON MARKER SYSTEMS FOR THE ASSESSMENT OF GENETIC DIVERSITY IN SOME C. SATIVUS GENOTYPES

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ABSTRACT

Investigating genetic diversity and population structure constitute an essential initial step for conservation and breeding programs. DNA-based molecular markers have been commonly used tools for the assessment and characterization of genetic diversity. A wide range of molecular marker systems has been developed, such as SSR (Simple Sequence Repeats), ISSR (Inter Simple Sequence Repeat), RAPD (Random Amplified Polymorphic DNA), and IPBS (Inter-primer Binding Site). Retrotransposons are one of the commonly used molecular markers with different aims, such as to detect genetic diversity, differentiation, and population structure. Understanding of the genetic diversity is an important step to characterize genetic resources for the future contribution to conservation and breeding programmes. *Crocus sativus* L. (Saffron), is an economically important species of the *Crocus* genus. *C. sativus* is vegetatively propagated by the corms. There are various studies such as cytogenetic studies, molecular marker analysis (such as IPBS, IRAP, RAPD, ISSR), and *in vitro* micropropagation. Due to the importance of saffron as a commercial plant, evaluation of its genetic diversity is an essential step for breeding and conservation programmes. The aim of the study is to perform iPBS-retrotransposon-based PCR amplification using the seven different primers including such as 2249, 2973, 2393, 2077, 2400, 2278, and 2378 in twelve *C. sativus* genotypes obtained from farmers in Safranbolu. The combined assay of iPBS based molecular marker analyses revealed that some primers regenerated monomorphic banding patterns among the analysed samples, whereas others produced distinct polymorphism profiles, may indicating the presence of genetic variation among the samples. As a result, iPBS markers may be used for the assessment of the genetic diversity in *C. sativus*. However, the analyses of larger samples using additional iPBS primers and other molecular marker systems are required for future researches to provide comprehensive information related to genetic diversity.

Keywords: Crocus sativus, Molecular Marker, Inter-primer binding site, iPBS

SACRED PLANTS AND BIOACTIVITY: A SCIENTIFIC EXPLORATION OF SPECIES MENTIONED IN THE QU'RAN

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ABSTRACT

Plants mentioned in the Qur'an hold significant importance from symbolic, nutritional, and medicinal perspectives. The main objective is to identify these species and evaluate their biological properties in light of modern knowledge, particularly in ethnobotany and pharmacology. The methodology is based on a review of the scientific and religious literature. Sources include Qur'anic exegesis texts, academic publications, and recognized databases such as PubMed and Scopus. Selection criteria focused on plants explicitly mentioned in the Qur'an that have been the subject of scientific studies validating their therapeutic properties. This approach ensures a rigorous and multidisciplinary analysis. The results highlight several major plants. The date palm (Phoenix dactylifera) is widely cited and recognized for its richness in carbohydrates, fiber, and minerals, particularly potassium. It possesses energizing and antioxidant properties, contributing to healthy digestive function. The olive (Olea europaea), described as a "blessed tree," is an important source of monounsaturated fatty acids and polyphenols, conferring cardioprotective and anti-inflammatory effects. The fig (Ficus carica), rich in fiber and micronutrients, supports digestive regulation and has beneficial effects on metabolism. Grapes (Vitis vinifera) are known for their resveratrol content, a powerful antioxidant involved in the prevention of cardiovascular diseases. Finally, ginger (Zingiber officinale), mentioned in a paradisiacal context, is recognized for its antiemetic and anti-inflammatory properties. Overall, these plants share common biological activities, including antioxidant, anti-inflammatory, and antimicrobial effects. They play a potential role in preventing many chronic diseases such as cardiovascular conditions, digestive disorders, and certain metabolic diseases. These findings confirm the value of traditional knowledge and its relevance in the current scientific context. The discussion highlights a convergence between knowledge derived from religious tradition and contemporary scientific data. However, certain limitations must be taken into account. The botanical identification of some plants may be debated, and clinical evidence in humans is sometimes insufficient. Moreover, the symbolic and spiritual dimension of these plants should not be interpreted as absolute therapeutic validation. A critical and scientific approach remains essential. **In conclusion**, the plants mentioned in the Qur'an constitute a rich and multidimensional heritage at the crossroads of spirituality, nutrition, and pharmacology. Their study reveals significant potential for scientific research, particularly in the development of new therapeutic and preventive approaches. This synthesis thus illustrates the value of an integrative approach combining traditional knowledge with modern scientific validation.

Keywords: sacred plants, species, exploration, review

BIOACTIVE COMPONENTS OF SOME WILD SPECIES OF THE GENUS ALLIUM L. DISTRIBUTED IN THE FLORA OF AZERBAIJAN

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ABSTRACT

Recently, the use of wild plants as medicinal raw materials and preventative dietary supplements has become increasingly important. Species of the genus Allium L. occupy an important position among widely used edible plants. The widespread use of species of the genus Allium L. in both folk and official medicine in many countries indicates that onions are promising medicinal plants and deserve detailed chemical and pharmacological studies. From a phytochemical point of view, most wild species of the genus Allium L. are still poorly studied, there is not enough literature information on the quantitative composition and dynamics of secondary metabolites in various organs of the onion. In addition, the available data on the quantitative composition of bioactive substances in these plants differ significantly, which is associated with the origin of the material, growing conditions and methods of analysis of raw materials. Therefore, the inclusion of wild onions in collections contributes to the preservation of their gene pool and the expansion of research with the prospects of their introduction into culture as food and medicinal plants. Despite the fact that wild onions are among the most common plants in the wild, their natural reserves are sharply declining due to plowing and grazing. The aim of this research was to investigate the chemical composition of seven wild onions under natural conditions. The contents of alkaloids, steroidal saponins, ascorbic acid, essential oils, and flavonoids were determined for the studied Allium species. It was found that the alkaloid content in the studied onion species ranges from 0.05 to 0.17, and the composition of essential oils is 0.03-0.15. High values of flavonoids are observed in A. atroviolaceum (1.74%), and saponins in A. albidum (3.14%). The rich chemical composition of wild onion species suggests their potential use them to be recommended as the basis for many preventative dietary supplements.

Keywords: alkaloids, flavonoids, saponins, vitamins, wild onions

TAXONOMIC REVISION OF THE FAMILY LILIACEAE IN THE FLORA OF ALBANIA

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ABSTRACT

The family Liliaceae has historically represented one of the most broadly circumscribed groups within monocotyledonous plants in the Albanian flora. In Flora e Shqipërisë (Flora of Albania, Vol. 4), the family was treated in a traditional taxonomic sense and included 25 genera characterized by considerable morphological diversity. However, advances in molecular phylogenetics and the development of modern classification systems during recent decades have substantially redefined the circumscription of Liliaceae, resulting in the transfer of numerous genera to several distinct families. The present study provides a critical taxonomic revision of Liliaceae in Albania through a comparative analysis between the traditional treatment presented in Flora e Shqipërisë and contemporary international taxonomic databases, including Euro+Med PlantBase and the Plants of the World Online (POWO) database of the Royal Botanic Gardens, Kew. Additional information was obtained from the Distribution Atlas of Vascular Plants in Albania, the Checklist of Albanian Flora, and other relevant botanical and taxonomic literature. The results demonstrate that, of the 25 genera traditionally included within Liliaceae, only five genera are currently accepted as members of the family: Erythronium, Fritillaria, Gagea, Lilium, and Tulipa. Most of the remaining genera have been reassigned to families such as Asparagaceae, Amaryllidaceae, Asphodelaceae, Colchicaceae, Melanthiaceae, Smilacaceae, and Nartheciaceae. The revised Albanian Liliaceae flora includes taxa of considerable floristic, phytogeographical, and conservation importance, including endemic and subendemic species such as Tulipa albanica, Tulipa kosovarica, Fritillaria ionica, and Lilium chalcedonicum. This study highlights the importance of integrating modern phylogenetic concepts into national floristic treatments and contributes to the taxonomic standardization and updated interpretation of the Albanian vascular flora.

Keywords: Albania, Balkan flora, floristic revision, Liliaceae, nomenclature, plant taxonomy

PARASITIC STAGES OF THE GENUS OROBANCHE L.

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ABSTRACT

The genus Orobanche L. (broomrape), belonging to the family Orobanchaceae Vent., comprises a group of obligate holoparasitic plants that completely depend on host plants for their survival, growth, and reproduction. Due to the total absence of chlorophyll, members of this genus are entirely incapable of performing photosynthesis and therefore obtain water, essential minerals, and organic nutrients through highly specialized parasitic organs called haustoria, which penetrate host root tissues and establish direct connections with the host vascular system. The genus is widely distributed throughout temperate, subtropical, and semi-arid regions of the world and is represented by approximately 198 species exhibiting a broad range of host preferences, morphological diversity, and ecological adaptations. The life cycle of Orobanche species is intimately and obligately associated with the presence of suitable host plants. Seed germination occurs only after the perception of specific chemical stimulants, primarily strigolactones, released from host roots into the rhizosphere; in the absence of these signals, seeds may persist in the soil in a dormant state for extended periods. Following germination, the parasite attaches to the host root, develops a functional haustorium, and establishes a continuous vascular connection that enables the unidirectional transfer of water, nutrients, and assimilates from the host to the parasite. The parasite subsequently forms underground tubercles and shoots, which later emerge above the soil surface to produce flowers and seeds. A single Orobanche plant is capable of producing thousands of minute, dust-like seeds that remain viable in the soil for many years or even decades, greatly contributing to the persistence and progressive spread of infestations across agricultural fields. Species of Orobanche are widely regarded as among the most destructive and economically damaging parasitic weeds affecting agricultural production worldwide. They parasitize numerous economically important crops, including sunflower, tomato, tobacco, carrot, legumes, and several other vegetable and field crop species. Heavy infestations frequently lead to severe and sometimes total reductions in plant growth, crop productivity, and overall product quality, causing substantial and recurring economic losses across many agricultural regions, particularly in the Mediterranean basin, the Middle East, and parts of Asia and Africa. The management of Orobanche remains particularly challenging due to its intimate physiological and vascular integration with the host plant, the prolonged viability of its seeds in the soil, and the inherent difficulty of detecting and targeting early underground developmental stages before irreversible crop damage has occurred. This review summarizes current scientific knowledge regarding the taxonomy, biological characteristics, life cycle, parasitic mechanisms, host–parasite interactions, and geographical distribution of the genus Orobanche. In addition, the agricultural and economic significance of these parasitic plants is discussed in detail, highlighting their considerable impact on crop production systems and the urgent need for effective and integrated control strategies. A comprehensive understanding of the biology, ecology, and host-specificity of Orobanche species is considered essential for the development of sustainable management approaches and for reducing the substantial economic damage caused by these highly specialized and persistent parasitic weeds.

Keywords*:* *Orobanche* L., holoparasite, parasitism, life cycle, haustorium, host attachment

DISTRIBUTION AND RAW MATERIAL RESERVES OF FERULA VARIA (SCHRENK) TRAUTV. AND FERULA FOETIDA (BUNGE) REGEL IN THE FLORA OF UZBEKISTAN

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ABSTRACT

The genus Ferula (Ferula L.) is a family of plants of the Umbelliferae family (Apiaceae), distributed mainly in dry desert and mountainous areas. There are 48 species of this genus in Uzbekistan. Ferula species are medicinal, essential oil, fodder and honey plants. Many species of Ferula contain a large amount of resin and are used in soap making, dye production, as well as in the textile and paper industries. The article analyzes the distribution and reserves of some species of the genus based on the methodology of M.G. Pimenov, K.A. Pupikina and others. F. varia is distributed in mountainous and foothill areas, and F. foetida - in desert areas. The reserve of F.varia is 629.73 ± 44.42 tons on an area of 1512 hectares, and the reserve of F.foetida is 6564.74 ± 233.88 tons on an area of 14037 hectares. It was revealed that 20 species of Ferula L. are distributed in the Gissar range (Uzbekistan, Tajikistan, Kyrgyzstan), of which 7 are polycarpics, 13 are monocarpics. The composition of plants contains coumarins, essential oil, flavonoids and other substances that can be used in medicine.Our next research is to study the reserves of species of the Ferula L. genus distributed in this region. This will allow us to assess the reserves of raw materials sufficient for pharmaceuticals in the future.

Keywords: ferula, fodder, food, honey, medicinal plants, field studies, herbarium materials, chemical composition.

EVALUATION OF TOTAL PHENOLIC CONTENT, ANTIOXIDANT CAPACITY, AND ANTIMICROBIAL ACTIVITY OF ELAEAGNUS ANGUSTIFOLIA L.

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ABSTRACT

This study evaluated the total phenolic content (TPC), DPPH radical scavenging activities, and antimicrobial potential of various extract and decoction formulations obtained from the fruits and aerial parts of Elaeagnus angustifolia L. (Elaeagnaceae) collected from Eskişehir and Bursa provinces (Türkiye). TPC was quantified using the Folin-Ciocalteu method, while antioxidant capacity was determined via DPPH assay. The antimicrobial profiles were screened against Escherichia coli ATCC 8739, Staphylococcus aureus ATCC 6538, Pseudomonas aeruginosa ATCC 9027, Candida parapsilosis ATCC 22019, and Candida albicans ATCC 90028 using the broth microdilution method to determine Minimum Inhibitory Concentrations (MIC, µg/mL). The findings showed that TPC ranged between 16.8 ±0.02 and 67.8±0.06 mg GAE/g extract. The highest phenolic concentration was recorded in sample 1 (Eskişehir, aerial parts,70% ethanol; 67.8±0.06 mg GAE/g), which also demonstrated the strongest DPPH radical scavenging response with the lowest IC50 value of 0.275±0.02 mg/mL. Conversely, sample 1E (Bursa, fruit, ethyl acetate) exhibited both the lowest TPC (16.8±0.02 mg GAE/g) and the weakest antioxidant capacity (IC50 2.101±0.05 mg/mL). The antimicrobial screening indicated that the evaluated extracts showed relatively higher efficacy against fungal strains compared to bacterial strains. Among the tested group, the highest antibacterial activity against E. coli and S. aureus was observed with a MIC value of 500 µg/mL. For antifungal activity, the lowest MIC value was observed against C. parapsilosis at 500 µg/mL. In contrast, P. aeruginosa displayed notable resistance, yielding high MIC parameters (>4000 µg/mL) across almost all tested formulations. In conclusion, E. angustifolia fruit and aerial part extracts exhibit antioxidant properties and antimicrobial activities that appear to be associated with their phenolic content. These preliminary outcomes suggest that these extracts have potential for further evaluation as natural ingredients in pharmaceutical and nutraceutical formulations.

Keywords: Elaeagnus angustifolia, Total phenolic content, Antioxidant activity, Antimicrobial effect

THE ANTIBACTERIAL ACTIVITY OF ATRIPLEX HALIMUS L

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ABSTRACT

Introduction: The increasing emergence of antibiotic-resistant bacteria has become a major public health concern, highlighting the urgent need to identify new antimicrobial agents from natural sources. Atriplex halimus L., a medicinal plant widely used in traditional Algerian medicine, is known for its richness in secondary metabolites with potential antibacterial properties. **Objective**: To evaluate the antibacterial activity of methanolic extracts obtained from the aerial parts (leaves and stems) of Atriplex halimus L., while characterizing their phytochemical composition in order to establish a relationship between their bioactive compounds and antimicrobial potential. **Materials and Methods**: Leaves and stems of Atriplex halimus L. were collected and extracted by maceration using absolute methanol. Qualitative phytochemical screening was performed to identify the major secondary metabolites. The antibacterial activity of the methanolic extracts was assessed against 16 Gram-positive and Gram-negative bacterial strains using the agar disc diffusion method, by measuring the diameters of the inhibition zones. **Results and Discussion**: Phytochemical screening revealed the presence of several bioactive compounds, including polyphenols, flavonoids, tannins, coumarins, saponins, and other secondary metabolites that may contribute to the observed antibacterial activity. The methanolic extracts exhibited variable antibacterial effects depending on the bacterial strain tested. Gram-positive bacteria were the most susceptible, particularly methicillin-resistant Staphylococcus aureus (MRSA), which showed the largest inhibition zone (27.1 mm), followed by Staphylococcus ATCC and Enterococcus spp. In contrast, Gram-negative bacteria, including ESBL-producing Escherichia coli, Salmonella spp., Klebsiella pneumoniae, and Pseudomonas spp., displayed low susceptibility or resistance to the extracts. This difference in susceptibility may be attributed to the more complex cell wall structure of Gram-negative bacteria, which limits the penetration of active compounds. These findings confirm the antibacterial potential of Atriplex halimus L., likely due to its high content of phenolic compounds and flavonoids. **Conclusion**: Methanolic extracts of Atriplex halimus L. exhibited promising antibacterial activity, mainly against Gram-positive bacteria, particularly staphylococci. These findings support the traditional use of this medicinal plant and encourage further studies to isolate and characterize the bioactive compounds responsible for its antibacterial activity, with the aim of developing new natural antimicrobial agents.

Keywords: Atriplex halimus L., Antibacterial activity, Methanolic extract.

MORPHOLOGICAL AND ANATOMICAL INVESTIGATIONS ON PHLOMIS PUNGENS WILLD. FROM ESKIŞEHIR

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ABSTRACT

The genus Phlomis L. (Lamiaceae), colloquially known in Anatolia as "ballık otu," "çalba," "şalba," or "calba," has widespread traditional uses ranging from herbal teas to wound-healing, analgesic, and tonic applications. In this study, Phlomis pungens Willd. (Syn: P. herba-venti L. subsp. pungens (Willd.) Maire ex De Filipps), naturally distributed around Eskişehir, was evaluated from a botanical perspective. The morphological and anatomical features of the species were characterized using light microscopy to establish diagnostic criteria for accurate identification. According to our morphological measurements on the collected specimens, P. pungens is a perennial herb (occasionally woody/shrubby at the base) with a height of up to 55 cm and a stem diameter of 0,3–0,5 cm. The stem is quadrangular and covered with characteristic stellate hairs. The simple to occasionally lobed leaves are arranged in a decussate arrangement; cauline leaves measure 2,5–14,7 cm in length and 0,3–4,8 cm in width. The inflorescence comprises up to 40 verticillasters, with each cluster containing more than 20 zygomorphic, bilabiate flowers. The calyx, which is actinomorphic and five-parted, measures 8–11 mm in length and 3–5 mm in width. The pink/purple petals (measured as individual corolla lobes) are 8–11 mm in height and 4–9 mm in width, with four stamens inserted into the corolla tube. Providing robust morphological and anatomical data for this traditionally utilized species is of significant importance. These findings will not only facilitate accurate taxonomic identification and ensure safe therapeutic use but will also serve as a foundational reference for future pharmacological and phytochemical research.

Keywords: Phlomis pungens, anatomy, morphology, diagnostic characters.

ANATOMICAL DIVERSITY AMONG SELECTED TAXA OF ZIZIPHUS L. (RHAMNACEAE)

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ABSTRACT

The genus Ziziphus L. belongs to the family Rhamnaceae and is widely distributed throughout tropical and subtropical regions of the world. Species of this genus are of considerable economic, nutritional, and medicinal importance. The present study aimed to investigate the anatomical characteristics of the leaf and stem tissues, with particular emphasis on the cellular inclusions and internal tissue organization, in Ziziphus species naturally distributed in Iraq. A field survey was conducted during which four species Ziziphus jujuba, Z. mauritiana, Z. nummularia and Z. spina-christi, were collected and examined. The outcome showed cross-sections of stem appeared a difference characters among the taxa in the shape, in Z. lotus and Z. nummularia was oval, Z. mauritiana elliptical, and circular in the species Z. spina-christi. epidermis consist of a single cells, oval in shaped, covered by trichomes in species Z. mauritiana only, and the cortex is featured into angular collenchyma tissue, and the second of the tissues is the parenchyma tissue. Druces crystals diffusion in the phloem and xylem. in the Z. jujuba pith there were many lysigenous intercellular spaces, it was formed of vacuoles, and in the species, Z. nummularia, these vacuoles were specialized intercellular spaces, The LS of the leaf midrib appeared a in the stomata scattered only in the abaxial epidermis with anonmocytic type except Ziziphus jujuba was anisocytic type. The unglandular trichomes are distributed on the abaxial, they are uniseriate-unicellular, excluding Z. nummularia . The druces crystals diffuse in the adaxial and abaxial. Comparative anatomical analyses revealed clear interspecific variations in anatomical characters, demonstrating the taxonomic value of these traits for distinguishing the studied species.

Keywords: Ziziphus, Rhamnaceae, Comparative anatomy, Iraq sider

PRELIMINARY PHYTOCHEMICAL SCREENING OF TEUCRIUM POLIUM L.: IDENTIFICATION OF MAJOR BIOACTIVE SECONDARY METABOLITES

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ABSTRACT

Teucrium polium L. is a medicinal plant belonging to the Lamiaceae family, widely used in traditional medicine across the Mediterranean region and North Africa due to its diverse therapeutic properties, including antimicrobial, antidiabetic, antioxidant, and anti-inflammatory effects. Despite its extensive ethnopharmacological use, a comprehensive characterization of its phytochemical composition remains essential to better understand the biological mechanisms underlying these therapeutic properties. The present study aimed to perform a preliminary qualitative phytochemical screening of T. polium extract in order to identify the major classes of secondary metabolites responsible for its pharmacological activities. The phytochemical analysis was carried out using standard qualitative tests specific to each class of metabolites. The results revealed the presence of several bioactive compounds, namely tannins, flavonoids, phenolic compounds, terpenes (confirmed by the Salkowski test), mucilages, resins, and coumarins. Conversely, saponins, volatile oils, quinones, and phytosterols were not detected under the experimental conditions employed, suggesting either their absence or their presence at concentrations below the detection threshold of the tests used. The notable abundance of phenolic and terpenoid compounds highlights the promising biological potential of T. polium, particularly with regard to its antioxidant and anti-inflammatory activities, which have been extensively reported in previous studies. These findings support the traditional therapeutic use of this species and reinforce its relevance as a source of bioactive natural compounds. These preliminary results provide a valuable foundation for further phytochemical investigations, including quantitative characterization of the identified metabolites, isolation of active compounds, and in-depth evaluation of their pharmacological and biological activities, with a view toward potential applications in phytotherapy and drug development.

Keywords: Teucrium polium L., phytochemical screening, secondary metabolites, phenolic compounds, terpenes.

RESULTS OF THE INVENTORY OF RED DATA BOOK ENDEMIC SPECIES OF THE GENUS SCUTELLARIA L. PRESERVED IN THE UZBEKISTAN NATIONAL HERBARIUM (TASH), A UNIQUE SCIENTIFIC COLLECTION

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ABSTRACT

This study is devoted to the inventory and scientific assessment of herbarium specimens of the genus Scutellaria L. preserved in the Uzbekistan National Herbarium (TASH) of the Institute of Botany, Academy of Sciences of the Republic of Uzbekistan, with particular emphasis on rare and endemic species included in the Red Data Book of Uzbekistan. During the study, a total of 1,543 herbarium specimens of Scutellaria L. deposited in the TASH collection were examined. A database was compiled containing information on the year of collection, collection locality, collectors, taxonomic identification, and conservation status of each specimen. The oldest specimen preserved in the collection dates back to 1907, while the majority of the material was collected from the mountainous regions of Central Asia and the Turan floristic province. The inventory revealed nearly 100 herbarium specimens representing five Scutellaria species listed in the Red Data Book of Uzbekistan. Among them, Scutellaria colpodea Nevski was the most frequently represented species, followed by Scutellaria fedtschenkoi Bornm., Scutellaria guttata Nevski ex Juz., Scutellaria holosericea Gontsch. ex Juz., and Scutellaria villosissima Gontsch. et Juz. The study also indicated that the taxonomic status of several specimens requires further verification. In addition, the morphological and ecological characteristics of the investigated species were summarized, highlighting their pharmacological potential and ornamental value. The findings provide an important scientific basis for the conservation of rare and endemic Scutellaria species, clarification of their distribution patterns, enhancement of herbarium collections, and future floristic, taxonomic, and biodiversity conservation studies in Uzbekistan.

Keywords: Uzbekistan National Herbarium (TASH), inventory, Scutellaria L., endemic and rare species.

TYPHA MINIMA HOPPE AND SISYRINCHIUM MICRANTHUM CAV . DATA IN SHKUMBIN RIVER VALLEY, ALBANIA

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ABSTRACT

The studied area is located in the middle section of the Shkumbin River Valley and extends across the Peqin, Elbasan and Librazhd areas, where botanical surveys were conducted during the spring seasons of 2025 and 2026. Along the river valley, geological formations gradually change from east to west, defining two sectors with distinct lithological and geomorphological characteristics. This lithological transition has influenced soil formation, valley morphology, and the ecological conditions that support the development of riparian vegetation. This section is characterized by a Mediterranean climate with continental influence. The river itself lattely is facing serious anthropogenic pressure and impact, as it is under road construction activities along its course from Elbasan to Librazhd. Along the riparian zones of the study area, four new localities of Sisyrinchium micranthum and four localities of Typha minima were recorded. For these taxa, this article presents and describes their distribution for Albania, population size, habitat and ecological preferences, threatness categories according the Red List of IUCN and Albania, ecological risks, as well as the alien status of S. micranthum is being discussed and recommended. Therefore, further monitoring and evaluation are needed to assess the species' invasive status within the country's flora. In addition, habitat conservation, restoration, and riverbank rehabilitation measures are required to mitigate habitat degradation and bank erosion while ensuring the long-term protection of native plant communities.

Keywords: Flora, Taxa, Naturalised, Shkumbin River, Albania

THE EFFECTS OF NITRIC OXIDE AND GLYCINE BETAINE APPLICATIONS ON TOMATO SEEDLINGS UNDER HEAT STRESS

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ABSTRACT

Heat stress is one of the most significant abiotic stress factors limiting agricultural production worldwide due to the effects of climate change. Tomato (Solanum lycopersicum L.), belonging to the Solanaceae family, is an economically and agriculturally important vegetable. However, rising heat due to climate change are negatively affecting the growth, development, and yield of tomatoes. This leads to increased production of reactive oxygen species (ROS) in plants, causing oxidative stress. On the other hand, nitric oxide (NO), a reactive nitrogen species (RNT), is a signaling molecule involved in the regulation of growth, development and stress responses in plants. Also, glycine betaine (GB) is an important organic compound involved in osmoregulation in plants, contributing to the maintenance of cellular water balance. This study investigated the physiological and biochemical effects of exogenous GB and NO donor sodium nitroprusside (SNP) applications on tomato (S. lycopersicum L. cv. H 2274) seedlings grown under heat stress. Six-week-old seedlings were treated with 5 mM GB and 100 µM SNP and 24 hours after application, the plants were exposed to heat stress at 46–50°C. Root and shoot length, fresh and dry weight, total chlorophyll and protein content, as well as peroxidase (POX) activity, hydrogen peroxide (H_2O_2) and lipid peroxidation (TBARs) levels were determined. Heat stress negatively affected growth and biochemical parameters, leading to a decrease in chlorophyll and protein content and an increase in H2O2 and TBARs levels. Conversely, GB and especially SNP applications significantly mitigated the negative effects of heat stress. SNP application increased growth parameters, total chlorophyll and protein content, and POX activity, while reducing H2O2 and TBARs levels and limiting oxidative damage. The findings demonstrate that NO-mediated signaling mechanisms strengthen the antioxidant defense system in tomato seedlings against heat stress and play a significant role in enhancing stress tolerance.

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Keywords: Solanum lycopersicum L., heat stress, sodium nitroprusside, glycine betaine, oxidative stress, antioxidant defense system

THE EFFECTS OF NITRIC OXIDE APPLICATION ON THE GROWTH AND DEVELOPMENT OF PEPPER (CAPSICUM ANNUUM L.) SEEDLINGS UNDER COLD STRESS

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ABSTRACT

Cold stress is one of the abiotic stress factors that limit plant growth and agricultural productivity under changing climatic conditions. In particular, pepper (Capsicum annuum L.) is an economically important vegetable crop that is highly sensitive to low temperatures. However, exposure to cold stress negatively affects the growth, development, and yield of pepper. This leads to increased production of reactive oxygen species (ROS) in plants, causing oxidative stress. Nitric oxide (NO), a reactive nitrogen species (RNS), is a signaling molecule that regulates plant growth, development, and stress responses while mitigating oxidative damage through activation of the antioxidant defense system. In this study, the physiological and biochemical effects of exogenous sodium nitroprusside (SNP), a nitric oxide donor, on pepper (C. annuum L. cv. BT Burkalem) seedlings exposed to cold stress were investigated. Six-week-old pepper seedlings were treated with 100 µM SNP and exposed to cold stress (0–5°C) 24 hours after application. Root and shoot length, fresh and dry weight, total chlorophyll and protein content, peroxidase (POX) activity, hydrogen peroxide (H2O2), lipid peroxidation (TBARs), and electrolyte leakage (EL) were determined. Cold stress negatively impacts plant growth and physiological performance, reducing growth parameters and chlorophyll content, while increasing oxidative damage by enhancing H2O2, TBARs accumulation, and EL. Conversely, SNP application significantly mitigated the negative effects of cold stress. SNP application improved root and shoot growth, biomass accumulation, and total chlorophyll content. Furthermore, SNP treatment increased POX activity while reducing H2O2 accumulation, TBARs, and EL. Although total protein content decreased in the SNP + cold stress treatment, the overall physiological and biochemical responses indicated that SNP effectively enhanced cold stress tolerance. These findings suggest that NO-mediated signaling enhances the antioxidant defense system in pepper seedlings under cold stress and contributes to reducing oxidative damage.

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Keywords: Capsicum annuum L., cold stress, nitric oxide, sodium nitroprusside, antioxidant defense system

DETERMINATION OF THE ALLELOPATHIC EFFECT OF EARLY STAGE HARVESTED RADISH (RAPHANUS SATIVUS L.) SEEDLINGS ON THE GERMINATION OF SOLANUM NIGRUM (BLACKCURRANT)

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ABSTRACT

Competition between weeds and cultivated plants negatively affects their product quality and yield. Solanum nigrum L. (nightshade), belonging to the Solanaceae family, is one of the most common weeds in agricultural areas. Herbicides are generally used in weed control, but there is also a need for alternative biological methods. Allelochemical substances are suggested as alternatives to pesticides in the use of bioherbicides. In this context, the use of essential oils and extracts obtained from allelopathic plants in weed control stands out. Plants in the Brassicaceae family release glucosinolates into their environment or isothiocyanates are formed because of the decomposition of plant parts, affecting the germination and development of weed seeds. Our research focuses on the allelopathic effect of extracts (RSE) obtained from radish (Raphanus sativus) sprouts at the early seedling stage compared to normally developing radish plants. For this purpose, the allelopathic effect of different concentrations of RSE on the germination of S. nigrum seeds was investigated based on physiological parameters. Extracts obtained from radish sprouts (25%, 50%, 75%, and 100%) gradually reduced the germination and germination rate of S. nigrum seeds with increasing concentrations. Germination suppression was most pronounced at 100% concentration, reaching 83%. Stem lengths of sprouts developing from S. nigrum seeds gradually increased up to 50% concentration but decreased to control levels at 100% concentration. Root lengths decreased at all concentrations, with the most severe decrease at 100% concentration compared to control, at 75%. Biomass results were similar to stem length results. Accordingly, RSE only reduced stem length by 50% compared to control at 100% concentration. The same concentration caused biomass to decrease to control levels. Chlorophyll content varied depending on the treatments, but decreased in all treatments compared to control, and no significant difference was found between concentrations. Our results indicate that extracts obtained from R. sativus seedlings harvested in the early seedling stage exhibit a strong concentration-dependent allelopathic effect on S. nigrum. In particular, the suppression of germination and seedling development as concentration increases suggests that these extracts could be evaluated as bioherbicides. These findings suggest that they could contribute to the development of environmentally friendly weed management strategies aimed at reducing the use of synthetic herbicides.

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Keywords: Solanum nigrum, Raphanus sativus, allelopathy, weed germination, growth

INVESTIGATION OF THE EFFECTS OF LEMONGRASS (MELISSA OFFICINALIS L.) EXTRACT ON THE GERMINATION OF REDSHANK (AMARANTHUS RETROFLEXUS L.) AND SPINACH (SPINACIA OLERACEA L.) SEEDS

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ABSTRACT

Encouraging the germination of plants with germination problems is important in plant production. Furthermore, controlling weeds is essential for the healthy development and productivity of crops in agricultural areas. This study investigated the activator and/or inhibitory role of the leaf extract of Melissa officinalis L. (Lemongrass) (Lamiaceae) as a biostimulant on the germination characteristics of two plants, one cultivated and one weed, both members of the Amaranthaceae. Specifically, the study focused on determining the allelopathic effect of M. officinalis leaf extracts (normal extract (MOE) and extract obtained from drought-re-irrigated plants (MOE-R)) on Amaranthus reflexus. Furthermore, the effects on the germination ability of spinach seeds were also studied comparatively. According to our results, MOE and MOE-R applications reduced the germination of spinach seeds by an average of 15% compared to control plants, while reducing the germination of A. reflexus seeds by 69% and 81%, respectively. In addition, these extracts increased the germination power of spinach seeds by 110%. They reduced the germination power of A. reflexus seeds by 77%. While they gradually increased the germination rate in spinach seeds, they significantly reduced the germination rate (75%) in A. reflexus seeds. The biomass of spinach seeds increased under drought treatment. Interestingly, a 30% increase in biomass was observed in A. reflexus seeds with drought and all extract applications. Stem and root development was stimulated in spinach seeds, while the inhibitory effect remained limited in A. retroflexus seeds. On the other hand, total chlorophyll content increased dramatically in spinach seeds with MOE by 3.2 times, under drought stress by 2 times, and with MOE-R by 102%. In A. retroflexus, it decreased by 24%, 38%, and 18%, respectively. In conclusion, water extracts obtained from M. officinalis plants grown under drought stress have the potential to suppress weed growth while creating a biostimulant effect in spinach, a cultivated plant. This suggests that M. officinalis extracts could be an alternative biological material that can be evaluated as a natural biostimulant and in environmentally friendly weed management in sustainable and organic farming practices.

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Keywords: Melissa officinialis, Amaranthus retroflexus, Spinacia oleracea, drought stress, allelopathy, germination

DESIGN AND IMPLEMENTATION OF AN OFF-GRID SOLAR-POWERED DRIP IRRIGATION SYSTEM WITH A SOIL MOISTURE CONTROLLER FOR DAYTIME IRRIGATION OF OLIVE GROVES IN CANAKKALE

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ABSTRACT

The olive tree is a typical Mediterranean climate plant characterized by dry and hot summers and capable of surviving with minimal water. However, if olive trees are irrigated, they exhibit increased bud formation and flowering, higher fruit production, larger fruit size, greater yield per tree, and a higher amount of olive oil. In recent years, renewable energy resources have been preferred in irrigation applications in order to both reduce fossil fuel-based energy consumption and irrigation costs. The use of solar energy as a renewable energy resource for agricultural irrigation has been steadily increasing. In this study, an off-grid solar-powered, soil moisture-controlled daytime drip irrigation system is implemented in an olive grove located in Ezine, Çanakkale. The mentioned irrigation system essentially includes a 12 Volt submersible pump, two photovoltaic panels (12 Volt, 340 Watt) and a control unit. The control unit determines the conditions under which the submersible pump operates and basically consists of a circuit breaker, a solar charge controller, a battery, a digital timer, and a soil moisture controller. The function of the battery in the control unit is to continuously provide energy needs of control circuits. Thus, control settings can remain constant at all times. In addition, since the battery is not used to power the submersible pump, a low-cost system can be designed using a low-capacity battery. Thanks to a digital timer, the solar drip irrigation system can operate at scheduled intervals during the daytime on a weekly basis. With the help of the soil moisture controller, efficient drip irrigation can be carried out based on the predetermined set value of soil moisture. In this design, the soil moisture controller continuously measures soil moisture with a sensor. If the level of soil moisture is below the set value and the time is between 9:00 and 18:00, the control unit allows irrigation. On the other hand, if the soil moisture level is above the set value or the time is outside the specified time range, irrigation is prevented. Owing to the drip irrigation system mentioned, water needs of olive trees are met during the daytime by controlling soil moisture. In this way, economical irrigation is achieved while agricultural productivity is enhanced. By preventing unnecessary irrigation, efficient use of water is possible. Additionally, this study can be used in any area where a sustainable irrigation system is required.

Keywords: Off-grid solar system, Renewable energy, Solar-powered irrigation, Sustainable production, Soil moisture-controlled system, Photovoltaic system

DESIGN AND APPLICATION OF AN OFF-GRID SOLAR-BASED, SOIL MOISTURE-CONTROLLED DRIP IRRIGATION SYSTEM FOR OLIVE GROVES IN TURKIYE

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ABSTRACT

Olive trees are grown mostly in countries bordering the Mediterranean basin, such as Türkiye, Spain, Italy, Greece, Tunisia, Portugal, Syria, Libya, Morocco and Algeria. Although the olive tree is a species resistant to drought conditions, it is one of the agricultural products that will be most affected by global climate change. Therefore, water resources should be managed carefully, and appropriate irrigation strategies should be implemented. The use of solar energy in agricultural irrigation is increasing day by day, as this energy is both an environmentally friendly approach and an economical solution in the long term. In this study, the installation of an off-grid solar-based, soil moisture-controlled 24-hour drip irrigation system is performed in an olive grove located in Ezine, Çanakkale. The drip irrigation system contains two photovoltaic (PV) panels (12 Volt, 340 Watt), a battery group (12 Volt), a 12 Volt submersible pump and a control unit. The control unit defines the operating conditions of the submersible pump and consists of a circuit breaker, a solar charge controller, a digital timer and a soil moisture controller. The solar charge controller allows PV panels to charge the battery group. The battery group provides the energy needs of both the control circuits and the submersible pump, enabling drip irrigation. To ensure 24/7 drip irrigation capability, the battery group must have sufficient power capacity. The designed system can be operated at various times throughout the day and night, owing to the digital timer. Thanks to the soil moisture controller, effective drip irrigation can be carried out by taking into account the predefined soil moisture threshold. In this application, the soil moisture controller constantly measures soil moisture using a sensor. If the soil moisture level falls below the specified threshold and the time is within the set time period, the control unit allows the battery group to power the submersible pump. If the soil moisture level exceeds the specified threshold or the time is outside the set time period, the control unit does not allow the battery group to power the submersible pump. With this solar-based irrigation system, olive trees' water needs are continuously met by considering soil moisture. Thus, an efficient, eco-friendly, cost-effective, and sustainable drip irrigation is realized and agricultural efficiency is increased. Additionally, this study can be used in any agricultural estate and the mentioned solar-based irrigation system will constantly support the development of the agricultural sector.

Keywords: Off-grid photovoltaic system, Solar based drip irrigation, Renewable energy, Sustainable production, Soil moisture-controlled system

PERFORMANCE EVALUATION OF EPOXY COATINGS IN AGGRESSIVE ENVIRONMENTS: APPLICATIONS IN PETROCHEMICAL INDUSTRY

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ABSTRACT

This study investigates the corrosion protection capabilities of epoxy-based coatings originally formulated for food-grade metal packaging when exposed to highly aggressive conditions typical of petrochemical environments. The main objective is to evaluate their potential for safeguarding carbon steel infrastructures (C-1020), widely employed in pipelines, storage tanks, and processing equipment subjected to acidic media in industrial operations. Gravimetric corrosion tests were conducted on coated steel samples prepared using both industrial-scale application techniques and manual laboratory deposition. These specimens were immersed in sulfuric acid (H_2SO_4) solutions at different concentrations for varying durations to simulate the harsh environments encountered in refinery units, acid cleaning processes, and chemical manufacturing systems. Corrosion performance was quantified through measurements of corrosion rate, mass loss (Δm), and inhibition efficiency (E). The results indicate that the corrosion resistance of the coatings is highly dependent on environmental severity, including acid concentration and exposure time, as well as on the quality of the coating itself. Coatings applied using industrial processes exhibited superior adhesion, uniform thickness, and structural integrity, which translated into significantly lower corrosion rates compared to manually applied coatings. The latter often displayed defects such as microcracks, porosity, and uneven thickness, which compromised their protective effectiveness. From an industrial standpoint, these findings suggest that epoxy coatings originally designed for food-grade applications can be successfully adapted for use in petrochemical environments, particularly in units exposed to strong acids. Achieving optimal performance requires strict control over the coating formulation, curing conditions, and application methodology. Proper optimization ensures long-term durability, enhanced chemical resistance, and mechanical stability, even under extreme operational conditions. This study demonstrates that with careful process control, epoxy coatings can provide reliable corrosion protection for critical carbon steel infrastructure in challenging acidic environments.

Keywords: Epoxy coatings, Petrochemical industry, Corrosion protection, Sulfuric acid, Carbon steel, Gravimetric analysis, Industrial coatings, Harsh environments

EXPERIMENTAL STUDY OF RECYCLED HIGH-DENSITY POLYETHYLENE AS A VIABLE MATERIAL FOR MODERATE ENGINEERING APPLICATIONS

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ABSTRACT

This study provides a detailed comparative evaluation of the mechanical and thermo-chemical properties of virgin and recycled high-density polyethylene (HDPE), focusing on the impact of recycling on material performance and its potential for industrial reuse. With growing environmental concerns and the push for sustainable materials, understanding how recycling affects HDPE is essential for promoting circular economy practices in the polymer sector.
Mechanical testing reveals that recycled HDPE exhibits slight reductions in key properties compared to virgin material. Specifically, abrasive wear resistance, elastic modulus, Shore D hardness, and impact strength show modest decreases. Despite these reductions, the performance remains within acceptable limits for applications exposed to moderate mechanical stresses, indicating that recycling does not critically compromise the polymer's structural integrity. These results suggest that recycled HDPE can be safely employed in components where extreme mechanical performance is not required, expanding its industrial applicability.
Thermo-chemical analyses further demonstrate that recycled HDPE maintains properties comparable to virgin material. Thermal stability measurements indicate that the onset of degradation is largely unchanged, while chemical resistance tests show that the polymer remains resistant to common solvents and chemicals. These findings imply that the recycling process induces minimal alterations to the polymer's molecular structure, preserving its functional integrity under typical operating conditions. Overall, the study highlights that recycled HDPE constitutes a practical and environmentally sustainable alternative to virgin material for non-critical applications. Its use not only ensures adequate mechanical and chemical performance but also reduces dependence on virgin petrochemical resources, lowers waste generation, and supports resource-efficient manufacturing. By combining functional reliability with ecological benefits, incorporating recycled HDPE into industrial processes provides a strategic approach to balancing performance requirements with environmental responsibility, contributing to a more sustainable and circular polymer economy.

Keywords: high-density polyethylene, recycling, mechanical properties, thermal stability, sustainability.

CHEMICAL PRETREATMENT OF ALGERIAN GOLD ORE: THE CASE OF AMESSMESSA – HOGGAR

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ABSTRACT

Refractory gold ores present significant challenges in gold extraction, requiring innovative and effective pretreatment methods to improve recovery rates. Their refractory nature is mainly related to their complex mineralogical composition, often involving silicate and sulfide minerals that encapsulate gold particles and limit their accessibility during conventional extraction processes such as direct cyanidation. With the progressive depletion of high-grade and easily treatable gold deposits, industrial interest has increasingly shifted toward refractory gold ores, which generally respond poorly to conventional extraction techniques. Under standard cyanidation conditions, these ores often exhibit low gold recovery rates, typically below 80%. Several factors may contribute to this refractory behavior, including the presence of cyanide-consuming elements. In particular, copper contents exceeding 1% can significantly affect the leaching process because copper forms stable complexes with cyanide, thereby increasing cyanide consumption and reducing its availability for gold dissolution. In this context, the present study aimed to evaluate the leaching behavior of the ore and to identify suitable pretreatment and leaching conditions for improving gold extraction. For this purpose, leaching tests were carried out, together with a physicochemical characterization of the ore. The results showed that cyanide consumption increased with its initial concentration, indicating the presence of elements with a high affinity for cyanide, mainly copper and iron. These findings confirm the refractory character of the studied ore and highlight the need for an optimized pretreatment strategy to enhance gold recovery.

Keywords: Gold, extraction, Amesmessa ore, pretreatment, cyanidation

QUANTITATIVE EVALUATION OF CYANOGENIC ELEMENTS FOR GOLD EXTRACTION IN AMESMESSA DEPOSIT BY NEUTRON ACTIVATION ANALYSIS

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ABSTRACT

Gold is a noble and rare metal with exceptional physicochemical properties. Its average **content** in the upper continental crust is approximately 0.005 mg kg-1 . Global demand for this resource continues to increase. Gold is generally associated with gangue minerals that contain elements such as iron, copper, zinc, arsenic, antimony, lead, mercury, selenium, tellurium, carbon and silicon. This coexistence can limit gold extraction. Gold can be extracted by several methods, including the gravimetric method, amalgamation and leaching with chlorides, cyanides, thiosulfates, and thiourea. Cyanidation remains the most widely used method. Before cyanidation, mechanical comminution (crushing and grinding) is required to liberate gold from the gangue matrix Adequate comminution is therefore essential for optimizing gold liberation. Several characterization techniques are used in petrographic and exploration studies, including X-ray diffraction (XRD), X-ray fluorescence (XRF), and inductively coupled plasma-optical emission spectrometry (ICP-OES). These methods are becoming more common at various stages of the mining process. For mineralized orebody characterization, XRD identifies mineralogical phases, while XRF measures major and minor element content. Trace-element analysis is carried out using ICP-OES. In the Amesmessa gold deposit, such elements as As, Sb, Cu, Pb, and Zn may occur at trace to minor mass fractions, and their presence can significantly influence cyanide leaching efficiency. Their impact has been discussed by several researchers. For example, the presence of 20 mg kg-1 of antimony in the leaching medium can significantly reduce gold recovery. Elemental determination by ICP-OES is not always idea . Using acidic reagents during open-vessel digestion may cause losses of volatile analytes during sample preparation. Instrumental neutron activation analysis (INAA) is a suitable alternative, because it is non-destructive and provides a detection limit for gold of 0.01 mg kg-1. This study evaluates the elemental content that may affect gold extraction at the Amesmessa gold deposit. Gold, silver, arsenic, antimony, cobalt, zinc, iron, calcium, and potassium were determined in ore samples and wall-rock facies from several zones of the deposit using instrumental neutron activation analysis (INAA) to delineate their spatial distribution. The gold content in the wall-rock facies reached 10.3 mg kg-1. Statistical analysis revealed significant correlations between Au–Ag (r = 0.936), Au–Ca (r = 0.965), Co–Fe (r = 0.902), and As–Zn (r = 0.720), indicating

distinct geochemical associations. The highest gold mass fraction in the northern part of the deposit were spatially associated with elevated Fe, K, Ca, Co, and Sb contents. Lithological chemical composition varied markedly from north to south across the deposit. These findings indicate that the composition of altered host rocks controls the distribution of rate-limiting elements during gold extraction from the Amesmessa deposit. This information is important for optimizing extraction conditions and improving overall gold recovery.

Keywords: Amesmessa ores, trace elements, gold, INAA, elemental distribution.

GET THE WAY: AN INTEGRATED AI-POWERED MOBILE APPLICATION FOR VISUALLY IMPAIRED

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ABSTRACT

Visually impaired individuals have limited independent mobility in unfamiliar environments such as stairs, potholes, barriers, vehicles, pedestrian crossings, and traffic lights. Improving their quality of life and contributing to social life is crucial. Current accessibility applications offer visual aids, text, descriptions of people, products, surrounding scenes, and camera-based information about nearby objects and written content. This does not adequately meet the needs of users. Therefore, the development of a more comprehensive and user-friendly mobile application has begun. This ongoing project presents Get the Way, an Android-based assistive system designed to provide short, priority, and voice-based guidance via smartphone. The system integrates camera-based object detection, optical character recognition, location and route services, speech recognition, text-to-speech conversion, vibration feedback, and AI-powered scene identification. Get the Way's distinguishing feature is that it combines environmental description with continuous motion-focused hazard awareness in a single system, prioritizing instant alerts over lengthy descriptions. Detection capabilities include stairs, doorways, pits, uneven surfaces, walls, barriers, people, vehicles, pedestrian crossings, and traffic lights. Additional functions include reading visible text, determining user location, providing route guidance, accepting verbal commands, and sharing location information in emergencies. A lightweight YOLO11n detector is planned for offline mobile data extraction. Preliminary stair detection studies have yielded promising results in various open spaces.

Keywords: Visual impairment, Assistive technology, Mobile artificial intelligence, Obstacle detection, Wearable technology

DESIGN OF A DISASTER COMMUNICATION SYSTEM USING WEARABLE IOT TECHNOLOGIES AND LORA-BASED MESH NETWORKING

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ABSTRACT

Due to their unpredictable outcomes and extreme destructiveness, natural disasters including earthquakes, avalanches, landslides, and floods are among the major categories of catastrophes that result in the loss of life and property. The success of search and rescue efforts after such tragedies depends crucially on the quick and precise identification of those buried beneath debris and the monitoring of their vital signs. However, conventional search and rescue techniques have a number of drawbacks with regard to communication continuity, speed, and accuracy. In particular, communication infrastructure damage or total disabling during a disaster impairs team collaboration, interferes with information sharing, and greatly increases reaction time. Consequently, it is crucial to create dependable communication systems that can function without infrastructure in crisis situations. This study proposes an end-to-end independent communication system that can be used by both disaster victims and search and rescue teams in disaster situations and that can operate without the need for cellular networks or an active internet connection. The system design is inspired by the Meshtastic platform, which adopts Low Power Wide Area Network (LPWAN) technologies and an infrastructure independent mesh network approach. In the proposed architecture, ESP32-based microcontrollers equipped with LoRa communication modules serve as the primary communication nodes. In the system, smartwatches with the Wear OS operating system are used as wearable Internet of Things (IoT) devices, transmitting vital data such as heart rate and oxygen saturation, as well as GPS-based location information, of disaster victims to the nearest ESP32 node via Bluetooth. The collected data is then transmitted to other nodes in the vicinity or directly to the crisis management center using LoRa communication technology operating in the unlicensed ISM frequency band. Thanks to the software infrastructure and mobile application developed at the crisis management center, search and rescue teams can view and track the real-time location and health data of disaster victims in real-time via a map-based interface. Thus, the aim is to accelerate response processes and increase the effectiveness of search and rescue operations by ensuring uninterrupted data sharing even in scenarios where communication infrastructure is unavailable after a disaster. Field tests have shown that the developed system can successfully transmit data over distances of 2 km and above using LoRa communication technology. These results show that the system does not require cellular connectivity infrastructure to deliver dependable data delivery during emergencies. Signal attenuation or data transmission interruptions may happen at certain locations because environmental elements including topography, physical impediments, and electromagnetic interference impact communication distance. However, because of the suggested mesh network design, data may be routed to the target node via multi-hop through other LoRa modules serving as intermediary nodes in circumstances when direct connection is not feasible or signal quality is inadequate.

Keywords: Disaster Management, Search and Rescue, LoRa, LPWAN, Mesh Network, ESP32, Wearable IoT, Vital Signs, GPS, Emergency Communication, Infrastructure-Independent Communication, Meshtastic

DESIGN AND IMPLEMENTATION OF EMG-BASED GAMIFIED REHABILITATION SYSTEM

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ABSTRACT

Due to their prolonged and repetitive exercises, traditional physical therapy applications employed in the rehabilitation of musculoskeletal disorders may eventually result in a decline in patient motivation and treatment adherence. By making the treatment process more interactive and engaging, EMGbased gamified rehabilitation systems, on the other hand, boost patient motivation by promoting consistent exercise participation and bolstering the efficacy of the rehabilitation process. Neuromuscular therapy has been established utilizing games or virtual reality settings with EMG sensors, particularly for disorders that cause muscle weakness on one side of the body, such as hemiparesis that develops after a stroke. The goal of this project is to use electromyography (EMG) data from human muscles to operate computer games without a keyboard or mouse. The electrical impulses produced during muscular contraction are detected by the device, sent in real time to the computer, and used as orders in the game. Therefore, it has been shown that biological signals are useful in human-computer interaction. An Arduino Uno reads the muscle impulses from the EMG sensor, sends them to a Python application via serial connection, and uses this information to drive the Dino game. The Arduino produces a "JUMP" command when the user tenses their muscles and goes above a certain threshold. Python recognizes this command and makes the in-game character leap. An Arduino Uno, an EMG sensor, surface electrodes, a USB connection, and a computer make up the system's hardware. The Arduino IDE, Python, PySerial, and Pygame are used for software processing and game control, while the EMG sensor sends electrical impulses from the muscles to the Arduino. The system's minimal latency, dependable data exchange between Arduino and Python, and successful transfer of the user's muscular motions to the game were all demonstrated by the experiments. This shows that biological signals may be used to control games in real time.

Keywords: Electromyography (EMG), Neuromuscular Rehabilitation, Gamification, Human-Computer Interaction, Muscle Activity, Bio-Signal Processing, Real-Time Control, Arduino Uno

DC POWER FORECASTING OF TILE ROOF MOUNTED PHOTOVOLTAIC SYSTEMS USING THERMAL AND METEOROLOGICAL INPUTS: A COMPARATIVE MACHINE LEARNING APPROACH

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ABSTRACT

This study aims to accurately predict the direct current (DC) power output of a photovoltaic (PV) panel installed horizontally on a tile roof using climatic and thermal measurements and to compare the performance of different machine learning approaches. To prevent data leakage during the modeling process, DC voltage and current variables were excluded, while solar irradiance, ambient temperature, relative humidity, wind speed, panel surface temperature, temperature beneath the panel, and temperature beneath the roof were used as input variables, with DC power defined as the target variable. A total of 4,962 complete experimental records collected between June 10, 2026, and July 12, 2026, were chronologically divided into 80% training and 20% testing datasets. Multiple Linear Regression (MLR), Artificial Neural Network (ANN), and Random Forest (RF) regression models were evaluated using the coefficient of determination (R^2), Mean Absolute Error (MAE), and Root Mean Square Error (RMSE). The experimental results showed that all models successfully captured the system dynamics, achieving R^2 values above 0.89. While the two hidden layer ANN architecture provided more stable results than MLR, the RF model configured with 100 decision trees and default hyperparameters achieved the best overall performance, with R^2 = 0.9180, MAE = 23.52, and the lowest RMSE. The RF model reduced the MAE by 21.6% compared with MLR and by 15.6% compared with ANN. These results demonstrate that integrating microclimatic thermal variables into nonlinear models can significantly improve short-term power generation prediction accuracy in rooftop PV systems.This study aims to accurately predict the direct current (DC) power output of a photovoltaic (PV) panel installed horizontally on a tile roof using climatic and thermal measurements and to compare the performance of different machine learning approaches. To prevent data leakage during the modeling process, DC voltage and current variables were excluded, while solar irradiance, ambient temperature, relative humidity, wind speed, panel surface temperature, temperature beneath the panel, and temperature beneath the roof were used as input variables, with DC power defined as the target variable. A total of 4,962 complete experimental records collected between June 10, 2026, and July 12, 2026, were chronologically divided into 80% training and 20% testing datasets. Multiple Linear Regression (MLR), Artificial Neural Network (ANN), and Random Forest (RF) regression models were evaluated using the coefficient of determination (R^2), Mean Absolute Error (MAE), and Root Mean Square Error (RMSE). The experimental results showed that all models successfully captured the system dynamics, achieving R^2 values above 0.89. While the two hidden layer ANN architecture provided more stable results than MLR, the RF model configured with 100 decision trees and default hyperparameters achieved the best overall performance, with R^2 = 0.9180, MAE = 23.52, and the lowest RMSE. The RF model reduced the MAE by 21.6% compared with MLR and by 15.6% compared with ANN. These results demonstrate that integrating microclimatic thermal variables into nonlinear models can significantly improve short-term power generation prediction accuracy in rooftop PV systems.

Keywords: Energy, Photovoltaic panel, DC power prediction, Machine learning.

SOLAR ENERGY PREDICTION AND PARAMETER OPTIMIZATION USING XGBOOST AND GRASSHOPPER OPTIMIZATION ALGORITHM

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ABSTRACT

The depletion of fossil fuel resources and the escalating impacts of climate change have accelerated the transition toward renewable energy sources, particularly solar energy. However, the intermittent and weather-dependent nature of solar power generation poses significant challenges for maintaining the supply-demand balance in smart grids, highlighting the need for accurate energy production forecasting. In this study, a data-driven decision-support framework is proposed to determine the optimum operating conditions of photovoltaic systems by integrating an XGBoost-based prediction model with the Grasshopper Optimization Algorithm (GOA). The predictive performance of the XGBoost model was evaluated using the coefficient of determination (R^2), root mean square error (RMSE), and mean absolute error (MAE). The results demonstrated excellent predictive capability, achieving an R^2 of 0.98, an RMSE of 0.59, and an MAE of 0.32. Subsequently, the trained XGBoost model was employed as the objective function within the GOA framework to identify the optimal input parameter values that maximize energy production. To assess the robustness and reliability of the optimization process, the GOA was validated through five independent optimization runs, and both the convergence characteristics and the optimal parameter values were analyzed. The optimization results yielded a maximum predicted energy production of 35.674 ± 0.386 ($n = 5$). Overall, the findings demonstrate that the proposed hybrid XGBoost-GOA framework provides an effective and reliable tool for photovoltaic energy forecasting and the determination of optimum operating conditions, offering valuable decision support for improving the operational efficiency of solar energy systems.

Keywords: Photovoltaic systems, XGBoost; Grasshopper Optimization Algorithm, Machine Learning

COMPARATIVE CHEMICAL PROFILING, ANTIOXIDANT POTENTIAL, AND MOLECULAR DOCKING INVESTIGATION OF ESSENTIAL OILS AND HYDROLATES FROM TWO SALVIA ROSMARINUS VARIETIES (LAXIFLORUS AND TROGLODYTORUM) NATIVE TO SOUTHERN TUNISIA

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ABSTRACT

This study investigated the phytochemical composition and antioxidant potential of essential oils and hydrolates obtained from two wild rosemary varieties, Salvia rosmarinus var. laxiflorus and Salvia rosmarinus var. troglodytorum, native to southern Tunisia. The objective was to characterize their bioactive constituents and evaluate their potential applications as natural antioxidants. Total phenolic content (TPC) and total flavonoid content (TFC) were determined to assess the abundance of antioxidant compounds. The chemical composition of the essential oils was analyzed using gas chromatography–mass spectrometry (GC–MS), enabling the identification of the major volatile constituents. Antioxidant activity was evaluated through DPPH radical scavenging and ferric reducing antioxidant power (FRAP) assays. In addition, molecular docking studies were performed to examine the interaction of the main compounds with the 3QFT protein, and a preliminary assessment of their endocrine-disrupting potential was conducted.The results revealed notable differences between the two rosemary varieties. The hydrolate derived from S. rosmarinus var. laxiflorus exhibited the highest levels of phenolic and flavonoid compounds. GC–MS analysis showed that the essential oil of this variety was mainly composed of 1,8-cineole, eugenol, α-pinene, camphor, and α-terpineol. In contrast, the essential oil of S. rosmarinus var. troglodytorum was characterized by the predominance of 1,8-cineole, camphor, α-pinene, α-terpineol, and borneol. A key distinction between the two oils was the significant presence of eugenol in the laxiflorus variety, which was absent in troglodytorum. Consistently, both the essential oils and hydrolates of S. rosmarinus var. laxiflorus demonstrated stronger antioxidant activity in DPPH and FRAP assays. Molecular docking analysis indicated that eugenol showed the highest binding affinity toward the 3QFT protein. Furthermore, 1,8-cineole, camphor, and eugenol displayed minimal endocrine-disrupting potential. Overall, these findings highlight the value of wild rosemary as a natural source of antioxidants and support the potential use of its essential oils and hydrolates in food and pharmaceutical applications.

Keywords: Salvia Rosmarinus, essential oils, GC–MS analysis, Molecular docking

INVESTIGATION OF ANTIBACTERIAL AND ANTI-INFLAMMATORY POTENTIAL OF OPTIMIZED PASSION FRUIT EXTRACT USING MOLECULAR DOCKING STUDIES

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ABSTRACT

This study investigates the antibacterial and anti-inflammatory potential of Passiflora edulis peel extract, aiming to promote the valorization of this agro-industrial by-product and to explore its possible therapeutic applications. Fruit peels are often discarded despite being rich in bioactive compounds with significant pharmacological properties. In this work, the extract was obtained using ultrasound-assisted extraction (UAE), a technique known for improving extraction efficiency while preserving thermolabile compounds. The phytochemical composition of the obtained extract was characterized by high-performance liquid chromatography coupled with a diode-array detector (HPLC-DAD)**,** enabling the identification of several phenolic acids and flavonoids. The antibacterial activity of the extract was evaluated using the agar well diffusion method against four pathogenic bacterial strains: Staphylococcus aureus, Bacillus cereus, Escherichia coli, and Salmonella typhimurium. The results demonstrated noticeable inhibitory effects, suggesting that the peel extract contains compounds capable of limiting bacterial growth. In addition to experimental assays, molecular docking analysis was performed to further elucidate the potential mechanisms underlying the observed biological activities. This computational approach allowed the assessment of interactions between the identified phytochemicals and selected protein targets associated with bacterial proliferation and inflammatory responses. Docking simulations revealed that several compounds, including gallic acid, caffeic acid, coumaric acid, ferulic acid, rutin, luteolin-7-O-glucoside, and apigenin-7-O-glucoside**,** exhibited strong binding affinities and stable interactions with the studied targets. These interactions suggest that such phenolic constituents may play an important role in the antibacterial and anti-inflammatory properties of the extract. Overall, the results highlight Passiflora edulis peel as a promising natural source of bioactive molecules with relevant biological activities. By combining in vitro antibacterial assays**,** phytochemical profiling**,** and in silico molecular docking**,** this study provides comprehensive evidence supporting the potential use of passion fruit peel as a sustainable and valuable resource for the development of natural therapeutic agents and functional products.

Keywords: Passiflora edulis, luteolin-7-O-glucoside, apigenin-7-O-glucoside, anti-inflammatory

LOW-COST SYNTHESIS OF MESOPOROUS SILICA NANOPARTICLES FROM WASTE GLASS FOR THE REMOVAL OF CRYSTAL VIOLET DYE

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ABSTRACT

The valorization and reuse of natural resources represent a promising alternative for reducing material production costs, particularly in the case of glass waste, which is generated in large quantities and is difficult to dispose of. The aim of this work is to propose a new silica source that is less expensive than conventional precursors such as TEOS. In this study, mesoporous silica nanoparticules (MSN) was synthesized via a hydrothermal process using sodium silicate extracted from waste glass as the silica precursor. The influence of synthesis pH on the structure and physicochemical properties of the material was investigated in order to determine the optimal preparation conditions. The obtained white powder was characterized by X-ray fluorescence (XRF), revealing a silica content higher than 98%. X-ray diffraction (XRD) and nitrogen adsorption–desorption analyses at −196 °C confirmed the formation of MSN exhibiting an ordered hexagonal structure and a homogeneous mesoporous distribution. The results showed that the synthesis pH strongly affects the textural properties of the material, particularly the specific surface area and pore diameter. The material prepared at pH = 9.5 exhibited a high specific surface area (600 $m^2 \cdot g^{-1}$) and a larger pore diameter (3.81 nm). The adsorption performance toward crystal violet (CV) dye was evaluated as a function of several experimental parameters, including initial concentration, temperature, and pH. Fitting the experimental data to the Langmuir and Freundlich isotherm models confirmed the high adsorption capacity of the MSN material toward CV dye. This work therefore highlights a sustainable and cost-effective approach for the synthesis of mesoporous materials from glass waste, offering broad application prospects in catalysis and wastewater treatment.

Keywords: Glass waste, Ultrasonic, Mesoporous, Silica

MYCOTOXIN CONTAMINATION IN FEED INGREDIENTS (RYE, BARLEY, AND WHEAT BRAN) INTENDED FOR DAIRY-PRODUCING ANIMALS, ALBANIA CASE

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ABSTRACT

This study investigated the occurrence of mycotoxins in 12 feed ingredient samples (2 rye, 7 barley, and 3 wheat bran) intended for dairy-producing animals in Albania. A total of 24 mycotoxins – aflatoxins (B1, B2, G1, and G2), penicillium acid, DON, 15-Ac DON, 3-Ac DON, mycophenolic acid, ZEA, FB1, FB2, OTA, roquefortine C, HT-2, T-2, gliotoxin, neosolaniol, cyclopiazonic acid, DAS, tenuazonic acid, tentoxin, alternariol, alternariol methyl ether– were analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS). Samples were collected from feed-producing facilities across Albania. Overall, the toxins produced by the Alternaria genus were more prevalent, while only DON was identified in one sample. At least one mycotoxin was detected in 75% of samples (9/12), with barley showing the highest incidence (5/7, 71.4%), followed by rye and wheat bran. Alternaria toxins – tenuazonic acid (75.0%), tentoxin (22.5%), alternariol (8.33%), and alternariol methyl ether (8.33%) – were the most abundant. Deoxynivalenol (DON) was found in wheat bran (33.3%), while other Aspergillus, Fusarium, and Penicillium genus toxins were not found above the respective limit of detection. Overall, the occurrence of multiple toxins in these feed ingredients was lower than previously reported for maize in Albania, and detected concentrations remained below regulatory limits where applicable. Nevertheless, the recurrent presence of Alternaria toxins underscores the need for enhanced monitoring, stricter controls over raw materials, and preventive measures throughout the cereal supply chain.

Keywords: feed ingredient, rye, barley, wheat bran, mycotoxins, Aflatoxin, Deoxynivalenol, Fumonisins, Ochratoxin A, Zearalenone, LC-MS/MS, Albania

MAROCCANIN, A NEW Γ-LACTONE, AND KNOWN SESQUITERPENES FROM THE SAHARAN ENDEMIC CENTAUREA MAROCCANA: ISOLATION, STRUCTURE ELUCIDATION, AND CHEMOTAXONOMIC SIGNIFICANCE

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ABSTRACT

A comprehensive phytochemical investigation was carried out on the flowering aerial parts of Centaurea maroccana Ball. (Asteraceae), a rare endemic species native to the northern Sahara. Systematic fractionation of the chloroform-soluble sub-extract, obtained from the aqueous-methanol macerate, resulted in the isolation of one unprecedented γ-lactone, designated maroccanin (1), together with five known secondary metabolites: scopoletin (2), 8α-[2'-hydroxymethyl-2'-butenoyloxy]-dehydromelitensin (3), 11,13-dehydromelitensin (4), 8α-[2'-hydroxymethyl-2'-butenoyloxy]-sonchucarpolide (5), and 5Hα,6Hβ,7Hα-15-hydroxy-8α-(1',2'-dihydroxyethyl-acryloxy)-elema-1(2),3(4),11(13)-trien-6,12-olide (6). The structural elucidation of all isolates was rigorously achieved through a combination of chemical derivatization and comprehensive spectroscopic analyses. High-resolution mass spectrometry (HR-ESIMS and HREIMS), UV spectrophotometry, and extensive one- and two-dimensional NMR experiments—including COSY, NOESY, HSQC, and HMBC—were instrumental in unambiguously establishing both planar structures and stereochemical configurations. Acid hydrolysis further corroborated the proposed structural assignments where applicable. Beyond the characterization of the novel γ-lactone maroccanin, this study delivers significant chemotaxonomic insights. Notably, compounds 3 and 5, although previously documented in other taxa, are reported here for the very first time within the genus Centaurea. This finding considerably broadens the known chemical spectrum of this taxonomically complex genus and highlights the underexplored metabolic richness of Saharan endemic species. Overall, the present results provide a solid phytochemical foundation, paving the way for future pharmacological screenings and chemosystematic comparisons among Asteraceae members.

Keywords: New γ-Lactone, Maroccanin, Sesquiterpenes

EVALUATION OF AQUEOUS EXTRACT FROM URTICA DIOICA ROOTS AS A SUSTAINABLE GREEN CORROSION INHIBITOR FOR A106 CARBON STEEL IN 1 M HYDROCHLORIC ACID

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ABSTRACT

Industrial processing systems reliant on carbon steel infrastructure face significant operational risks and material degradation caused by acid pickling, industrial cleaning, and chemical descaling procedures. To adress aggressive acidic dissolution while adhering to stringent environmental standards and sustainability metrics, the development of non-toxic, eco-friendly green corrosion inhibitors has emerged as a crucial scientific imperative. This research investigates the inhibition efficiency of an aqueous extract derived from Urtica dioica (stinging nettle) roots on ASTM A106 carbon steel in a highly aggressive 1 M hydrochloric acid (HCl) environment at a constant ambient temperature of 298 K. The botanical active compounds were obtained via Clevenger-type hydrodistillation of 300 g of dried, powdered Urtica dioica roots collected during the peak flowering stage in September 2021 Northeastern Algeria. Gravimetric mass loss assessments were carried out across various inhibitor concentrations (100, 200, 400, and 800 ppm) over extended exposure intervals of 24 and 48 hours. The quantitative gravimetric findings demonstrated a clear dose-dependent corrosion inhibition. The addition of Urtica dioica extract revealed outstanding protective capabilities, achieving corrosion efficiencies above 70% for all tested concentrations. This remarkable performance is attributed to the spontaneous physical and chemical adsorption of organic active phytochemical constituents present in the Urtica dioica extract onto the exposed metallic interface. The adsorbed biomolecules form a compact, protective barrier film that isolates the active iron sites from direct contact with aggressive chloride ions (Cl^-) and hydronium species in the electrolyte. These results highlight the prospective application of Urtica dioica root extract as a viable, highly efficient, safe, and biodegradable alternative to traditional synthetic toxic inhibitors for industrial acid processing.

Keywords: Urtica dioica, aqueous extract; Green inhibitor, Carbon steel A106, Hydrochloric acid, Mass loss study

ANTIOXIDANT AND ANTIBACTERIAL POTENTIAL OF THE N-BUTANOL FRACTION OF VIOLA ODORATA L.: CORRELATION WITH ITS PHYTOCHEMICAL COMPOSITION

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ABSTRACT

The family Violaceae contains around 25 genera that comprise ∼1,000 species; the genus Viola is by far the largest and most diverse taxonomic group of this family with >500–600 species. Viola odorata L. has appeared in the literature as a potential useful medicinal plant due to its wide range of active phytochemical ingredients and various biological activities. In this study, the aim was to evaluate V. odorata flower n-butanol fraction for its phytochemical profile and biological activities such as antioxidant potential and antibacterial activity. The butanolic extract was obtained from the maceration at room temperature, which yielded 34.6% of its dry original plant material. Flavonoids, tannins and sterols were detected by qualitative phytochemical screening while alkaloids, quinones, anthraquinone and coumarin were not found. DPPH radical scavenging assay exhibit considerable free radical-scavenging capacity with the IC_{50} < 0.45 mg/mL (ascorbic acid: 0.02 mg/mL), demonstrating antioxidant activity by these compounds. The antibacterial activity that measured has likewise by the agar disk diffusion strategy known about their selectivity on these bacteria strains. The highest inhibition was recorded against Bacillus cereus (inhibition zone of 15, 5 mm at 50 mg); Escherichia coli and Pseudomonas aeruginosa were resistant with zones equal to the paper disk diameter (6mm). The antioxidant and antibacterial activities observed were probably attributed to the high presence of phenolic compounds, especially flavonoids and tannins. The results suggest that the n-butanol fraction of V. odorata flowers could be a valuable source for bioactive compounds with pharmaceutical and nutraceutical applications.

Keywords: Viola odorata, phytochemical screening, flavonoids, antioxidant activity, DPPH, antibacterial activity

DEVELOPMENT AND VALIDATION OF A NOVEL HPLC METHOD FOR MONITORING TIME DEPENDENT CHANGES OF ORGANOSULFUR COMPOUNDS IN BROCCOLI

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ABSTRACT

Broccoli (Brassica oleracea var. italica) is a rich source of glucosinolates and their hydrolysis products, organosulfur compounds, which are associated with numerous health-promoting effects. Upon tissue disruption, the enzyme myrosinase comes into contact with glucosinolates, leading to the formation of biologically active organosulfur compounds such as sulforaphane. The aim of this study was to develop and validate a novel HPLC method for the determination and monitoring of time-dependent changes in organosulfur compounds formed in broccoli after tissue disruption. Fresh broccoli samples were subjected to different degrees of physical disruption and incubated for various time intervals (0, 5, 10, 15, 30, and 60 min) to promote the enzymatic conversion of glucosinolates. Organosulfur compounds were extracted using an optimized extraction procedure. Chromatographic separation was achieved on a reversed-phase C18 column under optimized conditions. The developed HPLC method was validated according to ICH guidelines with respect to specificity, linearity, accuracy, precision, limit of detection (LOD), limit of quantification (LOQ), and robustness. The proposed method provided satisfactory chromatographic separation and reliable quantification of the target organosulfur compounds. Validation results demonstrated excellent linearity ($R^2 > 0.99$), acceptable accuracy and precision, and adequate sensitivity for analytical applications. Time-dependent variations in organosulfur compound levels were observed following tissue disruption. The concentration of these compounds increased during the initial incubation period due to enzymatic hydrolysis and subsequently reached a plateau or decreased depending on the incubation time. The developed and validated HPLC method proved to be a reliable and reproducible analytical tool for monitoring time-dependent changes in organosulfur compounds in broccoli. This method may be useful for investigating the formation kinetics of bioactive sulfur-containing compounds in broccoli and other Brassicaceae vegetables, as well as for studies focusing on functional foods and nutraceutical applications.

Keywords: Broccoli, Organosulfur Compounds, HPLC, Method Development and Validation

CHEMICAL COMPOSITION OF THE ESSENTIAL OIL FROM CENTAUREA DILUTA COLLECTED IN ALGERIA

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ABSTRACT

The genus Centaurea (family Asteraceae) includes a large number of aromatic and medicinal species that have long been used in traditional folk medicine across different regions of the world. These plants are known for their rich diversity in secondary metabolites, particularly volatile compounds that often exhibit important biological activities. In the present study, essential oil was extracted from the aerial parts of Centaurea diluta, a species collected in Algeria, using the hydrodistillation technique, which is widely employed for isolating volatile oils from plant materials. The chemical composition of the obtained essential oil was analyzed using gas chromatography coupled with mass spectrometry (GC-MS), a powerful analytical method for identifying and quantifying volatile constituents. The analysis revealed a complex mixture composed of 45 different volatile compounds, accounting for 98.01% of the total oil content, indicating a high level of chemical characterization. Among these constituents, limonene (25.02%), methyl-cyclohexane (23.73%), and o-cymene (13.20%) were identified as the major components. These compounds are commonly reported in essential oils from various aromatic plants and are known for their potential therapeutic properties, including antioxidant, antimicrobial, and anti-inflammatory activities.

Keywords: Centaurea diluta, essential oil, GC-MS, volatile compounds, limonene, Asteraceae, Algeria

EXTRACTION AND STRUCTURAL CHARACTERIZATION OF HUMIC ACIDS DERIVED FROM NITRIC ACID-ASSISTED COW MANURE COMPOST

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ABSTRACT

Humic substances are widely employed in agriculture due to their capacity to enhance crop yields and improve soil quality. Among these, humic acid often exhibits superior efficacy. This study aims to isolate and characterize humic substances, particularly humic acid, for subsequent agricultural applications. The raw material was cow manure compost pretreated with nitric acid, containing 36.68% C and 6.47% N. This pretreatment was selected to enhance the extraction efficiency of humic substances and to obtain fractions with improved physicochemical properties. Characterization was performed using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR) and UV–visible (UV–Vis) spectroscopy. XRD patterns revealed ordered, graphite-like aromatic domains within the extracted humic acid, while UV–Vis and FTIR analyses confirmed the clear distinction between humic acid and fulvic acid and highlighted the higher aromaticity and structural complexity of humic acid compared with the more oxygen-rich, reactive fulvic acid. The combined analytical techniques provided complementary information on the molecular organization and functional groups of the extracted humic fractions. These features indicate that nitric-acid–assisted cow manure compost is a promising source of functional humic fractions for soil conditioning and sustainable agricultural use. The results also provide a valuable basis for the future evaluation of the agronomic performance of the extracted humic acid under different soil and crop conditions.

Keywords: Humic acid, Cow manure compost, Nitric acid pretreatment, XRD, FTIR, Sustainable agriculture

BIFUNCTIONAL COFE2O4-ZNS:MN CORE-SHELL NANOPARTICLES FOR NANOSCIENCE APPLICATIONS

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ABSTRACT

In recent years, bifunctional nanomaterials with magnetic and optical properties have gained considerable attention in nanomedicine especially for nanoscience applications. Materials show different properties at the nanoscale compared to their bulk size. In addition, when the size decreases, the surface properties of nanoparticles become richer. For example, an increased surface-to-volume ratio provides a large surface area, leading to an increase in functional efficiency. Therefore, quantum dots and magnetic nanoparticles are commonly used for their unique properties. The conventional quantum dots often contain highly toxic heavy metals, such as cadmium, which restricts their clinical translation. Manganese-doped zinc sulfide (ZnS:Mn) was developed to overcome this drawback, and is a biocompatible cadmium-free substitute with stable luminescence. In this study, we synthesized core-shell CoFe2O4-ZnS:Mn nanoparticles through co-precipitation and then successfully developed a dual-modal imaging advanced platform. SEM morphology showed that the core of cpbalt ferrite magnetic nanoparticles was successfully coated inside the ZnS:Mn shell. Also, the photoluminescence (PL) spectra showed a strong and characteristic orange-yellow emission around 630-700 nm, which corresponds to the 4T1→6A1 transition of Mn2+ ions. The coexistence of large magnetic response and bright luminescence indicates that these cadmium-free core-shell nanostructures are very promising for targeted drug delivery and concurrent optical/magnetic resonance imaging.

Keywords: Nanoscience, Quantum Dots, Magnetic Naoparticles

SEMISYNTHESIS OF NOVEL 13-AMINO-PARTHENOLIDE-9-ONE DERIVATIVES

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ABSTRACT

This study presents a comprehensive investigation in the field of natural products chemistry, focusing on the isolation, hemisynthesis, and characterization of secondary metabolites derived from the medicinal plant Anvillea radiata (Asteraceae). The main objective is to explore the chemical reactivity and potential pharmacological relevance of sesquiterpene lactones, particularly 9α-hydroxyparthenolide and 9β-hydroxyparthenolide derivatives, which remain of significant interest in medicinal and pharmaceutical chemistry [1-2]. The methodology employed includes phytochemical extraction, chromatographic purification, and hemisynthetic modification through nucleophilic addition reactions on both 9α- and 9β-hydroxyparthenolide scaffolds. The synthesized compounds were characterized using standard analytical techniques, including Nuclear Magnetic Resonance (NMR), and Infrared Spectroscopy (IR), in order to confirm their chemical structures and physicochemical properties. The preliminary results show that the obtained derivatives display interesting structural diversity, highlighting the influence of stereochemistry on the reactivity of sesquiterpene lactones. These findings provide a solid basis for future work, particularly regarding biological activity evaluation and molecular modeling studies, which will be conducted in order to better understand the potential interactions of these compounds with relevant biological targets. Overall, this work contributes to advancing knowledge in natural products and bio-organic chemistry and opens perspectives for the future development of new bioactive molecules with potential pharmaceutical and biomedical applications.

Keywords: Anvillea radiata, Sesquiterpene lactones, Hemisynthesis, 9α hydroxyparthenolide

STRUCTURAL AND ELECTRONIC PROPERTIES OF ASPIRIN ADSORPTION IN $AL_{12}P_{12}$ NANOCAGE EVALUATION USING DENSITY FUNCTIONAL THEORY

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ABSTRACT

The interaction between acetylsalicylic acid (aspirin) and AlP nanocages represents an important research area with implications for drug delivery and sensor technologies. In this study, the adsorption behaviour of the aspirin molecule on the surface of an AlP nanocage was investigated. Geometry optimisations, atomic charge analyses, and frontier molecular orbital (HOMO–LUMO) calculations were performed within the framework of density functional theory (DFT) using the Gaussian 09 software package at the B3LYP/6-31G(d,p) level of theory. All geometry optimisations were carried out using the default convergence criteria of Gaussian 09 without imposing any geometric constraints. Additionally, vibrational frequency analyses were conducted for all optimized structures and their corresponding complexes, and no imaginary frequencies were observed. This confirms that the obtained structures correspond to true minima on the potential energy surface. The interaction between the drug molecule and the AlP nanocage was comprehensively evaluated using adsorption energy calculations, changes in the HOMO–LUMO energy gap, global reactivity indices, thermodynamic parameters, charge transfer analysis, and desorption (recovery) time estimates. The results demonstrate that AlP nanocages exhibit high adsorption capacity, pronounced changes in electronic structure, favourable thermodynamic stability, and suitable desorption behaviour. These findings indicate that AlP nanocages are promising nanomaterials for aspirin delivery and nanosensor applications.

Keywords: Aspirin, Nanotubes, $Al_{12}P_{12}$ nanocages, and Density Functional Theory (DFT)

DESIGN OF A SOLAR-TRACKING AND IOT-BASED SMART CLOTHES DRYING RACK: A RENEWABLE ENERGY-ASSISTED HOME TECHNOLOGY APPROACH

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ABSTRACT

Conventional outdoor clothes-drying systems provide an energy-efficient alternative to electrically powered drying appliances; however, they are passive systems that cannot actively respond to changes in solar position, sudden rainfall, or environmental risks. This study presents the design and prototype development of a smart clothes-drying rack integrating a solar-tracking mechanism, environmental sensors, Internet of Things (IoT)-based communication, and photovoltaic energy generation within a single product architecture. The developed prototype employs light-dependent resistors (LDRs) to determine differences in incident light intensity and automatically orient the clothes-supporting structure toward the most appropriate direction. Four LDR measurements are processed as upper-lower and left-right sensor groups. Differences between the corresponding average sensor values are calculated, and when these differences exceed a predefined tolerance threshold, positional correction commands are transmitted to the servo motors. The two-axis control architecture therefore enables the prototype to respond dynamically to changes in the spatial distribution of incident light. The proposed system further incorporates environmental sensing functions for rainfall detection and movement-related outdoor risks, together with a wireless communication architecture intended to provide real-time notifications to the user. A photovoltaic panel and rechargeable battery are employed as the proposed energy supply architecture to reduce dependence on an external electrical source. The principal contribution of the study is the adaptation of solar-tracking principles, widely employed in photovoltaic applications, to a domestic clothes-drying product while combining solar tracking, environmental sensing, user interaction, and renewable energy technologies in an integrated system. The technical originality of the developed design has also been registered as a utility model by the Turkish Patent and Trademark Office. The proposed system provides a potential design framework for sustainable household technologies, smart living systems, and energy-efficient consumer products.

Keywords: Smart clothes drying rack, solar tracking, Internet of Things, LDR, photovoltaic energy, sensor-based system, utility model.

COMPARISON OF THE ANTIFUNGAL ACTIVITY OF CHITOSAN AND CURCUMIN LOADED ONTO OIL PALM EMPTY FRUIT BUNCH FIBRES AGAINST GANODERMA BONINENSE

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ABSTRACT

Ganoderma boninense is a disease frequently found in oil palm plantations in West Kalimantan, Indonesia and has a significant impact on reducing oil palm fruit productivity. Ganoderma boninense is generally treated using synthetic chemical antifungals that have negative environmental impacts. This study will examine the use of two natural substances with development potential in West Kalimantan: chitosan and curcumin. Chitosan is known as the deacetylated derivative of chitin, an insoluble polymer (N-acetyl-D-glucosamine) naturally found in the shells of animals, with low mechanical and thermal strength and low solubility at neutral pH, which limits its application. Turmeric is a widely known herbal plant due to its main bioactive compound, curcumin. Curcumin, with a diarylheptanoid group, has various biological activities as an antioxidant, antibacterial, and antifungal agent. Curcumin has limitations in terms of bioavailability and environmental stability. These limitations can be addressed through incorporation of this substance with other materials to enhance its properties. In this research, chitosan and curcumin will be loaded onto oil palm empty fruit bunch (OPEFB) fibres to mitigate active ingredient deficiency. Antifungal activity testing was conducted using the food poisoning method. The results showed that the growth inhibition capabilities of the chitosan oil palm empty fruit bunch fibre composite and curcumin composite (5%, w/w) against Ganoderma boninense were 98.9% and 82.29%, respectively. This research also offers opportunities for further development of composite applications utilizing oil palm empty fruit bunch fibres as a carrier material for antifungal agents in biodegradable polybags during the seedling stage.

Keywords: Antifungal, Chitosan, Curcumin, Empty Fruit Bunch Fibre, Ganoderma boninense

STATISTICAL MODELING OF CATIONIC DYE REMOVAL BY BIOADSORBENT: KINETIC AND ISOTHERM ANALYSIS

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ABSTRACT

The escalating discharge of organic dyes from textile, leather, and paper industries into water bodies poses severe threats to aquatic ecosystems, biodiversity, and human health due to their toxicity, carcinogenicity, and persistence. This underscores the urgent need for sustainable, cost-effective remediation strategies beyond traditional methods like coagulation and advanced oxidation. Bioadsorbents, derived from abundant natural biomass such as agricultural wastes (e.g., rice husks, banana peels) and microbial sources (e.g., fungal biomass), have emerged as promising eco-friendly alternatives to synthetic adsorbents. Their appeal lies in high specific surface area, abundant functional groups (e.g., hydroxyl, carboxyl), low cost, and renewability, enabling efficient sequestration of organic dyes via mechanisms like electrostatic attraction, hydrogen bonding, and π-π interactions. To maximize their performance, Response Surface Methodology (RSM)—a multivariate statistical approach—was employed for modeling and optimizing critical parameters, including solution pH, adsorbent dosage, contact time, and initial dye concentration, which profoundly influence adsorption efficiency. This study investigates chemically modified bioadsorbents for removing cationic dyes (e.g., methylene blue) from synthetic wastewater. Optimization utilized RSM with Central Composite Design (CCD) and Box-Behnken Design (BBD) to generate quadratic models predicting maximum removal (>95%). Biosorbents were comprehensively characterized using Fourier Transform Infrared (FTIR) spectroscopy for functional groups, Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray (EDX) for morphology and elemental composition, X-ray Diffraction (XRD) for crystallinity, Thermogravimetric Analysis (TGA) for thermal stability, X-ray Fluorescence (XRF) for elemental analysis, Brunauer-Emmett-Teller (BET) for surface area, and point of zero charge (pHpzc) determination. Statistical validation through Analysis of Variance (ANOVA) confirmed model adequacy ($R^2 > 0.98$, $p < 0.0001$). Adsorption isotherms fitted well to both Langmuir (monolayer) and Freundlich (multilayer) models, with kinetics obeying pseudo-second-order, indicating chemisorption dominance. Thermodynamic studies revealed a spontaneous ($\Delta G° < 0$), endothermic ($\Delta H° > 0$), and entropy-driven process, highlighting practical viability for industrial-scale dye remediation.

Keywords: Statistical validation, Response Surface Methodology, Non-linear model, waste water, dyes, treatment

CATIONIC DYE ADSORPTION ONTO SURFACTANT-FUNCTIONALIZED BIOMATERIALS: EXPERIMENTAL AND DFT MECHANISTIC STUDY

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ABSTRACT

Industrial wastewater containing synthetic dyes poses a severe threat to freshwater ecosystems. Among these, Malachite Green (MG) is a hazardous cationic dye known for its environmental persistence and carcinogenic properties. While conventional treatments are often hindered by high costs and sludge generation, biosorption using agricultural byproducts offers a sustainable, low-cost, and efficient alternative for pollutant detoxification. This study investigated the potential of prickly pear seed residue, a by-product of oil extraction, as a sustainable adsorbent for removing malachite green (MG) dye. The material was tested in its raw form (GFB) and after surface modification with the anionic surfactant sodium dodecyl sulfate (GFB/SDS). Batch experiments assessed key operational parameters, including the effect of ionic strength (KCl), to simulate the salinity of industrial wastewater. The surface properties of the adsorbents were assessed by determining the point of zero charge (pHPZC) and further characterized using Fourier-transform infrared spectroscopy (FTIR). The equilibrium data were rigorously analyzed using nonlinear regression with isotherm models ranging from two to five parameters. Three error functions (Δq, $\chi 2$, and RMSE) were employed to ensure mathematical precision. The results demonstrate a significant enhancement in the adsorption capacity and kinetics of GFB/SDS compared to those of raw GFB. The optimal conditions were reached at a dosage of 3 g/L, pH 6.12, [MG] = 20 mg/L, and a contact time of 120 min. Adsorption followed a pseudo-second-order kinetic model, whereas thermodynamic analysis confirmed a spontaneous and endothermic process. Finally, Density Functional Theory (DFT) and molecular dynamics simulations elucidated the interactions at the atomic scale. Electronic descriptors (electrophilicity, softness, HOMO–LUMO, and energy gap) strongly correlate with experimental data, confirming that surfactant modification creates a more energetically favorable adsorption mechanism. This combined approach demonstrates that GFB/SDS is a high-performance and eco-efficient solution for industrial effluent treatment.

Keywords: Adsorption, Modified biomaterial, Non-linear modeling (4 and 5 parameters), Error analysis, DFT calculations.

SYNTHESIS AND CHARACTERIZATION OF SOL-GEL -DRIVED CO/SIO2 NANOCOMPOSITES FOR ELECTROCHROMIC APPLICATIONS

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ABSTRACT

Electrochromic (EC) materials have attracted considerable scientific and technological interest over the past decades owing to their remarkable ability to reversibly change color under the application of a low electrical potential. Their promising applications in smart windows, low-energy displays, optical sensors, and energy-efficient devices have stimulated extensive research aimed at developing cost-effective, stable, and environmentally friendly electrochromic systems. Among transition-metal-based EC materials, cobalt-containing compounds exhibit interesting optical and electrochemical properties that make them suitable candidates for next-generation electrochromic devices. In the present work, cobalt nanoparticle-based electrochromic thin films were successfully synthesized using a simple and economical sol–gel method. Cobalt (II) nitrate hexahydrate was employed as the cobalt precursor, while a stable silica sol was prepared from siliceous by-products derived from kaolin processing, contributing to the valorization of industrial waste materials. The cobalt precursor was incorporated into the silica matrix to obtain a homogeneous Co–SiO_2 sol, which was subsequently deposited onto glass substrates using the dip-coating technique. The prepared films were initially amorphous and underwent structural transformation after thermal treatment at 500 °C, leading to the formation of crystalline phases and improved film stability. The structural, optical, and electrochemical properties of the obtained films were investigated using X-ray diffraction (XRD), UV–Visible spectroscopy, and cyclic voltammetry (CV). XRD analysis confirmed the formation and homogeneous dispersion of cobalt nanoparticles within the silica matrix after heat treatment. Optical characterization revealed significant changes in transmittance associated with the electrochromic behavior of the films. Electrochemical investigations carried out in a 1 M KOH electrolyte demonstrated a stable and reversible positive electrochromic response under repeated coloration and bleaching cycles, indicating excellent electrochemical activity and durability. The results highlight the effectiveness of combining cobalt nanoparticles with silica matrices derived from low-cost industrial by-products to fabricate efficient electrochromic coatings. This study therefore proposes a sustainable, low-cost, and scalable route for the preparation of cobalt–silica electrochromic films with promising potential for smart window technologies and other advanced optoelectronic applications. The developed approach not only enhances material performance but also contributes to environmental sustainability through waste valorization and resource optimization.

Keywords: Nanocomposite, Electrochromic, sol-gel, silica

EXCESS MOLAR VOLUMES OF 1-CHLOROBUTANE WITH METHYL TERTIO-BUTYL ETHER MIXTURES

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ABSTRACT

The study of the thermodynamic properties of binary liquid mixture containing halogenated compounds and ethers is essential for understanding molecular interactions in solution. In this work, the density (ρ) of the binary system (1-Chlorobutane – methyl tertio-butyl ether MTBE) was measured over the entire concentration range, for mole fractions ranging from 0 to 1. Measurements were carried out at atmospheric pressure using a high-precision digital density meter (Anton Paar, DMA 5000 mode) within a temperature range from 283.15 K to 303.15 K with a step of 10 K. From these experimental data, excess molar volumes (VE) were calculated and subsequently correlated as a function of mole fraction using the Redlich-Kister polynomial equation. The results reveal the effect of temperature on the volumetric behavior of the mixture. The sign and magnitude of the obtained VE values are discussed in terms of physical contributions, such as the disruption of initial interactions between pure molecules, geometric packing effects, and the establishment of new attractive forces between 1-Chlorobutane and MTBE. These new, precise experimental characterization of such systems and prove useful for the validation of theoretical thermodynamic prediction models. Ultimately, these findings contribute to a deeper understanding of molecular packing and interstitial accommodation in complex fluid environments

Keywords: Density, Excess molar volume, 1-Chlorobutane, MTBE, Anton Parr, Redlich-Kister

DEVELOPMENT OF NOVEL FERTILIZER SYSTEMS FROM DOLOMITE BY NITRIC ACID AND MAGNESIUM-BASED PROCESSING ROUTES

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ABSTRACT

Dolomite is a widely available calcium-magnesium carbonate mineral that can be considered as a strategic raw material for the development of magnesium- and calcium-containing fertilizer systems. In this study, a process-oriented manuscript draft was prepared for the conversion of dolomite into value-added fertilizer intermediates by combining calcination, particle size control, nitric acid dissolution, selective precipitation, and filtration steps. The proposed route was structured by considering literature data on sulfuric acid leaching of dolomite for magnesium sulfate production and patent documents describing the preparation of easily filterable magnesium hydroxide from calcined dolomite in chloride-containing media. The process design focuses on the formation of soluble magnesium nitrate and calcium nitrate intermediates, followed by the controlled precipitation of magnesium hydroxide or direct formulation into liquid and suspension fertilizers. Critical process parameters include calcination temperature, particle size distribution, acid concentration, reaction temperature, pH, residence time, filtration rate, and impurity control. The expected outputs are magnesium nitrate solution, calcium nitrate solution, magnesium hydroxide suspension, magnesium oxide precursor, and dolomite-derived specialty fertilizer formulations. The proposed approach offers potential advantages in terms of local raw material utilization, fertilizer product diversification, reduction of imported magnesium compounds, and development of patentable process know-how. Further laboratory and pilot-scale studies are required to validate reaction yields, nutrient availability, filtration performance, impurity profile, and agronomic efficiency under greenhouse and field conditions.

Keywords: Dolomite, Magnesium hydroxide, Magnesium nitrate, Nitric acid, Fertilizer production, Filtration

DEVELOPMENT OF SLOW-RELEASE UAN-28, UAN-32, UAN-33 AND UAN-34 LIQUID NITROGEN FERTILIZERS: NITROGEN USE EFFICIENCY AND LOW-TEMPERATURE STABILITY

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ABSTRACT

Urea ammonium nitrate (UAN) solutions are important liquid nitrogen fertilizers because they combine urea, ammonium and nitrate nitrogen in a homogeneous liquid phase. However, urea-containing fertilizers may be exposed to nitrogen losses after soil application, particularly through ammonia volatilization under unfavorable soil, climatic and application conditions. The main objective of this study is to develop UAN-28, UAN-32, UAN-33 and UAN-34 product concepts with delayed/controlled nitrogen release characteristics in order to increase the plant availability period of urea-derived nitrogen and improve nitrogen use efficiency. A second technological output of the study is the improvement of low-temperature stability by managing crystallization/freezing tendency during storage and handling. The formulation approach is based on nitrogen mass balance, controlled urea/ammonium nitrate ratio, optional use of sulfur-containing components such as ammonium thiosulfate, and evaluation of stabilizing auxiliary components that regulate urea hydrolysis and nitrogen transformation in soil. The study proposes a product specification matrix, quality control parameters and a laboratory validation plan including total nitrogen, density, pH, visual clarity, crystallization onset, cold storage stability and agronomic performance indicators. The proposed framework provides a technical basis for pilot-scale product development and field validation of slow-release UAN liquid fertilizers.The results indicate that low-temperature UAN design should be treated as a multi-parameter process-chemistry problem rather than a single freezing-point adjustment. The proposed confidential framework supports scalable industrial optimization while protecting formulation know-how.

Keywords: UAN, liquid nitrogen fertilizer, slow release, nitrogen use efficiency, urease inhibition, crystallization stability

OPTIMIZATION OF WASTEWATER USING ELECTROCOAGULATION PROCESS

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ABSTRACT

The aim of this study is to model and optimize the performance of a new electrocoagulation (E,C) process for the treatment of wastewater as well as the energy consumption in order to extrapolate it to the industrial scale. Through judicious application of an experimental design, it has been possible to evaluate the individual effects and interactions that have a significant influence on both objective functions (maximizing efficiency and minimizing energy consumption) by using aluminum electrode. Preliminary experiments have shown that the pH of the medium, the applied potential and the treatment time with E,C are the main parameters. A 33 factorial design has been adopted to model performance and energy consumption. Under optimal conditions, the pollution reduction efficiency is 93%, combined with a minimum energy consumption of 2,60.10-3 kWh / mg-COD. The potential or current applied and the processing time and their interaction were the most influential parameters in the mathematical models obtained. The results of the modeling were also correlated with the experimental ones. The results offer promising opportunities to develop a clean process and inexpensive technology to eliminate or reduce wastewater pollution. The results obtained demonstrate the effectiveness of the wastewater treatment using this new electrocoagulation technology multiobjective optimization using DOE of wastewater treatment.

Keywords: electrocoagulation, green process, DOE, wastewater, modeling

ADSORPTIVE REMOVAL OF 4-AMINOPHENOL USING CITRIC ACID-MODIFIED MIL-101(CR): KINETIC INVESTIGATION

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ABSTRACT

Today, 4-aminophenol is an important chemical intermediate widely used in the synthesis of common drugs such as paracetamol, as well as in the dye, cosmetics, and photography industries. However, it accumulates in wastewater from industrial production facilities and the degradation of various chemicals in nature; due to its high toxicity and difficult-to-decompose nature, it poses a serious environmental risk to ecosystems and living organisms [1,2]. The removal of 4-aminophenol from water by adsorption, a low-cost, byproduct-free, and easy method, was investigated. MOFs are a class of multifunctional porous materials with high surface areas and have received increasing attention in recent years due to their high potential in adsorption processes [3,4]. In this study, citric acid-modified MIL-101(Cr) was used as an adsorbent. MIL-101(Cr) was synthesized by the solvothermal method. MIL-101(Cr) was post-synthetically modified with citric acid to acquire carboxyl functional groups on its surface. Adsorption studies were carried out using a UV-Vis spectrophotometer at a wavelength of 296 nm. Pseudo-first-order, pseudo-second-order, Elovich, and Bangham kinetic models were investigated to evaluate the adsorption kinetics. The highest correlation coefficient was obtained for the Elovich and Bangham models (R2=0.96). The Elovich model suggests that surface heterogeneity and chemical interactions may be effective in the process, while the Bangham model suggests that intrapore diffusion and adsorbate transport may be effective [5]. The results obtained show that the adsorption process can occur under the influence of more than one mechanism and that citric acid-modified MIL-101(Cr) is an effective adsorbent alternative in 4-aminophenol removal.

Keywords: 4-Aminophenol, Adsorption, Citric acid modification, MIL-101(Cr)

INTEGRATING DRONE-BASED HERBICIDE APPLICATIONS IN THE WATER-SEEDED RICE PRODUCTION SYSTEMS

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ABSTRACT

Drones, also known as uncrewed aerial vehicles (UAVs), have been increasingly used in precision agriculture, particularly in areas where natural obstacles or limited feasibility prevent conventional pesticide applications. The objectives of this research were to evaluate the use of drones in a water-seeded rice system, compare their efficiency with conventional ground applications, and assess the potential for off-target herbicide movement in the 2025 and 2026 growing seasons. In the drone efficacy experiment, benzobicyclon + halosulfuron-methyl at 302 + 65 g ai ha–1 was applied to 1–2 leaf rice as a base treatment across the whole field. A tank-mix combination of florpyrauxifen-benzyl at 40 g ha–1 plus penoxsulam + cyhalofop-butyl at 44 + 312 g ha–1 was applied with 584 ml ha–1 methylated seed oil (MSO) to 4–5 leaf rice. Treatments were arranged in a randomized complete block design with four replicates. The spray heights were 1.5, 2, and 2.5 m, and the spray volumes were 24, 48, and 96 L ha–1 to compare drone applications with a 1 m height, 192 L ha–1 ground application. The DJI Agras T50 drone was equipped with four centrifugal nozzles calibrated to deliver 320-micron droplets during application. Experimental plots were separated with 6-m-wide buffers, and replicates were separated with 12-m-wide buffers. There was no distinguishable rice crop injury across all treatments. All treatments, including the ground application, achieved >90% control of watergrass, >97% control of sedge, and 100% control of broadleaf weeds at 28 days after treatment (DAT). Grain yield among treatments ranged from 9,500 to 10,500 kg ha–1 compared to only the benzobicyclon + halosulfuron-methyl treated plot that remained at 7,850 kg ha–1. The efficacy study clearly showed that weed control with drone applications is similar to ground application. In the drone off-target drift experiment, clomazone at 672 g ha–1 was applied on the day of seeding, and benzobicyclon + halosulfuron-methyl at 302 + 65 g ha–1 was applied to 1–2 leaf rice as a base treatment to the whole field. A tank-mix combination of glufosinate-ammonium at 1682 g ha–1 with 584 ml ha–1 MSO was applied to full-tiller rice in 6-m-by-15-m plots. Off-target drift treatment was arranged in a randomized complete block design with three replicates. The spray height was 2 m, and the spray volume was 96 L ha–1 to simulate realistic herbicide application scenarios using drones under a 3.2 kph wind. Experimental plots were separated with 30-m-wide buffers. There was a distinguishable rice crop injury across all replicates. The off-target drift was recorded up to 50 m from the sprayed plots at 7 DAT, underscoring the need for robust drift mitigation practices during herbicide applications with UAVs. While both studies were repeated in the 2026 season, the drift drone was updated to a Hylio AG-216 spray drone equipped with eight TeeJet XR110015-VP nozzles, calibrated to deliver 96 L ha–1 during application, to determine whether there are differences in off-target drift potential between the two UAVs.

Keywords: drone, herbicide application, uncrewed aerial vehicle, water-seeded rice, weed control

EVALUATION OF FLORAL FERTILITY IN DIFFERENT OLIVE (OLEA EUROPAEA L.) VARIETIES IN BEJAIA (ALGERIA)

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ABSTRACT

In order to improve the productivity of olive orchards in Algeria, this study was undertaken to characterize the floral biology and pollen performance of several olive (Olea europaea L.) varieties from the Béjaïa region (Algeria), with the aim of assessing their reproductive potential. The study was conducted within the olive germplasm collection at the INRAA experimental station in Oued Ghir. The adopted approach combined field-based phenological monitoring of flowering with laboratory analyses focusing on floral fertility, fruit set, pollen production and viability, as well as its in vitro germination capacity. This approach allows for a better understanding of the mechanisms governing the fertility of the studied varieties. The results revealed marked inter-varietal variability. The wild olive (oleaster) and the Aharoun variety exhibited high levels of floral fertility (92.4% and 90.2%, respectively) and strong reproductive potential. In contrast, the Aimel variety showed extremely low fertility (0.27%), associated with the absence of fruit set due to almost complete pistillar abortion. Other varieties, such as Azaradj, Bouichert, and Aberkane, displayed intermediate levels of fertility and fruit set. Flowering generally extended from late March to mid-April, with variations in earliness and duration depending on the genotype (ranging from 11 to 24 days). From a palynological perspective, pollen grains were predominantly spherical and triporate, with notable differences in production, size, and viability. The Azaradj variety was characterized by high pollen production, while Aimel exhibited maximum viability (98%). In contrast, Bouichert showed moderate viability but a relatively large pollen surface area. In vitro germination was particularly high in Aharoun (38.5%), confirming its strong reproductive potential. Overall, these results highlight the decisive role of floral fertility and pollen traits in the reproductive success of olive trees. They emphasize the value of certain varieties as effective potential pollinizers, particularly oleaster and Aharoun, as well as the potential of Azaradj for breeding programs and orchard diversification, thereby contributing to a better valorization of local olive genetic resources.

Keywords: Olea europaea L., local varieties, flowering, floral fertlity, pollen viability, in vitro germination, Algeria

TRENDS IN DAIRY PRODUCTION AND SMART MONITORING: A CASE STUDY IN NORTH MACEDONIA

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ABSTRACT

The aim of this paper is to present trends in cow milk production in Macedonia over the period 2016–2025 and to assess the role of smart on-farm monitoring through a pilot study employing smart collars and pedometers. The main empirical contribution lies in the continuous collection of data on individual cows' activity, feeding-related behavior, health status, reproduction, and productivity, with the aim of enabling earlier detection of health and reproductive events and improving operational farm management. To contextualize the significance of this technology, the introductory analytical section utilizes official secondary data from the State Statistical Office (MakStat) at national level and for the eight planning regions. The analysis focuses on three core indicators: the number of dairy cows, average annual milk yield per cow, and total cow milk production, complemented by the number of pregnant heifers per 100 dairy cows and the share of milk delivered to dairies. Results from the secondary analysis reveal whether the production base is declining, whether productivity per cow is improving, and whether such improvements are sufficient to offset herd reductions. This allows an assessment of whether the future sustainability of milk production will increasingly depend on better management of health, reproduction, and productivity at the individual animal level. The combination of macroeconomic trends and pilot-farm data provides a clear picture of the development trajectory of dairy production and the potential of digital technologies to enhance efficiency. The paper concludes that smart monitoring represents a strategic tool for improving the competitiveness of dairy farms amidst declining dairy cow numbers and rising quality and traceability requirements.

Keywords: cow milk production, trends, smart monitoring, cow productivity, livestock health, R.North Macedonia

BETWEEN VALUES AND A COMMON SHARED VISION FOR REVITALIZING RURAL COMMUNITIES – IN SOUTHEASTERN TRANSYLVANIA, ROMANIA

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ABSTRACT

The current economy is proving to be increasingly dynamic and diverse at the global level, and there is a great need to make more efforts to integrate the local economy into the national and, furthermore. The local economy for agricultural areas in South Eastern Europe stands mostly on the primary commodities production originating from husbandry and crop cultivation. In this case, there is a great need to evaluate the value chains for all resources to understand better what opportunities local communities are missing and to integrate them into the co-creation and co-generation processes for their further economic development. All local actors, including the regional and national levels, should be involved to first develop the best communication channels among each other (i.e., policy, local administration, education and research, industry, non-governmental organizations, business). For local communities in Sibiu County, Romania, as well as in most areas in Eastern European countries, we may find traditional and local values (i.e., values related to history, religion, ethnicity, and local philosophy). The major question is how we can integrate these values to preserve the identity of the local community on one hand and to support further economic development and integration into the future vision of local communities' development further. The present paper discusses major tools and methods already applied between 2024 and 2026 for the community in practice in Central Romania. The major results of these analyses revealed the stringent need to revitalize rural areas as well as the need to define and integrate rural life's vital factors. We mention mainly the need to re-define tourism support, handicrafts promotion (empirical vs. educational), increasing the village-city relationship, and further integrating innovations as much as possible by involving research, academia, education and business groups.

Keywords: agriculture, rural communities, sustainable development, values, vision

HYBRID AND PLANT DENSITY EFFECTS ON GRAIN YIELD AND QUALITY OF IRRIGATED MAIZE MANAGED USING SMART FARMING TECHNOLOGIES

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ABSTRACT

This study evaluated the effects of hybrid, plant density, and their interaction on grain yield and selected grain quality traits of maize (Zea mays L.) grown during the 2024 season in Karacabey, Bursa, Türkiye. Seven commercial hybrids (DKC6980, DKC6897, LG 31.695, KWS KEFRANCOS, P1772, P2105, and P2088) were evaluated at 85,000 and 125,000 plants ha^{-1} in a split-plot design with three replications, with hybrids assigned to main plots and plant densities to subplots. Sowing was performed with a precision planter linked to an online farm-management platform that generated georeferenced sowing maps. Planting data and field observations on crop establishment, water-related stress, and lodging were recorded throughout the season, enabling field- and computer-based monitoring. Soil preparation, fertilization, irrigation, and crop protection were applied uniformly according to regional maize production requirements. Thousand-kernel weight and grain yield were recorded, while ash, crude fat, crude protein, and starch contents of the grain were determined on a dry matter basis. Data were subjected to split-plot analysis of variance, and means were compared using Fisher's LSD test at $p < 0.05$. Hybrid, plant density, and their interaction significantly affected all traits ($p < 0.01$). Averaged across hybrids, 85,000 plants ha^{-1} resulted in higher thousand-kernel weight (423.14 vs. 370.71 g), ash content (1.363% vs. 1.242%), crude protein content (8.037% vs. 7.890%), starch content (69.437% vs. 65.277%), and grain yield (20.03 vs. 18.88 Mg ha^{-1}), whereas 125,000 plants ha^{-1} increased crude fat content (3.228% vs. 2.715%). The highest grain yield was obtained from DKC6897 at 85,000 plants ha^{-1} (22.24 Mg ha^{-1}), while DKC6980 at the same density had the highest starch content (73.800%). Among the two densities tested, 85,000 plants ha^{-1} provided a more favorable yield–quality balance; however, the significant interaction demonstrated that density responses were hybrid-specific.

Keywords: maize, precision planting, smart farming, yield–quality balance

PERFORMANCE OF THE COMBINED TILLAGE MACHINE FOR CLAY SOILS

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ABSTRACT

Conventional tillage methods in clayey and moist soils lead to adverse effects such as soil compaction, plow pan formation, and excessive clod formation. These effects complicate seedbed preparation and reduce field emergence rates. In heavy clay soils with high moisture content and poor drainage, ridge sowing should be applied to protect seeds from groundwater. A new prototype machine consisting of a lister and a rotary tiller was designed for use in areas with these soil and climatic characteristics. The ridges created by this machine were then processed with the rotary tiller to prepare them for sowing. In this study, the performance of the prototype machine at an average soil moisture content of 25% (the minimum observable moisture level) was compared with that of conventional tillage methods using physical and mechanical soil properties, including bulk density, porosity, penetration resistance, and aggregate size distribution. The results showed that there was no statistically significant difference between the plow + prototype tillage treatment and the prototype tillage treatment. These findings demonstrate that the prototype machine can be used effectively as a standalone implement under clayey and humid soil conditions. By forming ridges and preparing the seedbed in a single pass, thereby protecting seeds from groundwater and replacing the conventional four-pass tillage system, the prototype machine provides significant advantages in terms of time, labor, and fuel consumption.

Keywords: Conventional tillage, Ridge tillage, Poor draninage, Clay Soil

KEFE CUMIN (LASER TRILOBUM (L.) BORKH.) IN TURKISH CUISINE

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ABSTRACT

Kefe cumin (Laser trilobum (L.) Borkh.) is a perennial herbaceous species belonging to the Apiaceae (Umbelliferae) family and is commonly known as cumin. The species grows naturally in certain regions of Türkiye and is also referred to by various regional vernacular names, including Kefe cumin, mountain cumin, sıra baharatı, and geyik sırası. Chemical analyses have shown that the aerial parts and fruits of the plant contain high levels of d-limonene and perillaldehyde. Widely distributed throughout the flora of Türkiye, Laser trilobum has become integrated into the gastronomic and ethnobotanical traditions of the regions where it naturally occurs, resulting in its diverse range of uses. Kefe cumin has a long-standing history in traditional Anatolian medicine and continues to be widely used by local communities as a medicinal plant. Herbal tea prepared by boiling the seeds has been reported to be traditionally consumed for the management of diabetes, hypertension, and digestive system disorders. The ethnobotanical applications of the species play an important role in the traditional culinary culture of the Mediterranean and Southeastern Anatolia regions, where it is valued as an aromatic ingredient. From a gastronomic perspective, the spice obtained by drying and grinding the seeds into a powder is widely used as a flavoring agent in meat dishes and traditional beverages, particularly in the provinces of Mersin, Adana, and Hatay. In this context, the increasing popularity of the species in recent years, supported by both scientific evidence reported in the literature and the traditional practical knowledge of local communities, has renewed interest in its economic and medicinal importance. In conclusion, the conservation of the species' rich phytochemical composition and cultural value is of great importance for sustainable agriculture and local development strategies.

Keywords: Laser trilobum, Turkish cuisine, ethnobotany, d-limonene, perillaldehyde

MOLECULAR DIVERSITY ASSESSMENT OF ALGERIAN SORGHUM (SORGHUM BICOLOR (L.) MOENCH) USING SSR MARKERS

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ABSTRACT

Southern Algeria exhibits a remarkable diversity of plant species, including sorghum (Sorghum bicolor L. Moench), which is highly resistant to harsh conditions and considered climate-resilient plant of global importance, particularly in arid and semi-arid regions. Sorghum is an extremely important crop in Africa and Asia because it can thrive in hot, dry climates where many other plants fail, making it crucial for food security in arid regions. To well explore and understand the natural genetic variety hidden within local crops, we evaluated, in our study, 24 different Algerian sorghum plants by extracting their DNA, using the CTAB method, and amplifying them using 26 SSR markers. The SSR analysis revealed a high level of polymorphism, with a mean of 14 alleles per locus and an average PIC of 0.863, confirming the informativeness of the selected markers. Observed heterozygosity reached 1.0, suggesting considerable variability among genotypes. Genetic distance data showed both closely related and highly divergent accessions, with certain genotypes (e.g., S13, S15) forming distinct out-groups valuable for hybrid breeding programs. These distinct plant types are especially valuable because plant breeders can pair them with other varieties to create high-performing hybrid crops. Overall, this research demonstrates that southern Algeria possesses a rich treasury of genetic resources, providing a clear roadmap for scientists to conserve these plants and select the best genetic partners for future breeding programs.

Keywords: Sorghum bicolor, molecular markers, genetic diversity, plant breeding, population structure

SUNFLOWER PHENOLOGY AND YIELD (HELIANTHUS ANNUUS L.) AS A FUNCTION OF PLANTING DATE

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ABSTRACT

Sunflower production in Mexico does not meet the population's needs. Therefore, planting areas and yields must be increased with more appropriate agronomic practices. The choice of planting date is a decisive factor in achieving this. Thus, the objective of this study was to determine the effect of planting date on: a) the phenology, biomass, yield, and its components of sunflower (*Helianthus annuus* L.); b) the relationship between biomass and yield with rainfall and temperature; and c) the relationship between grain yield, its components, and biomass. The study was conducted under a rainy regime in Montecillo, Mexico, a temperate climate region, during 2023. The Victoria sunflower cultivar was sown at 6.5 plants per m² on April 18 (with two irrigations prior to the rainy season); May 4 (one pre-sowing irrigation) and 18; June 1, 15, and 29; and July 12, in sandy loam soil, pH 7.0, and NPK 100-100-00. Data were recorded for days to phenological stages, grain yield, number of grains per m², weight of 100 grains, head area, biomass, and its distribution within the plant. Monthly average temperature (°C), maximum and minimum temperatures, and rainfall were also recorded. The experimental design was a randomized complete block design with four replications. The results indicate that in plantings after May 18th, the days to phenological stages were later, maximum temperature decreased, rainfall was minimal, and grain yield, number of grains, and head area were reduced. A similar response was observed in the accumulation of dry matter in stems and leaves, receptacle, and total dry matter. Yield, number of grains, and head size showed a high dependence on temperature and rainfall. It is concluded that the planting dates for the highest biomass production and yield are April and May.

Keywords: dry matter distribution, yield components, climate elements, correlation, regression

EFFECT OF PLANTING DENSITY AND NUMBER OF STEMS ON THE YIELD OF THE HAZELNUT CULTIVAR 'ATA-BABA' IN AZERBAIJAN

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ABSTRACT

This study was conducted to determine the effects of planting density and stem number on yield and pomological characteristics of the local hazelnut (Corylus avellana L.) cultivar 'Ata-baba' under the ecological conditions of Azerbaijan during 2023-2025. The experiment was established at the Zaqatala Experimental Station using two planting schemes (6×7 m and 7×3 m) and different stem number treatments (7, 15, and 20 stems for 6×7 m; 4, 8, and 12 stems for 7×3 m). Growth parameters, leaf area, stem thickening, fruit weight, kernel ratio, kernel weight, nut number per husk, and yield per shrub and per hectare were evaluated. The results showed that leaf area generally decreased with increasing stem number among the regulated treatments, and was lowest of all in the untreated control. Stem thickening was generally highest in south-facing stems among the managed treatments, though this pattern did not hold in the untreated control. In the 7×3 m scheme, the highest yield per shrub was obtained from the 12-stem treatment (5.389 kg), whereas in the 6×7 m scheme the 15-stem treatment produced the highest yield (9.981 kg); yield in the untreated control remained lower than in any managed treatment in both schemes (3.485 kg and 5.861 kg, respectively, in 2024). Kernel ratio was highest at moderate stem densities, while fruit weight was highest at low-to-moderate densities depending on planting scheme; both were substantially higher in all managed treatments than in the untreated control, whose kernel ratio remained around 37-38% regardless of scheme or year. Yield per hectare increased with higher planting density despite slight reductions in individual nut traits. However, yield in 2025 was lower than in 2024, likely due to climatic factors and increased damage from the brown marmorated stink bug. Overall, the findings indicate that optimal stem number depends on planting density, and moderate stem densities (12 stems in 7×3 m and 15 stems in 6×7 m) provide the best balance between vegetative growth, yield, and nut quality for the 'Ata-baba' cultivar in Azerbaijan.

Keywords: Corylus avellana L., 'Ata-baba', planting density, stem number, hazelnut yield, Azerbaijan, Brown Marmorated Stink Bug.

PERLITE AS A SOIL WATER BUFFER FOR DROUGHT-RESILIENT OPEN-FIELD TOMATO PRODUCTION. A LIVING LAB APPROACH

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ABSTRACT

Recurrent drought is changing the conditions under which vegetable production systems operate. In Romania and several other European regions, increasing water scarcity has already resulted in restrictions on water use, including limitations or temporary prohibitions on irrigation of gardens and agricultural crops. Under these conditions, the challenge is not only the availability of irrigation water, but also the capacity of soils to retain water after rainfall or limited irrigation events and release it progressively according to crop demand. Soil amendments capable of acting as physical water buffers may therefore represent an important component of climate-resilient agroecological strategies. Expanded perlite is widely used in horticulture, particularly in propagation substrates, greenhouse cultivation and hydroponic systems, where its porous structure, low density and ability to modify water–air relationships have been extensively studied. However, evidence regarding its role as an amendment incorporated into mineral agricultural soils remains limited. Results obtained in soilless systems cannot be directly transferred to open-field conditions, where perlite interacts with soil texture, compaction, rainfall, wetting–drying cycles and root activity. Although expanded perlite has been investigated in Romania as a stand-alone horticultural substrate for tomato and lettuce production and in peat–perlite propagation media, its potential as a water-buffering amendment incorporated into mineral soil for open-field vegetable production remains largely unexplored. Particle size represents a critical but insufficiently explored factor controlling the hydraulic behaviour of expanded perlite. Conventional horticultural perlite grades, commonly used in growing substrates, contain relatively coarse particles that favour aeration and drainage, whereas fine expanded perlite contains a higher proportion of smaller particles and potentially different water-retention characteristics. However, the relationship between particle size and agronomic performance requires experimental validation, as finer fractions may also influence air-filled porosity, physical stability and particle redistribution within the soil profile. Within the Romanian Agroecology Living Lab framework of the AllEcoSys project, the AllHUB RoyalPoint experimental site at Moara Domnească Didactic and Agronomic Research Station (Ilfov County, Romania) investigates strategies for improving drought resilience of open-field tomato (*Solanum lycopersicum* L.) production under conditions of increasing summer heat and water limitation. This study proposes a comparative evaluation of horticultural-grade perlite and fine expanded perlite as soil amendments with potential water-buffering functions. The experimental approach combines laboratory and field-scale assessments, including water absorption capacity, drainage dynamics, evaporation patterns, soil water retention behaviour and plant performance under naturally occurring drought conditions. The study will evaluate whether fine expanded perlite can provide improved water-buffering

capacity compared with conventional horticultural perlite while maintaining adequate soil aeration and root-zone functionality. By linking material properties, soil physical processes and crop responses within a real agroecological living lab, this research explores the potential of particle-size optimisation as a pathway for developing low-input strategies to improve water resilience in open-field tomato production.

Acknowledgment: This work was supported by a grant of the Ministry of Research, Innovation, and Digitalization (CNCS/CCCDI-UEFISCDI, project number COFUND-AGROECOLOGY-AllEcoSys, within PNCDI IV).

Keywords: perlite; particle size, plant-available water, drought adaptation, soil amendment, Solanum lycopersicum, open-field vegetable production, living lab

POTENTIAL CHARACTERISTICS OF SUNFLOWER SEEDS FOR TOLERANCE TO PESTS DURING STORAGE

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ABSTRACT

The storage of high-category seeds, as well as the preservation of quality and vitality in the post-harvest period, is a great challenge. In the period of severe climate changes and increasing temperature fluctuations, this task is gaining importance. However, we are witnessing that climate change poses a new challenge to the Seed Sector. Namely, the stored seed pests have taken precedence when it comes to damages that occur during storage. It is estimated that losses range from 10% to an incredible 100%. In an effort to alleviate this problem, one of the main tasks of the SafeSeed project is the development of pest-resistant plant ideotypes. In this context, the characteristics of the seeds of 10 plant species were analyzed, primarily sunflower, as one of the most important agronomic plant species, in order to assess the tolerance to the most important pests of stored products. 71 sunflower genotypes of different genetic bases were included in the research. Inbred lines and hybrids selected at the Institute of Field and Vegetable Crops from Novi Sad, Serbia were tested. This study presents preliminary results of seed characterization of selected genotypes, based on dimensions (length, width, thickness), shape i.e. sphericity, mass of 1000 seeds, hectoliter, percentage of husk, and moisture, oil and protein content. Given that this research included a wide range of genotypes of different types (oil, high-oleic, confectionery, decorative), significant differences were observed in the parameters examined. As these characteristics can affect attractiveness to insects, the observed differences may also affect the degree of tolerance of the examined genotypes to the most important pests of stored products.

Acknowledgment: This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, grant number: 451-03-33/2026-03/ 200032 as well as the Science Fund of the Republic of Serbia, #6691, New biorational methods for stored seed pest control and protection: To serve and prevent – SafeSeed. This work was performed as part of the activities of the Centre of Excellence for Innovations in Breeding of Climate-Resilient Crops - Climate Crops, Institute of Field and Vegetable Crops, Novi Sad, Serbia.

Keywords: sunflower, genotype, storage, seed traits, pest tolerance

AN HERBICIDE TRIAL ON CONTROL OF BARNYADGRASS SPP. IN RICE FIELDS

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ABSTRACT

Weeds are among foremost bottlenecks in rice production. Especially barnyard grasses (*Echinochloa* spp.) are becoming bigger problem as it has occurred worldwide in rice fields. In this study, some herbicides were investigated against the spreading barnyard grass species such as *E. oryzoides* (early watergrass) and *E. oryzicola* (late watergrass) as well as *E. cruss-galli* in 2019. Herbicides and herbicide mixtures were applied once in the 2-4 leaf stage of the weeds, and the effects were observed 10 and 70 days after the application. The highest *Echinochloa* spp. control at 10 days after application (DAA) was obtained from profoxydim (1000 ml/ha) 89.0% and quinclorac (1500 ml/ha and 3000 ml/ha) was 90.0%. The effect has increased in the high rate of quinclorac (96.0%) at 70 DAA while it has decreased in profoxydim (83.3%) and lower rate of quinclorac (85.7%). All other herbicides and mixtures in different rates (15 different treatments) have showed unacceptable level of control (between 40 to 70%) in both observation times. Today, it is not possible these high control rates from above mentioned herbicides due to frequent use of them. Integrated weed management system should be carefully employed in rice production to avoid or delay herbicide resistance in main weed species.

Keywords: Rice, barnyadgrass spp., weed control, herbicide

HEAT STRESS EFFECTS ON PHOTOSYNTHETIC PIGMENTS IN F_2 COTTON HYBRIDS

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ABSTRACT

This study evaluates the genetic control and variability of photosynthetic pigment accumulation in various cotton (*Gossypium hirsutum* L.) cultivars and their F_2 hybrid populations under open field and controlled phytotron (greenhouse) environments. The experimental results reveal that environmental factors severely affect pigment synthesis, with open field conditions promoting optimal chlorophyll accumulation, whereas the high temperature and artificial stress of the phytotron suppress total chlorophyll levels and decrease the Chl a/b ratio across all studied genotypes. Significant genotypic diversity in heat tolerance was identified based on pigment stability under stress; the pure lines Buxoro-102 and ADNS-1 emerged as highly heat-resistant, while Ignabargli and Xitoy-65 were found to be highly heat-sensitive. Among the segregating populations, the hybrid F_2 S-8290 x XinluGhong-78 demonstrated exceptional positive heterosis and stable pigment retention under phytotron stress, confirming the successful genetic inheritance of the "stay-green" physiological trait from the high-pigment parental donor S-8290. These findings suggest that Buxoro-102 and S-8290 serve as valuable genetic donors for developing climate-resilient cultivars. Furthermore, screening total chlorophyll and carotenoid retention under controlled greenhouse conditions offers a reliable, non-destructive, and efficient physiological biomarker for early-generation selection in future cotton breeding programs.

Keywords: abiotic stress, Gossypium hirsutum L., F2 hybrids, chlorophyll a, chlorophyll b, carotenoids, photosynthesis, spectrophotometry, high temperature, thermotolerance

EFFECTS OF LONG-TERM MONOCULTURE AND CROP ROTATION ON THE MORPHOLOGICAL AND ANATOMICAL CHARACTERISTICS OF RICE (ORYZA SATIVA L.)

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ABSTRACT

Long-term cultivation practices can substantially influence soil fertility and plant development. The present study evaluated the effects of long-term continuous monoculture and crop rotation on the morphological and anatomical characteristics of rice (Oryza sativa L.) under field conditions. The study was conducted using the rice cultivar 'Gala' grown in two fields with contrasting cultivation histories: approximately 20 years of continuous rice monoculture and approximately 15 years of crop rotation involving alfalfa (Medicago sativa) and common vetch (Vicia sativa). Soil properties, stem and root development, panicle length and panicle weight were compared, and root and leaf anatomy was examined using light microscopy. The crop rotation field showed generally improved soil nutrient status, including higher organic matter (2.7% vs. 1.2%), nitrogen (0.11% vs. 0.06%), phosphorus (8 vs. 5 ppm), potassium (146 vs. 100 ppm) and magnesium (185 vs. 120 ppm) compared with the monoculture field. At 120 days, stem and root lengths reached 115 and 25 cm under crop rotation, compared with 108 and 21 cm under monoculture, respectively. Maximum panicle length was 17.5 cm in the rotation field and 13.0 cm in the monoculture field. Mean panicle weight was 5.5574 g under crop rotation compared with 3.5481 g under monoculture. Anatomical observations further revealed more developed vascular tissues and thicker mesophyll layers in plants from the crop rotation field. Overall, the results indicate that long-term crop rotation was associated with improved soil conditions and enhanced morphological and anatomical development of rice compared with continuous monoculture.

Keywords: Rice, Oryza sativa L., crop rotation, long-term monoculture, plant anatomy, plant morphology

LAND USE AND LAND COVER DYNAMICS AND FUTURE PROJECTIONS AROUND THE BOSPHORUS STRAIT FOLLOWING MAJOR BRIDGE CONSTRUCTIONS (1972–2025)

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ABSTRACT

In Istanbul, following the construction of the largest infrastructure projects of the era when transportation between the Asian and European continents was provided by suspension bridges, the urban development dynamics and Land Use and Land Cover (LULC) patterns have changed. This study aims to examine the changes in LULC and future predictions around the 15 July Martyrs Bridge (1973), Fatih Sultan Mehmet Bridge (1988), and Yavuz Sultan Selim Bridge (2016) located across the Bosphorus Strait between 1972 and 2025 using Remote Sensing (RS) and Machine Learning (ML) techniques. LULC maps were created before and after the construction of the bridges around the Bosphorus Strait between 1972 and 2025 using Landsat (MSS, TM, ETM+, OLI/OLI-2) and Sentinel-2 satellite images and the Random Forest (RF) algorithm via Google Earth Engine (GEE). Maps show a 47.2% increase in impervious surface area between 1972 and 2025, while agricultural and forest areas decreased by 16.6% and 25%, respectively. Future projections created using a Cellular Automata Markov Chain (CA-Markov) hybrid model predict that impervious surface area will continue to increase by 11.7%, 31.9%, and 48.1% from 2025 to 2030, 2040, and 2050, respectively. The findings highlight the need for proactive policy decisions aimed at protecting the natural environment within the framework of sustainable urban planning, given the changes in the Bosphorus caused by transportation infrastructure and urbanization.

Keywords: Transport Infrastructure, LULC, Remote Sensing, Istanbul Bosphorus Bridges, Cellular Automata Markov Chain (CA-Markov)

BIOSURFACTANT PRODUCTION BY *PSEUDOMONAS PUTIDA* ICCF 391 USING LOW-COST CARBON SUBSTRATES WITH BIOCONTROL POTENTIAL AGAINST *ERWINIA CAROTOVORA*

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ABSTRACT

Microbial biosurfactants are increasingly recognized as sustainable, biodegradable, and low-toxicity alternatives to synthetic surfactants, with broad applications in agriculture and environmental biotechnology. The use of low-cost carbon substrates represents a promising strategy to enhance process sustainability while reducing production costs and environmental impact. In this study, *Pseudomonas putida* ICCF 391 was evaluated for extracellular biosurfactant production using three carbon sources: glycerol (5%), waste cooking oil (5%), and a mixed substrate composed of glycerol (3%) and waste cooking oil (2%). Bioprocesses were conducted under controlled conditions, and biosurfactant production was assessed by the emulsification index (E24) using heptane, octane, and sunflower oil. All tested conditions produced efficient biosurfactant activity, with E24 values exceeding 60% across all substrates and hydrocarbons. Following downstream processing, the partially purified biosurfactant exhibited strong antimicrobial activity against *Erwinia carotovora* ICCF 138, producing a 30 mm inhibition zone, highlighting its biocontrol potential in plant disease management. The results showed that glycerol and waste cooking oil are suitable substrates for biosurfactant production by *Pseudomonas putida* ICCF 391, supporting process scalability for cost-effective production, with demonstrated inhibitory activity against *Erwinia carotovora*, highlighting the potential of waste valorisation within a circular economy framework for sustainable agricultural applications. Overall, the study demonstrates the conversion of agro-industrial residues into value-added biosurfactants, reducing reliance on synthetic surfactants and supporting sustainable applications in agriculture and environmental biotechnology.

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Keywords: biosurfactants, waste valorization, biocontrol, plant pathogen, sustainable agriculture, eco-friendly alternatives.

SEASONAL VARIATIONS IN ALGAL BIOMASS PRODUCTION IN HIGH RATE ALGAL PONDS UNDER SEMI-ARID TO ARID CLIMATE CONDITIONS IN MOROCCO

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ABSTRACT

Microalgae are rapidly emerging as key drivers of the global bioeconomy, with the market experiencing sustained growth rates exceeding 7–10% annually, reflecting their expanding applications in food, agriculture, bioenergy, and biotechnology. In this context, developing sustainable and scalable production systems is becoming a critical challenge, particularly in arid and semi-arid regions where conventional water resources are limited. In such environments, the use of non-conventional water sources, including pretreated wastewater, represents a promising alternative for microalgal cultivation. This study investigates the seasonal variations of algal biomass production in a High Rate Algal Pond (HRAP) system installed at the Faculty of Sciences Semlalia (Morocco), under semi-arid to arid climatic conditions. A *Chlorella* sp. strain was experimentally inoculated, and its growth performance was monitored under real environmental conditions. The results demonstrated that *Chlorella* sp. exhibited a strong adaptive and competitive capacity, reaching a maximum cell density of 15.5×10^6 cells mL^{-1}. Biomass productivity remained within the typical range reported for HRAP systems, despite pronounced seasonal fluctuations. These variations were mainly driven by temperature and light intensity. Pigment analysis revealed chlorophyll a and b concentrations of 1.3 and 0.99 mg L^{-1}, respectively, indicating sustained photosynthetic efficiency within the algal culture. Importantly, beyond seasonal variability, the system showed resilience and the capacity to maintain continuous biomass production over time. This highlights the potential of HRAP systems as reliable platforms for perennial microalgal production, even under harsh climatic conditions. Such stability is essential for ensuring a consistent supply of biomass, which is a cornerstone for the development of a viable and sustainable bioeconomy.

Keywords: High Rate Algal Ponds (HRAP), Microalgae, Biomass production, Chlorella sp , Seasonal variation, Bioeconomy

IMPACT OF SECONDARY TREATED WASTEWATER ON GROWTH AND PHYSIOLOGICAL RESPONSES OF ROCKET (ERUCA SATIVA) IN HYDROPONICS

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ABSTRACT

Water scarcity represents a major constraint for agricultural production, particularly in arid and semi-arid regions, prompting the exploration of sustainable and resource-efficient alternatives to conventional irrigation practices. In this context, the reuse of treated wastewater has emerged as a promising strategy to reduce freshwater demand while simultaneously providing essential nutrients to crops. The present study evaluates the potential of secondary treated wastewater derived from activated sludge processes (TW2) as an alternative nutrient source for the hydroponic cultivation of rocket (Eruca sativa L.) using a low-cost passive wick system. To assess plant performance, a range of morphological and biochemical parameters were monitored and compared to plants grown under a standard Hoagland nutrient solution (T+), used as a control. The results indicated that TW2 irrigation led to a slight reduction in root length (−6.7%), suggesting a minor impact on belowground development. In contrast, shoot length exhibited a significant increase (+66.6%), reflecting enhanced aerial growth under wastewater conditions. Despite this stimulation of vegetative growth, a notable decline in total chlorophyll content (−45.9%) was observed, indicating potential stress effects on the photosynthetic apparatus. Biochemical analyses further revealed a decrease in total soluble protein content (−12.9%) in TW2-treated plants (62.6 mg/g FW) compared to the control (71.9 mg/g FW), suggesting alterations in metabolic activity. Conversely, proline accumulation increased nearly ten-fold under TW2 irrigation, highlighting a strong osmoprotective response and the activation of stress tolerance mechanisms. Overall, these findings demonstrate that secondary treated wastewater can effectively support plant growth in hydroponic systems, despite inducing moderate physiological stress. This study underscores the potential of integrating wastewater reuse into low-cost hydroponic systems as a sustainable approach for leafy vegetable production under water-limited conditions, contributing to improved water management and circular resource use in agriculture.

Keywords: Water reuse, Eruca sativa, Hydroponics, Sustainable agriculture

ANALYSIS OF UNİVERSİTY STUDENTS' METAPHORICAL PERCEPTIONS OF THE CONCEPT OF CLIMATE CHANGE

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ABSTRACT

This study aims to identify the metaphors that University students will use to describe the concept of "climate change," a current environmental issue worldwide. The study sample consists of 49 third and fourth-year students enrolled in the Science Education Department of the Faculty of Education at Trakya University during the 2024-2025 academic year. To determine science education students' perceptions of the concept of "climate change," a semi-structured form containing the statement "Climate change is like …… because ……" was distributed, and students were asked to express their views by focusing on only one metaphor and filling in the blanks. The data obtained at the end of the study were analyzed using content analysis. Participants generated a total of 46 different metaphors for the concept of climate change, and these metaphors were evaluated under 11 different conceptual categories to interpret the results. According to the findings, the most frequently recurring metaphors related to the concept of climate change were identified as our emotions and greenhouses. The conceptual categories are as follows: Global warming as a consequence, global warming as a result of our actions, global warming as a catastrophe, global warming as a threat, global warming as an asset, global warming as a commodity, global warming as a disease, global warming as an imbalance, global warming as a disruption of the natural balance, global warming as a necessity for taking action, and global warming as a result of human impact. The metaphors developed by the students were most commonly grouped under the conceptual category of global warming as an imbalance.

Keywords: Metaphor, Climate change, Environment, Science education students

EVALUATION OF THE ANNUAL PLAN AND SUBJECT CONTENT OF THE CLIMATE, ENVIRONMENT AND INNOVATIVE SOLUTIONS COURSE BY SCIENCE EDUCATION STUDENTS

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ABSTRACT

The rapid changes in science and technology, the evolving needs of individuals and society, and the innovations and advancements in learning and teaching theories and approaches have directly impacted the roles expected of individuals. This transformation defines an individual who produces knowledge, uses it functionally in life, solves problems, thinks critically, is entrepreneurial, determined, possesses communication skills, can empathize, and contributes to society and culture, etc. For these reasons, the Climate, Environment, and Innovative Solutions Curriculum aims to contribute to students becoming individuals who can find solutions to the problems in our environment. The curriculum, within the framework of virtue, values, and actions, aims to guide students from actions to values, from values to virtuous individuals, and from virtuous individuals to the ultimate goal of becoming peaceful individuals in a livable environment. The Climate, Environment, and Innovative Solutions course curriculum addresses climate change, the interaction of environmental systems with humans, and environmental problems. The program also includes topics such as environmental problems, the fundamentals of innovative solutions, and efforts to develop innovative solutions. Given that the environment and environmental problems occupy a significant place in our lives today, and because children need to be educated and develop attitudes on these issues from a young age, this research aims to evaluate the Climate, Environment, and Innovative Solutions Course Curriculum and Annual Plan implemented in Turkey, as perceived by University students. For this purpose, a qualitative research method was used in the study. As a data collection method, 22 final-year science education students who went to schools for internships were asked to evaluate the curriculum on A4 paper, and then the data were interpreted. When students' statements are evaluated, it is seen that the program is effective in some areas and unsuccessful in others.

Keywords: Climate, Environment and Innovative Solutions, Curriculum, Annual plan, Science education students

SEASONAL DYNAMICS OF WATER QUALITY AND ANTHROPOGENIC PRESSURES IN BÜYÜKÇEKMECE AND KÜÇÜKÇEKMECE LAGOONS IN A MEGACITY (İSTANBUL)

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ABSTRACT

In this comprehensive scientific study, the overall water quality status, physicochemical characteristics, and seasonal dynamics of Büyükçekmece and Küçükçekmece Lakes (Istanbul), two crucial coastal lagoon ecosystems tightly connected to the Sea of Marmara, were meticulously investigated under intense and continuous anthropogenic pressure mechanisms. Field sampling campaigns were systematically conducted across two highly contrasting seasons—the late dry season of 2022 and the wet late-winter season of 2023—focusing specifically on strategically designated sampling points located closest to the marine connection of each lagoon to accurately evaluate the extent of seawater intrusion and tidal interactions. The research program monitored a wide spectrum of key environmental parameters, including dissolved oxygen, pH, electrical conductivity, total dissolved solids, salinity, turbidity, ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, and phosphate phosphorus, to evaluate the level of environmental degradation. The analytical findings revealed distinct limnological profiles and highly varying pollution characteristics between the two interconnected aquatic systems; Büyükçekmece Lagoon exhibited a significantly higher salinity level and a much more pronounced brackish water character due to its direct and active marine interactions with the Sea of Marmara, whereas Küçükçekmece Lagoon demonstrated severe environmental degradation characterized by substantially higher nutrient concentrations, clearly indicating intense domestic, agricultural, and industrial pollution loads originating from its heavily urbanized watershed. Furthermore, the seasonal transition from the dry late-summer period to the wet late-winter season drastically altered the physical and chemical profiles of both lagoons through heavy precipitation and subsequent surface runoff, demonstrating that while natural marine inputs dominate the salinity profile of Büyükçekmece, heavy urban expansion and anthropogenic pressures continuously compromise the environmental health and long-term ecological integrity of Küçükçekmece.

Keywords: Büyükçekmece, Küçükçekmece, Coastal lagoons, Seasonal dynamics, Water quality, Istanbul megacity

ASSESSMENT OF WATER QUALITY AND NUTRIENT CONTAMINATION RISKS IN ISTANBUL'S URBAN LAGOONS (BÜYÜKÇEKMECE AND KÜÇÜKÇEKMECE) USING MODIFIED INDICES

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ABSTRACT

In this comprehensive scientific investigation, the overarching contamination threats, ecological risks, and seasonal pollution dynamics of Büyükçekmece and Küçükçekmece Lagoons (Istanbul, Türkiye), two critical and vulnerable urban coastal wetlands directly connected to the Sea of Marmara, were thoroughly evaluated under intense anthropogenic stress. A specifically modified Water Quality Index (modified WQI) alongside a newly modified Nutrient Pollution Index (modified NPI) were systematically utilized as the primary diagnostic frameworks to assess the precise extent of environmental degradation and evaluate hydrochemical risks within these complex transitional ecosystems. To effectively quantify the intense urban, agricultural, and industrial pressures exerted on the lagoons across highly contrasting dry and wet seasons, key hydrochemical macro-nutrients including ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, and phosphate phosphorus were monitored at strategically selected sampling stations located closest to the sea inlets. The successful application of these modified indices clearly demonstrated a sharp, multi-seasonal pollution contrast and spatial variation between the two adjacent lagoon systems. Based on the comprehensive modified WQI calculations, Büyükçekmece Lagoon was classified as having a relatively sustainable "good water quality" status (with index values safely ranging between 50 and 100), whereas Küçükçekmece Lagoon consistently exhibited a severely degraded and highly alarming "unsuitable" ecological status (with index values significantly exceeding 300). Correspondingly, the modified NPI values strongly corroborated these diagnostic findings, indicating a state of "moderate pollution" (ranging between 1 and 3) for the Büyükçekmece ecosystem, while rapidly escalating to catastrophic "very high pollution" levels (well exceeding 6) in the Küçükçekmece basin. Ultimately, these analytical results confirm that while natural marine-driven interactions predominantly dictate the hydrochemical character and salinity profile of Büyükçekmece, heavy municipal wastewater and industrial effluents pose a continuous, severe, and unchecked threat to the ecological integrity of Küçükçekmece across all seasonal cycles.

Keywords: Büyükçekmece, Küçükçekmece, Modified WQI, Modified NPI, Seasonal dynamics, Istanbul megacity

EVALUATION OF PURIFICATION CAPACITY IN TREATMENT PLANT STATION

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ABSTRACT

The most abundant biological entities in any habitat are Bacteriophages (or simply phages). Phages of different forms are present in different ecological niches, reaching a global abundance of 1031 viral particles and have undergone co-evolution alongside bacteria for nearly 4 billion years. Bacteriophages are viruses that infect and lyse bacteria. It is widely known that bacteria inhabit almost everywhere under all conditions, and similarly, phages exist in all niches where their hosts are present, including hypersaline environments, polar regions, deserts, on and inside organisms other than bacteria, freshwater, seawater, and soil. Interest in the ability of phages to control bacterial populations has extended from medical applications into the fields of agriculture, aquaculture and the food industry. In the present study, specific bacteriophages to different bacterial strains were collected from a wastewater treatment plant from raw and treated wastewater in El-Eulma (eastern of Algeria). After isolation, they were purified and their lysis ranges described; as well as to assess the self-purification capacity of wastewater at the plant level. The results varied considerably depending on the strain being tested; while for Escherichia coli SATE the probability of isolating a phage was 56.5%, for Escherichia coli A21E1R it was 46.3%. For Staphylococcus aureus, no phage could be isolated; 0%. The treatment plant's water purification capacity is very high, as evidenced by a decrease in the number of CFU/ml and a reduction in absorbance and turbidity in our dialysis bags. Staphylococcus aureus gradually and practically disappeared in the dialysis tubes after four weeks of incubation in the treatment pools. This confirms the natural effects of phages in polluted aquatic ecosystems, both as biological indicators of microbial load and as regulators of microbial activity.

Keywords: Bacteriophage, isolation, wastewater, Escherichia coli, Staphylococcus aureus, treatment plant.

SCREENING SALMONELLA BACTERIOPHAGES FROM WASTEWATER AND SURFACE WATER

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ABSTRACT

The emergence of multidrug-resistant (MDR) bacteria has become a critical threat to global public health, particularly concerning foodborne pathogens such as Salmonella enterica. This bacterium is responsible for severe gastroenteritis and systemic infection in both humans and animals. The increasing resistance of Salmonella to conventional first-line antibiotics, including ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole, has necessitated the search for alternative therapeutic strategies. Bacteriophages or phages are viruses that specifically infect and lyse bacterial cells**.** Phages are highly specific to their bacterial hosts, typically infecting a single species or even specific strains within a species. This specificity, combined with their bactericidal activity, makes them promising candidates for biocontrol and phage therapy against MDR Salmonella infection. Wastewater is known to be a rich reservoir of phages due to the high density of fecal bacteria. In this context, our study aimed to isolate and characterize bacteriophages specific to Salmonella enterica from environmental water sources, including Bougaâ-Hammam Guergour wastewater treatment plant and the Oued Bousselam (Sétif, Algeria). We evaluated the presence of lytic phages capable of forming clear plaques on Salmonella cultures using the double-layer agar method. Four sampling campaigns were conducted between February and May 2026. Salmonella-specific phages were successfully isolated only during the third campaign, producing two distinct plaque morphologies: translucent plaques from river water and opaque plaques from the influent. Green pigmentation appeared after amplification upon exposure to daylight. E. coli phages were more abundant, confirming the effectiveness of the isolation protocol. These results demonstrate that wastewater and river water are potential reservoirs of lytic bacteriophages against Salmonella enterica.

Keywords: Salmonella enterica, Escherichia coli, bacteriophages, wastewater treatment plant, Oued Bousselam, double-layer agar, lytic phages, green pigmentation

HALOPHYTES AS NATURE-BASED SOLUTIONS FOR THE REHABILITATION OF METAL-CONTAMINATED MEDITERRANEAN DRYLANDS: INSIGHTS FROM MESEMBRYANTHEMUM CRYSTALLINUM IN SOUTHERN TUNISIA

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ABSTRACT

Mediterranean arid and coastal ecosystems are increasingly threatened by the combined effects of salinization and metal contamination resulting from industrial activities. In these environments, conventional remediation approaches are often costly and poorly adapted to water-limited conditions, highlighting the need for sustainable nature-based solutions. Halophytes, naturally adapted to saline habitats, have emerged as promising candidates for the rehabilitation of degraded lands due to their exceptional tolerance to multiple abiotic stresses and their capacity to accumulate and stabilize potentially toxic elements. This study investigated the physiological, biochemical and phytoremediation responses of the halophyte Mesembryanthemum crystallinum L. along a salinity gradient in the industrially impacted region of Gabès (southern Tunisia), one of the most polluted areas of the Mediterranean Basin. Soil, root and leaf concentrations of Cd, Zn, Fe, Mn, Sr, Rb and Zr were determined, and biological transfer and translocation factors were assessed. Plant responses were evaluated through relative water content, malondialdehyde (MDA), proline and reducing sugar accumulation. Salinity strongly influenced the distribution and bioavailability of trace elements, with the most saline site exhibiting the highest metal loads. Mesembryanthemum crystallinum showed remarkable tolerance to combined salinity and metal stress while maintaining a stable water status. The species exhibited efficient uptake and translocation of Zn, Fe, Mn and Rb, indicating significant phytoextraction potential, whereas Cd and Sr were predominantly retained in roots, suggesting phytostabilization mechanisms. Enhanced accumulation of proline and soluble sugars, together with increased lipid peroxidation under the most stressful conditions, demonstrated the activation of effective osmoprotective and detoxification pathways. Significant correlations between soil and plant concentrations of several metals further support the use of this species as a biomonitor of environmental contamination. These findings highlight the multifunctional role of halophytes in the ecological restoration of contaminated Mediterranean drylands and identify M. crystallinum as a valuable candidate for integrated phytoremediation, biomonitoring and sustainable rehabilitation programs in arid industrial landscapes.

Keywords: halophytes, phytoremediation, biomonitoring, heavy metals

BIOPESTICIDICAL EFFECTS OF THE ENTOMOPATHOGENIC FUNGI "NOVACRID" AGAINST THE TOMATO LEAFMINER TUTA ABSOLUTA (GELECHIIDAE, LEPIDOPTERA)

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ABSTRACT

Tuta absoluta, commonly known as the tomato leafminer, is one of the most destructive insect pests of tomato crops worldwide. Native to South America, it has spread across Europe, Africa, Asia, and the Middle East, causing significant agricultural losses. The larvae feed by mining leaves, stems, flowers, and fruits, reducing both yield and fruit quality. Under favorable conditions, Tuta absoluta reproduces rapidly, making it difficult to control. Effective management typically involves an integrated approach that combines monitoring, biological control, cultural practices, and selective insecticides to minimize crop damage and reduce the risk of insecticide resistance. In 2008, Algeria experienced devastating damage caused by a new pest: "The tomato lifeminer" Tuta absoluta. The insect spread rapidly throughout the country's tomato-growing regions, causing substantial production losses. This study aims to propose alternative solutions based on the use of natural "bio-insecticide" Novacrid produced from the entomopathogenic fungus Metarhizium acridium, products to fight the larvae population of the pest Tuta absoluta, against this background we have evaluated the insecticidal effect of the fungus which was selected for its therapeutic properties and its bio-pesticidal effect. Three doses were tested to estimate larval mortality and three replicates were carried out for each treatment, with the controls receiving sterilised distilled water (containing no additives). (1st dose (D1 =1,25g), 2nd dose (D2 =2,5g), 3rd dose (D3 = 3,75g)) Results shows that the number of dead individuals demonstrated that the fungus was truly effective, he has a high toxicity against Tuta absoluta indeed 100% mortality of larvae treated with novacrid was observed after 7days of treatment. We can conclude that the entomopathogenic fungi M. anisopliae "NOVACRID" was aggressive and used an insecticidal activity against the larvae of T. absoluta.

Keywords: biopesticide, novacrid, leafminer toxicity.

INFLUENCE OF SUMMER MICROBIOLOGICAL POLLUTION ON THE DISTRIBUTION OF ANTIBIOTIC-RESISTANT ESCHERICHIA COLI IN THE VJOSA RIVER BASIN

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ABSTRACT

The Vjosa River basin is increasingly exposed to faecal contamination derived from agricultural runoff, livestock activity, rural settlements, and tributary inflows. At the same time, environmental *Escherichia coli* isolated from the basin has shown high levels of antibiotic resistance, including marked resistance to β-lactam antibiotics and a high multidrug-resistant (MDR) fraction. This study develops an integrated interpretation of one-year microbiological monitoring data from thirteen stations along the Vjosa River and its tributaries, with a particular focus on the summer period as a critical window for contamination and antimicrobial resistance risk. Faecal coliforms/*E. coli* proxy and intestinal enterococci were analysed monthly from October 2024 to October 2025, and summer microbial loads were linked with previously determined antibiotic resistance patterns in environmental *E. coli* isolates. Since station-specific and month-specific antimicrobial susceptibility data were not available in the microbiological spreadsheet, resistant *E. coli* burdens were estimated by applying reported resistance prevalences to the observed microbial concentrations. The annual mean faecal coliform/*E. Coli* proxy concentration was 183.6 MPN/100 mL, while the summer mean was 163.4 MPN/100 mL. The highest summer microbial loads were observed at stations S-13-GJO, S-16-KDQ, S-17-GJK, and S-15-DRI, indicating spatially concentrated contamination pressure. The estimated MDR *E. coli* burden was highest at these same locations, especially S-13-GJO. The results suggest that summer faecal pollution can function as a seasonal amplifier of antibiotic-resistant E. coli distribution in the Vjosa River basin by increasing the abundance of bacterial hosts exposed to environmental selection pressures. These findings support the need for coordinated summer monitoring of microbiological pollution, antibiotic resistance, wastewater inputs, and agricultural runoff in the Vjosa River National Park.

Keywords: Antibiotic resistance, Escherichia coli, faecal contamination, multidrug resistance, summer season, Vjosa River, water quality

LINKING SUMMER WATER QUALITY DYNAMICS TO FAECAL CONTAMINATION HOTSPOTS IN THE VJOSA RIVER (ALBANIA)

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ABSTRACT

The Vjosa River represents one of the last free-flowing river systems in Europe and supports a wide range of ecological functions and biodiversity. Despite its ecological importance, seasonal variations in water quality, particularly during summer, may significantly influence microbial contamination patterns. This study investigates the relationship between summer physicochemical conditions and faecal contamination dynamics across selected monitoring sites of the Vjosa River and its major tributaries. Water quality assessment focused on the summer period (June-September 2025), when elevated temperatures, reduced river discharge, increased agricultural activities, and intensified recreational use create favorable conditions for bacterial proliferation. The study evaluates the influence of temperature, dissolved oxygen, electrical conductivity, total dissolved solids, and pH on the distribution of *Escherichia coli* and intestinal enterococci. Particular attention was given to contamination hotspots previously identified in Poçem, Sarandoporo, Gjorm, Drino, and Kardhiq. Results indicate that the summer season represents the most critical period for microbiological deterioration of river water quality. Elevated temperatures and reduced dilution capacity were associated with increased concentrations of faecal indicator bacteria, while dissolved oxygen showed an inverse relationship with microbial abundance. The findings highlight the importance of seasonal monitoring and provide valuable information for the management and protection of the Vjosa River ecosystem.

Keywords: Escherichia coli, faecal contamination, intestinal enterococci, physico-chemical parameters, summer season, Vjosa River, water quality.

PHYSICOCHEMICAL CHARACTERISATION AND INSECTICIDAL ACTIVITY OF THE ESSENTIAL OIL OF "ORIGANUM FLORIBUNDUM" AGAINST THE STORED-PRODUCT INSECT TRIBOLIUM CASTANEUM

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ABSTRACT

The genus Origanum in Algeria comprises two species: Origanum floribundum and Origanum glandulosum. Origanum floribundum Mumby is a rare, endemic aromatic and medicinal plant native to Algeria, belonging to the Lamiaceae family. The species grows wild in the high mountains of Hammam Melouane (Blida, Algeria). The sites where essential oils are secreted and stored are located in the above-ground parts of the plant (stems, leaves and flowers). This study forms part of research into the physicochemical characterisation and the insecticidal activity of the essential oil of Origanum floribundum against the stored-product pest 'Tribolium castaneum'. The essential oil was obtained by hydrodistillation using a Clevenger-type apparatus. The essential oil yield is approximately 1.86 per cent. The results of the physicochemical analysis show that the essential oil has a refractive index of 1.492, a relative density of 0.9539, a specific rotation of +0.003° ± 0.00047° and a pH of 6.058. Physicochemical analysis of the essential oil showed that its physicochemical properties comply with AFNOR standards. The toxicity of the essential oil against Tribolium castaneum was assessed by contact using the filter paper method. 100 per cent mortality was recorded after just 8 hours of exposure to the essential oil at a concentration of 200 µL/mL.

Keywords: Origanum floribundum, essential oil, hydrodistillation, insecticidal activity, Tribolium castaneum

DIGITAL TWIN OF ZIZYPHUS LOTUS CELLULOSE FOR ADSORPTION PERFORMANCE PREDICTION VIA ARTIFICIAL INTELLIGENCE

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ABSTRACT

This work presents a digital twin framework for Zizyphus lotus derived cellulose to predict its adsorption performance toward water contaminants. raw experimental data-material properties (BET, porosity, surface functional groups), operation parameters (pH, temperature, contact time, adsorbate concentration), and adsorption measurements (equilibrium, kinetics)- are assimilated into a digital counterpart that merges mechanistic adsorption models with data driven artificial intelligence. Various machine learning algorithms including random forest, gradient boosting, and deep neural networks are employed and cross validated using the combined database to learn nonlinear correlations between material characteristics, operation conditions and adsorption capacity/kinetics. The digital twin allows quick in silico exploration of material modification and operation regimes, delivering high accuracy prediction results (R2 > 0.90 and RMSE close to experimental uncertainty) and insight into critical parameters through feature importance. Sensitivity and uncertainty analyses enhance model reliability and provide guidance for the design of experiments to bridge knowledge gaps. The outcome is a versatile digital platform to facilitate fast in silico screening of cellulose modification strategies (chemical activation, surface functionalization and porosity manipulation) and operation conditions in various water chemistries to improve removal efficiency. The model performance was confirmed using an independent experimental dataset and yielded good agreement (coefficient of determination and relatively low error within experiment errors). In silico prediction combining with underlying theory is the core innovation which speeds up material design, decreases experimental trials, and provides decision support to scale up and process integration for sustainable and biomass-derived adsorbents. The approach is applicable to other lignocellulosic biomasses for general data-driven design of adsorbents.

Keywords: Digital twin, Ziziphus lotus cellulose, adsorption performance, artificial intelligence, machine learning adsorption kinetics, adsorption isotherms

VALORIZATION OF NATURAL PLANT PIGMENTS AS SAFE ALTERNATIVES TO SYNTHETIC FOOD COLORANTS: EXTRACTION, CHARACTERIZATION, AND STABILITY ASSESSMENT

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ABSTRACT

The global food industry increasingly relies on synthetic additives to enhance the sensory attributes of ready-to-eat products. Among these, artificial colourings are widely used due to their low cost and high stability. However, mounting evidence links chronic consumption of synthetic dyes to adverse health effects, including carcinogenicity, genotoxicity, and neurobehavioral disorders in children. This has prompted urgent regulatory scrutiny and growing consumer demand for clean-label, naturally derived alternatives. In response, the search for renewable, non-toxic, and biodegradable natural colorants has become a strategic priority in food science and public health. The present study aims to develop a sustainable approach for replacing artificial food colourings with natural pigments extracted from locally available plant materials. Specifically, we investigated four sources—turmeric (Curcuma longa), beetroot (Beta vulgaris), carrot (Daucus carota), and onion peel (Allium cepa)—to evaluate their potential as viable industrial colorants. Fresh and dried forms of beetroot and carrot were compared to assess the effect of dehydration on pigment recovery. Extraction was carried out using appropriate solvents under optimized conditions. The resulting extracts were characterized for: (i) extraction yield (%), (ii) solubility in aqueous and lipid media, (iii) stability across a pH range (2–10), and (iv) optical properties using UV-Visible spectrophotometry and thin-layer chromatography (TLC). All experiments were performed in triplicate to ensure reproducibility. The findings demonstrated considerable pigment diversity across the selected sources. Curcumin from turmeric showed maximum absorption (λmax) at 425 nm, betanin from beetroot at 535 nm, carotenoids from carrot at 450 nm, and flavonoid-based pigments from onion skins at 256 nm. Extraction yields varied significantly, ranging from 0.17% for tomato-derived carotenoids to 20.39% for betanin from dried beetroot—highlighting the superior potential of the latter. Notably, drying substantially enhanced pigment extractability, with carrot yields increasing from 0.25% (fresh) to 1.2% (dried). Solubility tests revealed that curcumin and carotenoids were lipophilic, while betanin exhibited excellent water solubility. Stability assessments showed that betanin and onion pigments retained colour integrity under acidic to neutral conditions, whereas carotenoids remained stable across a broader pH spectrum. This study confirms that the selected plant pigments possess favourable physicochemical properties, including good colour intensity, moderate to high stability, and complete biodegradability. Their non-toxic profile and renewable origin make them strong candidates for replacing synthetic dyes in both the food and cosmetic sectors. Moreover, the

use of agricultural by-products such as onion peel aligns with circular economy principles, adding value to food waste. Future work will focus on encapsulation strategies to further enhance stability and industrial scalability.

Keywords: Natural colorants, food safety, plant pigments, extraction yield, UV-Vis spectroscopy, circular economy.

VALORIZATION OF MOROCCAN AROMATIC AND MEDICINAL PLANTS: A CRITICAL REVIEW OF SORPTION THERMODYNAMICS, DRYING KINETICS, AND PHYTOCHEMICAL QUALITY

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ABSTRACT

Morocco, benefiting from its Mediterranean bioclimates, is home to a rich biodiversity of over 4,200 species of aromatic and medicinal plants (AMPs). Although AMPs represent a strategic sector on a global scale, their valorization faces significant post-harvest losses (estimated at 30% in Morocco) due to poor control over drying and storage processes. This literature review examines the socio-economic, scientific, and technological contexts of aromatic and medicinal plants in Morocco, while integrating the thermodynamic and kinetic principles governing moisture and AMP drying, utilizing sorption isotherms as a central characterization tool. The study addresses the AMP sector, their valorization, and their active compound composition. It also analyzes water within biological matrices and sorption thermodynamics (water state, sorption isotherms, modeling, thermodynamic properties, etc.), AMP drying (fundamental principles, kinetics, methods, and impacts, etc.), and the effect of thermal processes on the integrity of phytochemical quality (essential oils and polyphenols). Despite the importance of drying for post-harvest stability, current scientific literature focuses predominantly on traditional species and is often limited to the physical modeling of mass loss. A critical scientific barrier exists regarding the lack of studies linking fundamental hygroscopic behavior to the degradation kinetics of active molecules. The identified scientific gaps justify an experimental approach combining multi-temperature isotherms, convective kinetics, and the biochemical quality monitoring of AMPs. This synthesis serves as the methodological foundation for an original and rigorous experimental protocol.

Keywords: Aromatic and medicinal plants, drying, sorption isotherms, Post-harvest preservation, phytochemical quality

A MULTI-INDEX MACROINVERTEBRATE APPROACH FOR ASSESSING THE ECOLOGICAL STATUS OF LAKE TONGA (NORTHEASTERN ALGERIA)

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ABSTRACT

Mediterranean wetlands are increasingly threatened by anthropogenic pressures, highlighting the need for reliable tools to assess their ecological condition. Among biological monitoring approaches, aquatic macroinvertebrates are widely recognized as effective indicators because they integrate environmental disturbances over time and reflect changes in ecosystem integrity. This study evaluated the ecological status of Lake Tonga, a Ramsar wetland in northeastern Algeria, using macroinvertebrate assemblages and three complementary biotic indices: the Family Biotic Index (FBI), the Biological Monitoring Working Party (BMWP), and the Average Score Per Taxon (ASPT). Macroinvertebrates were collected seasonally from seven littoral stations between March 2017 and February 2018. The recorded assemblage comprised seven taxonomic orders, dominated by Heteroptera (24.87%), Diptera (21.41%), and Coleoptera (19.39%). Biological assessment revealed contrasting but complementary patterns among the indices. BMWP classified most sampling stations as having moderate ecological quality, whereas FBI and ASPT indicated poorer biological conditions, reflecting varying degrees of ecological degradation across the lake. The use of multiple biotic indices provided a more comprehensive evaluation than any single index alone, illustrating the complementary information provided by different scoring systems. These findings demonstrate the effectiveness of macroinvertebrate-based biomonitoring for evaluating the ecological status of Mediterranean wetlands and support its application as a practical tool for the long-term conservation and management of protected freshwater ecosystems.

Keywords: Aquatic macroinvertebrates, Biomonitoring, Biotic indices, Ecological status, Lake Tonga, Mediterranean wetland

SPATIAL ANALYSIS AND POPULATION STRUCTURE OF PHORCUSTURBINATUS AS INDICATORS OF THE ECOLOGICAL QUALITY OF COASTAL ECOSYSTEMS

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ABSTRACT

Phorcus turbinatus is a marine gastropod commonly associated with rocky intertidal habitats, where its abundance and spatial distribution may reflect habitat quality and the degree of anthropogenic disturbance. As an ecologically important grazer, this species contributes to the maintenance of intertidal ecosystem functioning and has considerable potential as a bioindicator of coastal environmental conditions. In the context of marine biodiversity conservation, understanding its spatial distribution and population dynamics is essential for assessing the ecological status and sustainability of coastal ecosystems. The present study aimed to characterize the spatial distribution of P. turbinatus across several coastal sites, evaluate spatial variations in population density, and identify the environmental factors influencing its abundance. Standardized field surveys were conducted using systematic sampling, followed by statistical and geostatistical analyses to investigate spatial autocorrelation patterns and distribution gradients. The results revealed pronounced spatial heterogeneity, with high-density populations occurring in areas characterized by suitable rocky substrates, moderate hydrodynamic exposure, and relatively low levels of human disturbance. Conversely, lower abundances were observed in sites subjected to intensive harvesting or habitat degradation. These findings indicate that the spatial distribution of P. turbinatus is governed by the combined effects of ecological conditions and anthropogenic pressures. Overall, this study demonstrates the value of P. turbinatus as a sentinel species for monitoring coastal biodiversity and supports the integration of spatial ecological approaches into the conservation and sustainable management of intertidal marine ecosystems.

Keywords: Phorcusturbinatus, spatial distribution, coastal biodiversity, intertidal ecosystems, sentinel species

DISTRIBUTION AND POPULATION STRUCTURE OF PHORCUSTURBINATUS ALONG THE INTERTIDAL GRADIENT

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ABSTRACT

Phorcus turbinatus is a characteristic marine gastropod inhabiting Mediterranean rocky shores, where its distribution is strongly influenced by environmental conditions and habitat heterogeneity. As a dominant grazer in intertidal ecosystems, this species plays an important ecological role and can serve as a valuable indicator of coastal environmental quality. The present study aimed to investigate the spatial distribution and population structure of P. turbinatus along the intertidal gradient and to assess the influence of key environmental factors on its abundance. A stratified sampling design was adopted, considering vertical zonation (upper, middle, and lower intertidal zones) together with wave exposure. Randomly distributed 0.25 m² quadrats, identified as the optimal sampling unit, were used within each stratum to ensure representative sampling. The abundance and shell size of individuals were recorded, while environmental variables, including algal cover and substrate type, were simultaneously assessed. The results revealed significant spatial heterogeneity in the distribution of P. turbinatus, with the highest densities occurring in the mid-intertidal zone. This pattern suggests that both abiotic factors, such as hydrodynamic conditions and substrate characteristics, and biotic factors, including vegetation cover, play a key role in shaping population structure. These findings improve our understanding of species–environment interactions and provide valuable information for ecological monitoring, biodiversity conservation, and the sustainable management of Mediterranean coastal ecosystems.

Keywords: Phorcusturbinatus, intertidal zonation, species–environment relationships, spatial heterogeneity, stratified random sampling, generalized linear mixed models (GLMM), generalized additive models (GAM)

COMPARATIVE ASSESSMENT OF COPPER- AND NICKEL-INDUCED ALTERATIONS IN MITOTIC ACTIVITY OF PISUM SATIVUM L. ROOT MERISTEMS

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ABSTRACT

Heavy metal contamination represents a significant environmental challenge due to the ability of metal ions to interfere with cellular proliferation and plant development. This study evaluates the comparative cytotoxic responses induced by copper (Cu) and nickel (Ni) in root meristems of Pisum sativum L. through analysis of mitotic activity and phase distribution. Plants were exposed to increasing concentrations of Cu (6.25–25 μg/L) and Ni (5–20 μg/L), and a minimum of 5000 cells per experimental variant was analysed. Both metals caused a concentration-dependent reduction in the mitotic index, indicating inhibition of meristematic cell proliferation. Copper demonstrated a stronger antiproliferative effect, reducing the mitotic index from 32.93 ± 3.36% in control samples to 15.33 ± 3.87% at the highest concentration, whereas Ni reduced it to 23.18 ± 4.93%. In addition to mitotic inhibition, Ni induced more pronounced alterations in the distribution of mitotic phases, characterised by changes in the relative proportion of prophase, metaphase, anaphase and telophase cells. Conversely, Cu primarily affected overall mitotic activity with comparatively limited changes in phase distribution. The observed differences reveal distinct cytological response patterns to Cu and Ni exposure and indicate a higher inhibitory potential of copper on cell proliferation. The Pisum sativum root meristem assay demonstrates high sensitivity as a plant bioassay for comparative evaluation of heavy metal-induced cytotoxic responses and environmental stress effects.

Keywords: Pisum sativum, copper, nickel, heavy metals, mitotic index, plant bioassay, ecotoxicology

ENVIRONMENTAL ENTEROCOCCUS SPP. IN AQUATIC AND TERRESTRIAL MATRICES FROM NORTHWESTERN ALGERIA: ANTIMICROBIAL RESISTANCE PROFILING AND PRELIMINARY IN VITRO EVALUATION OF LACTOBACILLUS-DERIVED ANTAGONISM

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ABSTRACT

Environmental enterococci are increasingly recognized as major reservoirs of antimicrobial resistance (AMR) determinants and reliable indicators of fecal contamination in aquatic and terrestrial ecosystems. This exploratory pilot study, conducted on a limited convenience sample from the Oran region (northwestern Algeria) within a One Health framework, pursued two objectives: (i) to characterize the AMR profiles of environmental Enterococcus isolates recovered from hospital wastewater, municipal sewage sludge, manure-amended agricultural soil, and contaminated river water through species-specific sodA-targeted PCR; and (ii) to evaluate the preliminary in vitro antagonistic potential of four Lactobacillus spp. strains against multidrug-resistant (MDR) enterococci. Thirteen isolates (8 Enterococcus faecalis, 5 Enterococcus faecium) were confirmed by sodA-PCR. Universal ciprofloxacin resistance (100%) and high-level ampicillin resistance (75–80%) were recorded, while all isolates remained fully susceptible to linezolid and tigecycline. One E. faecalis isolate from hospital wastewater showed a phenotype consistent with vancomycin-resistant Enterococcus (putative VRE; genotypic confirmation pending). The four Lactobacillus spp. strains (LBAS-01 to LBAS-04), confirmed at genus level by 16S rRNA PCR and screened for safety, produced measurable inhibition of MDR enterococci (inhibition zones 9–20 mm). Strains LBAS-02 and LBAS-04 showed the strongest activity, substantially reduced after proteinase K treatment, indicating a bacteriocin-like contribution. These findings identify anthropogenically impacted environments—particularly hospital effluents—as reservoirs of MDR enterococci and highlight Lactobacillus spp. as promising biocontrol candidates for sustainable AMR mitigation, warranting confirmatory genotypic and quantitative follow-up.

Keywords: Enterococcus faecalis, Enterococcus faecium, antimicrobial resistance, vancomycin-resistant enterococci, sodA-PCR, Lactobacillus spp., biocontrol, One Health, Algeria

INTEGRATED PHYSIOLOGICAL AND MULTI-ANALYTICAL CHARACTERIZATION OF ABS MICROPLASTIC BIODEGRADATION BY ATLANTIBACTER HERMANNII

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ABSTRACT

Acrylonitrile butadiene styrene (ABS) is among the most widely used engineering plastics, and its increasing accumulation has become an emerging environmental concern due to its high chemical stability and resistance to natural degradation. Despite the widespread occurrence of ABS microplastics, information regarding their microbial biodegradation remains limited. Thus, the biodegradation potential of A. hermannii against ABS microplastics was investigated in the present study under laboratory conditions. The incubation of A. hermannii with ABS microplastics was performed for 40 days, and bacterial growth, metabolic activity, cell surface hydrophobicity, extracellular protein production, total enzymatic activity, and laccase activity were assessed for microbial adaptation and biodegradation. Polymer degradation was further investigated through weight-loss analysis and complementary physiochemical characterization using SEM, FTIR, AFM, XRD, and GC–MS/MS. The bacteria displayed increased metabolic activity, release of extracellular enzymes and a high affinity to the hydrophobic ABS surface, resulting in successful colonization of the polymer. The biodegradation was confirmed by measurable reduction of the polymer weight and significant morphological and chemical modifications of the treated ABS microplastics. SEM analysis revealed extensive surface erosion, fissures, and cavities, whereas FTIR analysis demonstrated modifications in characteristic functional groups, indicating alteration of the polymer backbone, and GC-MS/MS further identified aromatic and aliphatic degradation intermediates, such as α-methyl styrene and substituted benzaldehydes, indicative of microbial cleavage of styrene-containing domains of ABS. In conclusion, the combined physiological, biochemical and physicochemical data confirmed the biodegradation potential of A. hermannii over ABS microplastics. The results offer novel insights into the bacterial degradation of engineering thermoplastics and point to the potential application of A. hermannii as a promising bacterium for sustainable bioremediation of ABS-contaminated environments.

Keywords: Biodegradation, microplastics, enzymes, laccase, bioremediation, polymers

COMPARATIVE ASSESSMENT OF THE GENOTOXIC POTENTIAL OF COPPER AND NICKEL USING THE ALLIUM CEPA L. TEST SYSTEM

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ABSTRACT

Genotoxic effects of heavy metals represent an important aspect of their ecotoxicity, as metal-induced damage to genetic material may interfere with normal cell division and genome stability. The Allium cepa test system is an established plant bioassay for genotoxicity assessment through the analysis of chromosomal aberrations in root meristematic cells. The aim of the present study was to comparatively evaluate the genotoxic potential of copper (Cu) and nickel (Ni) by analyzing the frequency and spectrum of induced chromosomal alterations. Seeds of Allium cepa were exposed to four concentrations of Cu (6.25–25 μg/L) and Ni (5–20 μg/L), including the permissible limit concentrations. The genotoxic effect was evaluated by determining the total frequency of chromosomal aberrations, the frequency of aberrations among dividing cells, and the distribution of individual cytogenetic abnormalities. Both metals induced a concentration-dependent increase in chromosomal aberration frequency. At the highest concentration, copper caused a higher total frequency of aberrations (1.89 ± 0.27%) and a higher frequency of aberrations among dividing cells (11.96 ± 3.64%) compared with nickel (1.67 ± 0.60% and 7.34 ± 4.02%, respectively). Both metals induced chromosomal fragments, vagrant and lagging chromosomes, C-mitosis, anaphase and telophase bridges, diagonal and multipolar anaphases, as well as micronuclei. At higher concentrations of nickel, additional abnormalities, including chromosome pulverization and chromosomal disorganization, were observed, indicating more severe structural damage to the chromosomal material. The obtained results demonstrate that copper and nickel exhibit distinct genotoxic profiles. Copper induced a higher frequency of chromosomal aberrations, whereas nickel was characterized by the occurrence of specific severe structural chromosomal abnormalities at higher concentrations. The findings confirm the high sensitivity of the Allium cepa test system for assessing the genotoxic potential of heavy metals and its applicability in ecotoxicological monitoring.

Keywords: Allium cepa, genotoxicity, chromosomal aberrations, copper, nickel, heavy metals

ASSESSMENT OF GREENHOUSE GASES AND THEIR TOXICOLOGICAL IMPACTS ON HUMAN HEALTH AND THE ENVIRONMENT

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ABSTRACT

Greenhouse gases (GHGs) are atmospheric gases of both natural and anthropogenic origin that absorb and re-emit infrared radiation, thereby contributing to global warming. The principal greenhouse gases include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Industrial activities are among the major sources of these emissions, making their assessment essential for developing sustainable environmental policies and mitigating their impacts on the environment and human health. This study was conducted at the GP1/Z industrial complex in Arzew, Oran, Algeria, which is affiliated with the national oil and gas company. The main objective was to evaluate the environmental impact of greenhouse gas emissions generated by the complex through the analysis of emitted gases, the assessment of their potential effects, and the identification of mitigation measures implemented on site. The methodology combined theoretical research with practical fieldwork. During an internship in the environmental laboratory, gas chromatography was used to analyze the composition of liquefied petroleum gas (LPG). The results revealed that the LPG produced is of high purity, consisting mainly of propane and butane with only trace impurities. Because these hydrocarbons are carbon-rich, their combustion generates significant carbon dioxide emissions, making CO_2 the primary greenhouse gas associated with the complex's activities. The analysis of emissions showed that direct emissions (Scope 1), originating from stationary combustion sources (turbines and boilers), mobile equipment, and fugitive emissions, were substantially higher than indirect emissions (Scope 2), which are associated with purchased electricity, treated water, and nitrogen supplied to the facility. To complement the environmental assessment, a questionnaire was administered to 33 employees from different departments, out of a workforce of approximately 900 employees, to evaluate occupational exposure to greenhouse gases and awareness of related health risks. Although the sample size was limited, the survey provided useful insights into workplace conditions and existing preventive measures. The findings also highlighted the company's commitment to environmental protection through awareness campaigns on greenhouse gas risks and the development of extensive green spaces within the industrial complex, reflecting its efforts to improve environmental sustainability.

Keywords: Greenhouse gases (GHGs), Carbon dioxide (CO_2), Industrial pollution, Environmental toxicology, Gas chromatography, Liquefied petroleum gas (LPG), Occupational exposure, Environmental management, Climate change, Sustainable development

AMMONIUM FIXATION CAPACITY IN SOME SELECTED SOILS IN THE ISHËM RIVER BASIN, ALBANIA

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ABSTRACT

Ammonium (NH_4^+) fixation is an important soil process that regulates nitrogen retention, fertilizer use efficiency and NH_4^+ availability for plant uptake. By retaining NH_4^+ within the soil matrix, this process reduces nitrogen losses through leaching and nitrification, thereby enhancing nutrient conservation. However, excessive NH_4^+ fixation may temporarily reduce ammonium availability to plants, potentially limiting short-term nitrogen uptake. Therefore, quantifying the NH_4^+ fixation capacity of soils is essential for optimizing nitrogen management in agricultural systems. In this study, NH_4^+ fixation capacity of selected soils from the Ishëm River Basin was evaluated using batch adsorption experiments with 0.01 M $CaCl_2$ as the background electrolyte. Air-dried soil samples were equilibrated with NH_4Cl solutions containing 0, 5, 10, 20, 50 and 100 mg NH_4^+ L^{-1} at a soil-to-solution ratio of 1:10 for 24 h. The equilibrium NH_4^+ concentration was determined spectrophotometrically using the indophenol blue method and NH_4^+ fixation was calculated as the difference between the initial and equilibrium NH_4^+ concentrations. Results showed that NH_4^+ fixation increased progressively with increasing initial ammonium concentration in all soils. Compared with the sandy soil (5.2% clay), soils with higher clay contents exhibited substantially greater NH_4^+ fixation. The soil containing 62.5% clay reached a maximum fixation of 394.86 mg kg^{-1}, corresponding to 39–76% of the applied NH_4^+, whereas the sandy soil reached only 150 mg kg^{-1} (9–30% of applied NH_4^+). The highest NH_4^+ fixation was observed in the soil with an intermediate clay content (31.6%), reaching 506 mg kg^{-1} (47.47–65.1% of applied NH_4^+), likely due to the combined effects of clay minerals and its relatively high organic matter content (4.66%), which enhanced ammonium retention. Overall, the results highlight the important role of clay content in regulating NH_4^+ fixation, with organic matter likely acting as a complementary factor that enhances ammonium retention.

Keywords: Ammonium fixation, Batch adsorption experiments, Clay content, Organic matter, Ishëm River Basin

PHOSPHORUS FIXATION CAPACITY IN SELECTED SOILS OF THE ISHËM RIVER BASIN, CENTRAL ALBANIA

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ABSTRACT

Phosphorus fixation influences both fertilizers use efficiency and the potential transfer of phosphorus from soil to surface waters. However, phosphorus-fixation behavior in Albanian river basin soils remains poorly documented. This study assessed phosphorus fixation in topsoil (0–30 cm) from the Ishëm River Basin and examined its relationship with selected soil properties. Two grams of soil were equilibrated in duplicate with 20 mL of KH_2PO_4 solution prepared in 0.01 M $CaCl_2$, supplying 0, 25, 50, 100, 200 and 500 mg P kg^{-1} soil. Samples were shaken for 24 h at approximately 24 °C, and phosphorus remaining in solution was measured colorimetrically by the Murphy–Riley method. The selected soils exhibited total phosphorus levels ranging from 182.81 to 662.65 mg P kg^{-1}, organic matter contents from 0.94% to 4.66%, and clay contents from 5.16% to 62.48%. Fixed phosphorus was calculated as added phosphorus minus phosphorus remaining at equilibrium. Across all P additions, adsorption ranged from 38.31% to 98.99. Soils with higher clay and organic matter contents retained a greater proportion of added phosphorus, following logarithmic relationships with clay content ($R^2 = 0.962$) and organic matter content ($R^2 = 0.622$). These patterns indicate that total P content alone does not dictate fixation behavior, which is strongly governed by soil texture and organic matter content. These preliminary findings provide an essential baseline for improving phosphorus-fertilizer management and assessing phosphorus mobility in the Ishëm River Basin.

Keywords: Phosphorus fixation, Ishëm River Basin, soil texture, organic matter, adsorption capacity

MAPPING GROUND VEGETATION BIODIVERSITY OF FOREST ECOSYSTEMS THROUGH SPATIAL ANALYSIS

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ABSTRACT

In this study we assessed the diversity of the ground vegetation across 29 circular plots inside the Mediterranean forest of the National Park Divjake-Karavasta. Ground vegetation and associated shrub and tree species in the study area forest exhibit varying conservation significance when assessed against national Red List data. The majority of species are generally classified as Least Concern or are not explicitly listed due to their broad distribution and ecological resilience. Similarly, Mediterranean and maquis-associated taxa such as Phillyrea angustifolia L., Erica arborea L., Rhamnus alaternus L., Paliurus spina-christi Mill., and Ruscus aculeatus L. are considered stable, although they may be affected locally by fire regimes and land-use change. In contrast, certain species demonstrate higher conservation sensitivity at the national level. Juniperus macrocarpa remains associated with vulnerable coastal dune habitats and is considered Near Threatened in regional contexts, while Pyrus pyraster (L.) Burgsd. is characterized by fragmented populations and may also be regarded as Near Threatened locally. The descriptive analysis highlights that the 29 plots of the Divjaka Mediterranean forest are characterized by a vertically developed vegetation structure, but with significant horizontal heterogeneity, especially in the lower vegetation layers. These patterns highlight that, although most species fall under Least Concern globally, incorporating national-level conservation assessments is essential for accurately identifying ecologically sensitive vegetation clusters in spatial analyses such as SKATER, thereby improving biodiversity mapping and conservation planning in Albanian ecosystems.

Keywords: biodiversity, forest, structure, map, spatial analyses

HABITAT-BASED ANALYSIS OF SPECIES DIVERSITY IN DIVJAKË–KARAVASTA NATIONAL PARK

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ABSTRACT

The objective of this research was to assess the tree species diversity structure and composition within two different habitats of Divjakë-Karavasta National Park. Thirty-five circular sampling plots (0.1 ha each; radius 11.28 m) were established to characterize the tree communities within the study area. In total, 2,336 trees were inventoried. The Kulari (Argjinatura Shkumbin) forest contained 45 plant taxa distributed among 11 orders, 15 families, 19 genera, and 22 species, whereas the Gjeneruka forest comprised 31 taxa representing 8 orders, 10 families, 13 genera, and the same number of species (22). Analysis of the 15 sampling plots in the first forest habitat showed that the four most abundant tree species Populus alba L., Ulmus campestris L., Cornus mas L., and Phillyrea latifolia L. accounted for 57.41% of the total tree abundance. In the second forest habitat, based on data from 20 sampling plots, Carpinus orientalis Mill. was the dominant species, exhibiting the highest relative density (33%). It was followed by three members of the Fagaceae family: Quercus cerris L., Quercus frainetto Ten., and Quercus robur L. Differences in forest structure were examined through analyses of tree height and diameter-class distributions. Spatial variation in tree diversity was mapped in ArcGIS 10.5 using the Shannon, Simpson, and Species Richness indices. The results reveal distinct patterns of species diversity and stand structure between the two habitats, providing ecological evidence that can support biodiversity conservation, habitat management, and long-term monitoring within Divjakë–Karavasta National Park and other protected landscapes in Albania.

Keywords: tree species, habitat, ecological diversity, composition, forest structure

VALORIZATION OF AGRICULTURAL WASTE INTO ACTIVATED CARBON: CHARACTERIZATION AND PERFORMANCE FOR PHARMACEUTICAL POLLUTANT REMOVAL FROM WATE

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ABSTRACT

In this study, an activated carbon was prepared from broad bean (faba bean) pods, an abundant agricultural waste, by chemical impregnation. Two activating agents were compared: phosphoric acid (100%, 150%, 200%) and sulfuric acid (200%). The results showed that the carbon activated with 200% phosphoric acid exhibited the best performance, with an adsorption capacity of 107.5 mg/g, compared to 90 mg/g for sulfuric acid and only 2.98 mg/g for the raw pods. The study also investigated the parameters influencing adsorption, namely pH, temperature, ionic strength, and initial pollutant concentration. Adsorption equilibrium was reached within only 5 minutes for concentrations below 150 mg/L, indicating rapid kinetics consistent with the pseudo-second-order model. Fitting of the data to the Langmuir model confirmed monolayer adsorption, while thermodynamic analysis enabled the evaluation of key parameters such as Gibbs free energy, enthalpy, and entropy. The characteristics of the activated carbon (specific surface area, functional properties) were confirmed by BET, FTIR, and pHpzc analyses. These results demonstrate that the use of activated bean pods constitutes a sustainable, economical, and effective alternative for the remediation of water contaminated with pharmaceutical residues. This process falls within a circular economy approach aimed at valorizing agricultural waste into high-added-value materials for the preservation of water resources.

Keywords: Agricultural waste, activated carbon, adsorption, metoprolol, environment, remediation; circular economy

A HYBRID CEO_2 NANOZYME–ACTIVATED CARBON PLATFORM FOR ADSORPTION AND CATALYTIC DEGRADATION OF PERFLUOROALKYL ACIDS

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ABSTRACT

Perfluoroalkyl acids (PFAAs), a major subgroup of per- and polyfluoroalkyl substances (PFAS), are persistent organic pollutants (POPs) that pose serious risks to aquatic ecosystems and human health due to their exceptional chemical stability and resistance to conventional wastewater treatment processes. This project aims to develop an innovative and sustainable hybrid treatment material by immobilizing cerium oxide (CeO_2) nanozymes onto activated carbon (AC) to enable the simultaneous adsorption and catalytic degradation of PFAAs. The fabricated CeO_2-AC composite will be thoroughly characterized using advanced analytical techniques, including scanning electron microscopy (SEM), transmission electron microscopy (TEM), Brunauer–Emmett–Teller (BET) surface area analysis, X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and X-ray photoelectron spectroscopy (XPS). Batch experiments will be conducted to evaluate the effects of key operational parameters, including pH, oxidant concentration, temperature, and nanozyme loading, on PFAA removal performance. The degradation mechanisms and transformation products will be investigated using LC-MS/MS, high-resolution LC-MS, and electron paramagnetic resonance (EPR) spectroscopy. In addition, the stability, regeneration, and reusability of the composite material will be systematically assessed. By integrating the superior adsorption capacity of activated carbon with the enzyme-mimicking catalytic activity of CeO_2 nanozymes, this study proposes a highly efficient and environmentally sustainable strategy for the remediation of persistent, fluorinated contaminants. The findings are expected to advance next-generation water treatment technologies, promote sustainable material reuse within a circular economy framework, and contribute to the United Nations Sustainable Development Goals (SDGs) related to clean water, sustainable industry, and environmental protection.

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Keywords: Perfluoroalkyl acids; Cerium oxide nanozymes; Activated carbon, Catalytic degradation, Wastewater treatment

SMART COMPOSITE DESIGN: CARBOXYMETHYL CELLULOSE-MOF FOR EFFICIENT DYE REMOVAL AND BACTERIAL CONTROL

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ABSTRACT

MOF-polymer composite hydrogels have gained significant attention as advanced platforms for pollutant removal, combining the high porosity of MOFs with the flexibility and processability of polymer networks. In this study, a novel carboxymethyl cellulose-MOF-based composite hydrogel grafted with poly(acrylic acid) was synthesized via a rapid microwave-assisted method and evaluated as a dual-functional material for dye removal and antibacterial applications. The developed hydrogel composite demonstrated outstanding adsorption performance toward organic dyes, achieving over 90% removal of crystal violet at neutral pH. Adsorption kinetics followed a pseudo-second-order model, indicating strong interactions between the adsorbent and dye molecules. Isotherm analysis revealed that the Freundlich model best described the adsorption behaviour, suggesting heterogeneous and multilayer adsorption, while the Langmuir model predicted a high maximum adsorption capacity (q_{max}) of 1970 mg g^{-1}. The composite also exhibited excellent reusability, maintaining a high adsorption capacity of 1783 mg g^{-1} after ten adsorption-desorption cycles, with a cumulative adsorption capacity exceeding 23,500 mg g^{-1}. In addition to its adsorption capabilities, the hydrogel showed broad-spectrum antibacterial activity against both Gram-positive (*Staphylococcus aureus*, *Streptococcus pneumoniae*) and Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa)* bacteria, with inhibition zones up to 25 mm and minimum inhibitory/bactericidal concentrations as low as 125/250 µg mL^{-1}. These results highlight the potential of this multifunctional composite hydrogel as an efficient and sustainable platform for integrated water purification, combining high-capacity dye removal with effective antimicrobial performance.

Acknowledgement: This work has received funding support from the European Union's Horizon Europe research and innovation program under the Marie Skłodowska-Curie Grant Agreement No. 101126655, and from the Scientific and Technological Research Council of Türkiye under the scope of Agreement No. 123C459.

Keywords: Carboxymethyl cellulose-MOF, MOF-based composite hydrogel, Dye removal, Adsorption performance, Reusability, Antibacterial activity, Water purification

ASSESSMENT OF URBAN AIR QUALITY IN ELBASAN (ALBANIA) BASED ON AIR MONITORING DATA

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ABSTRACT

Urban air pollution is a growing environmental and public health challenge in Albania, driven by rapid urbanization and inadequate infrastructure. Elbasan, a major city with a strong industrial legacy, is particularly vulnerable. This study aims to evaluate urban air quality in Elbasan city using 2023 monitoring data, generated through measurements conducted by the National Environmental Agency (AKM) for key pollutants, including PM_{10}, NO_2, CO, O_3, SO_2, and C_6H_6. The analysis of the monitoring data shows that for some of the main pollutants (NO_2 and PM_{10}), the concentrations measured during 2023 exceeded or were very close to the limit values established by international air quality standards. The annual average NO_2 concentration (32.94µg/m³) remains below the EU limit of 40 µg/m³ but is approximately 3.5 times higher than the 2021 WHO guideline of 10 µg/m³. Regarding PM_{10}, the annual average concentration (47.85 µg/m³) slightly exceeds the EU limit (40 µg/m³) but is more than three times higher than the WHO guideline value (15 µg/m³). Additionally, daily PM_{10} concentrations frequently surpass both EU and WHO daily limits, indicating exceedances of both short-term and long-term air quality standards. Seasonal analysis shows that air quality is poorest during winter, when pollutants such as PM_{10}, NO_2, CO, and C_6H_6 reach their highest concentrations and most frequent exceedances. This pattern is driven by both winter meteorological conditions and increased human activities. These results also demonstrate that, especially during the colder months, residents of Elbasan are exposed to air pollution levels that may harm health, with children, older adults, and people with pre-existing health conditions being the most vulnerable.

Keywords: urban air quality, air pollution, air quality monitoring, Elbasan

PHYSICOCHEMICAL, ELEMENTAL AND SPECTROSCOPIC CHARACTERIZATION OF SEWAGE SLUDGE FROM THE JIJEL WASTEWATER TREATMENT PLANT (ALGERIA) FOR AGRICULTURAL VALORIZATION

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ABSTRACT

Agricultural valorization of sewage sludge represents a sustainable management strategy that contributes to nutrient recycling and soil improvement. However, its safe use requires comprehensive physicochemical and mineralogical characterization. This study aimed to characterize sewage sludge collected from the Jijel Wastewater Treatment Plant (northeastern Algeria) using physicochemical analyses combined with X-ray diffraction (XRD), X-ray fluorescence (XRF), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy coupled with energy-dispersive X-ray spectroscopy (SEM–EDS). The sludge exhibited a near-neutral pH (6.76), moderate electrical conductivity (1.77 mS cm^{-1}), high organic matter content (54.11%), and appreciable concentrations of nitrate and phosphorus. XRD analysis identified quartz as the dominant crystalline phase, together with calcite and feldspars. XRF revealed that calcium, silicon, iron, aluminum, phosphorus, and potassium were the predominant elements, whereas Zn, Cu, Cr, Ni, As, and Pb were detected at relatively low concentrations. FTIR confirmed the coexistence of mineral and organic constituents, while SEM observations revealed a heterogeneous and porous microstructure consistent with the EDS elemental composition. The complementary analytical approach demonstrated that the Jijel sewage sludge possesses physicochemical and mineralogical characteristics compatible with agricultural valorization. Nevertheless, its practical use should comply with applicable environmental regulations and be supported by further agronomic and environmental assessments under field conditions.

Keywords: Sewage sludge, Agricultural valorization, X-ray diffraction, X-ray fluorescence, FTIR, SEM–EDS, Physicochemical characterization

VALORIZATION OF SEWAGE SLUDGE THROUGH THE INCORPORATION OF DATE PALM PETIOLES PRIOR TO COMPOSTING

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ABSTRACT

The agricultural reuse of sewage sludge is often limited by its relatively low carbon-to-nitrogen ratio and the presence of potentially toxic elements. This study investigated the use of date palm (Phoenix dactylifera L.) petioles as a carbon-rich co-substrate to improve the initial characteristics of sewage sludge prior to composting. Five mixtures containing different sludge-to-petiole mass ratios (100:0, 80:20, 60:40, 40:60 and 20:80, w/w) were prepared and characterized. Physicochemical properties (pH, electrical conductivity, nitrate concentration and chemical oxygen demand), CHNS elemental composition, energy-dispersive X-ray fluorescence (ED-XRF), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy coupled with energy-dispersive spectroscopy (SEM–EDS) were used to evaluate the suitability of the mixtures as composting substrates. The addition of date palm petioles progressively increased the carbon-to-nitrogen ratio from 6.51 in raw sewage sludge to 31.86 in the mixture containing 80% petioles, while decreasing nitrogen content and the concentrations of potentially toxic elements through a dilution effect. ED-XRF analysis showed that all mixtures retained essential mineral nutrients while maintaining trace element concentrations well below the limits established by the Algerian standard NA 17 731 and AFNOR guidelines. FTIR spectra confirmed the coexistence of functional groups characteristic of sewage sludge and lignocellulosic biomass, whereas SEM–EDS observations revealed heterogeneous and porous structures favorable for microbial colonization. These results demonstrate that date palm petioles constitute an effective and sustainable bulking agent for improving the initial suitability of sewage sludge as a composting substrate. The proposed approach simultaneously promotes the valorization of two abundant organic residues and provides a promising strategy for the production of high-quality compost within a circular economy framework.

Keywords: Sewage sludge, Date palm petioles, Composting, CHNS, ED-XRF, FTIR, SEM–EDS, Circular economy

IDENTIFICATION AND QUANTIFICATION OF HEMOPARASITES OF THE BLUE TIT (CYANISTES TENERIFFAE L. 1831) IN AN EVERGREEN FOREST IN NORTHEASTERN ALGERIA

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ABSTRACT

Parasitic ecology is a rapidly developing discipline, owing to the potential role of parasites in regulating host populations and their impact on the balance and functioning of ecosystems. Parasites are an integral part of the natural evolution of animals and form an important component of ecosystem biodiversity. Parasites are divided into two main categories according to their size: microparasites (viruses, bacteria and protozoa) and macroparasites (helminths and arthropods). Birds host a wide variety of these parasites: cestodes, nematodes, arthropods, microparasites and haemoparasites. The latter includes bacteria, mycoplasmas, protozoa and flagellates that live in the blood of living hosts. Our work was carried out in a cork oak forest located in El-Kala National Park, in the far north-east of Algeria. Observations were made on 58 blood smears taken from 15 broods during the breeding season. We were able to identify five genera of blood parasites (four protozoa (Plasmodium, Haemoproteus, Leucocytozoon, Trypanosoma) and one nematode (Microfilaire)). The quantitative assessment of blood parasites was carried out by calculating parasite indices. Thus, the genus Haemoproteus was the most abundant, followed by Plasmodium, Leucocytozoon, Trypanosoma and Microfilaire. With regard to prevalence, the results also indicate that Haemoproteus is the most prevalent. It is present in 85.71 % of broods, followed respectively by Plasmodium and Leucocytozoon, found in 71.42 % of broods, Trypanosoma in 57.14 % of broods and Microfilaire in 28.57 % of broods. Plasmodium is the parasite with the highest average intensity, followed by Haemoproteus, Microfilaire, Trypanosoma and Leucocytozoon.

Keywords: Birds, Blue Tit, Cyanistes teneriffae, Haemoparasites, Forest.

URBANISATION AND NESTING STRATEGY IN MIGRATORY BIRDS: THE CASE OF THE WHITE STORK CICONIA CICONIA CICONIA IN NORTHEASTERN ALGERIA

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ABSTRACT

The effects of human activity on the white stork have raised many questions, given the complexity of the species' adaptive traits. Some studies suggest that the species thrives in urbanized areas and that human presence has a largely positive impact on the species' survival and reproduction, whilst other studies suggest that, over time, urbanization and human activity have had negative effects on stork populations, affecting both their habitats and their behavior and diet. The nesting strategies of the white stork have changed radically over recent decades. A declining number of couples are nesting at traditional nesting sites – such as trees, rooftops and chimneys – whilst electricity pylons are increasingly being chosen. Our study was carried out in north-eastern Algeria in three localities (Ben M'hidi, Dréan and Berrahal), which are home to the region's three largest populations. These localities have varying degrees of urbanisation. The results reveal that 55.5 % of white stork nests are found in Berrahal (urban area), Ben M'Hidi (a peri-urban area) accounts for 27.% of the nests, whilst Dréan (a rural area) accounts for 16.8 %. These results suggest that the urban environment of Berrahal offers more favorable nesting condition. Storks use a variety of nesting sites, with a marked preference for poles, which account for nearly 75 % of nests, followed by the 'other' category, which encompasses various man-made structures and accounts for 12 % of nests. Next come trees and roofs, with 7 % and 6 % of nests respectively.

Keywords: White stork, urbanization, strategy, nesting, supports, nests

AIRBORNE ULTRAFINE PARTICLES IN PRIMARY SCHOOLS: EVIDENCE OF RESPIRATORY RISKS IN ALGERIAN SCHOOLCHILDREN

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ABSTRACT

Background: Ultrafine particles (UFPs; ≤100 nm) are increasingly recognized as important contributors to adverse respiratory health because of their ability to penetrate deep into the respiratory tract and induce oxidative stress and inflammation. Despite growing concern worldwide, evidence from African countries remains extremely limited, particularly in school environments where children spend a substantial part of their day. **Methods:** This study investigated the relationship between school-based UFP exposure and respiratory health among 1,291 children attending 14 primary schools in the Kabylie region of Algeria. Indoor and outdoor UFP number concentrations were measured during autumn and winter using a portable particle counter. Respiratory outcomes, including physician-diagnosed asthma and a composite respiratory morbidity variable, were extracted from school medical records. Associations between exposure and health outcomes were examined using multivariable logistic regression, dose-response analyses, weighted ecological regression, and complementary sensitivity analyses. **Results:** UFP concentrations were consistently higher in urban schools than in rural schools, with the highest indoor median values reaching approximately 20,000 particles·cm^{-3} during autumn. Children attending schools with elevated indoor UFP concentrations showed significantly greater odds of respiratory morbidity and asthma, particularly at exposure levels above 15,000 particles·cm^{-3}. A clear dose-response relationship was observed, with respiratory risk increasing progressively across exposure categories. Additional statistical approaches, including ecological and sensitivity analyses, produced findings consistent with the primary models, reinforcing the robustness of the observed associations. **Conclusions:** This study provides the first evidence linking school-based UFP exposure with respiratory health outcomes among Algerian schoolchildren. The results suggest that elevated UFP concentrations in school environments may contribute to a higher burden of respiratory diseases and highlight the importance of improving school air quality through targeted environmental and public health interventions. Further longitudinal studies incorporating personal exposure assessment are warranted to better characterize the long-term health effects of UFP exposure in children.

Keywords: Ultrafine particles, School air quality, Respiratory health, Children, Environmental epidemiology

PLANT BIOCHEMICAL BIOMONITORING AS A PRACTICAL TOOL FOR EVALUATING ULTRAFINE PARTICLE POLLUTION IN RESOURCE-LIMITED SETTINGS

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ABSTRACT

Conventional monitoring of ultrafine particles (UFPs) relies on expensive instrumentation that remains inaccessible to many low- and middle-income countries, creating substantial gaps in air quality surveillance. Plant biomonitoring offers a promising alternative by exploiting physiological responses that integrate pollutant exposure over time. This study investigated whether the spider plant (Chlorophytum comosum) can serve as a practical biological indicator of UFP pollution in school environments. A total of 135 comparable juvenile plants were deployed for 90 days in fifteen urban and rural primary schools in the Béjaïa region of northern Algeria. Plants were exposed indoors and outdoors under standardized conditions. Chlorophyll a, chlorophyll b, total chlorophyll, and free proline contents were measured before exposure, after 45 days, and after 90 days. These biochemical responses were compared with previously measured UFP concentrations recorded at the same schools. Associations were evaluated using non-parametric correlation analyses, group comparisons, principal component analysis, regression models, and classification tree analysis. Clear physiological responses were observed along the pollution gradient. Proline accumulation increased significantly with increasing UFP concentrations (Spearman's $\rho = 0.59$, $p < 0.001$), whereas chlorophyll pigments declined progressively, indicating impairment of the photosynthetic apparatus under higher pollution levels. Exposure duration strongly influenced biomarker performance: chlorophyll responses became markedly stronger after prolonged exposure, suggesting that approximately three months are required to capture chronic pollution effects reliably. Multivariate analyses confirmed that plant physiological changes closely followed the combined influence of traffic intensity, industrial activity, and airborne UFP concentrations. Among all biomarkers evaluated, proline demonstrated the highest ability to discriminate pollution categories. These findings provide the first evidence from Algeria that Chlorophytum comosum can reflect spatial variations in atmospheric UFP exposure through measurable biochemical responses. The proposed biomonitoring approach represents an affordable and reproducible alternative for environmental surveillance in regions where conventional air quality monitoring remains limited, while offering new opportunities for large-scale pollution assessment in school environments and other urban settings.

Keywords: Biomonitoring, Ultrafine particles, Chlorophytum comosum, Air pollution, Physiological biomarkers

MICROPLASTICS IN SOIL ECOSYSTEMS: IMPACTS ON MICROBIAL COMMUNITIES, NUTRIENT CYCLING, AND AGRONOMIC SUSTAINABILITY

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ABSTRACT

Microplastics (MPs), defined as synthetic polymer particles smaller than 5 mm, have become pervasive contaminants in terrestrial ecosystems. Soils, particularly agricultural soils, are now recognized as major sinks for MPs due to inputs from plastic mulching, sewage sludge, compost, irrigation water, and atmospheric deposition. Their persistence, diverse morphology, and chemical complexity enable MPs to interact directly with soil microorganisms, which are central to nutrient cycling, organic matter decomposition, and plant health. This review synthesizes current knowledge on the ecological risks and microbial responses associated with MPs in soil. MPs alter soil physical properties such as porosity, bulk density, and water retention, thereby reshaping microbial habitats. They also act as carriers of persistent organic contaminants, heavy metals, and antibiotics, amplifying combined toxicity. At the microbial level, MPs induce shifts in community composition, favoring taxa capable of colonizing plastic surfaces or tolerating oxidative stress, while reducing the abundance of nitrifiers and ammonia oxidizers. Functional consequences include disrupted carbon, nitrogen, and phosphorus cycling, altered enzyme activities, and increased greenhouse gas emissions. Plant–microbe symbioses, including nitrogen-fixing bacteria and arbuscular mycorrhizal fungi, are impaired, leading to reduced nutrient uptake and crop productivity. Although certain microorganisms demonstrate limited biodegradation potential, ecological benefits are outweighed by concerns regarding long-term accumulation, persistence of additives, and potential horizontal gene transfer of resistance traits. Significant knowledge gaps remain, particularly regarding chronic field-scale impacts under diverse agro-climatic conditions. Future research should integrate molecular, ecological, and biogeochemical approaches to assess cumulative effects and inform sustainable strategies for mitigating MP pollution in soils.

Keywords: Microplastics, Soil microorganisms, Microbial community shifts, Biodegradation, Carbon and nitrogen cycling, Soil fertility, Ecological risks, Plastisphere, Environmental sustainability

HEAVY METAL ACCUMULATION IN THE EDIBLE LAND SNAIL CORNU ASPERSUM (GASTROPODA: HELICIDAE) FROM THE RÉGHAÏA RAMSAR WETLAND (NORTHERN ALGERIA)

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ABSTRACT

The edible land snail Cornu aspersum is a recognized bioindicator of terrestrial pollution because it accumulates trace elements from contaminated environments. This study evaluated arsenic (As), zinc (Zn), and lead (Pb) concentrations in C. aspersum collected from the Réghaïa Ramsar wetland, northern Algeria, an ecosystem exposed to agricultural, urban, and industrial pressures. The work complements previous parasitological investigations on the same snail population and contributes to an integrated assessment of environmental quality. Heavy metal analyses were carried out by the Algerian Scientific Police Laboratory. Arsenic concentrations ranged from below the detection limit to 0.071 µg g^{-1}, zinc from 0.742 to 3.479 µg g^{-1}, and lead from 1.106 to 20.01 µg g^{-1}. The highest lead concentrations were recorded in samples H4P and H5P, indicating marked spatial variability and suggesting localized contamination sources within the wetland. In contrast, arsenic remained at very low concentrations in all analyzed samples. The results confirm the capacity of C. aspersum to reflect environmental contamination by trace metals and support its application in biomonitoring programs. The elevated lead concentrations detected in some samples warrant further investigation because this edible species may represent a pathway for human exposure. This study provides the first baseline data on heavy metal accumulation in C. aspersum from the Réghaïa Ramsar wetland and supports future ecotoxicological monitoring and conservation strategies in protected Mediterranean ecosystems.

Keywords: Cornu aspersum, heavy metals, lead, zinc, arsenic, biomonitoring, Algeria

A SCIENCE MAPPING ANALYSIS OF GLOBAL WILDLIFE HABITAT RESEARCH: THEMATIC STRUCTURE AND RESEARCH TRENDS (1978–2026)

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ABSTRACT

The conservation and sustainable management of wildlife habitats have gained increasing importance in recent years due to global environmental challenges such as biodiversity loss, habitat fragmentation, and climate change. These challenges have stimulated a growing body of scientific research and diversified the range of topics addressed within wildlife habitat studies. Nevertheless, research on wildlife habitats continues to evolve under different conceptual frameworks, and evaluating the knowledge structure shaped around habitat quality, habitat restoration, habitat enhancement, and carrying capacity within a common framework may contribute to a better understanding of the field's overall developmental dynamics. Therefore, this study aims to reveal the scientific development, thematic structure, and research trends of wildlife habitat research during the period 1978–2026 through bibliometric analysis. The dataset consists of 136 publications retrieved from the Web of Science and Scopus databases. Bibliometric analyses were conducted using the Bibliometrix/Biblioshiny software package. The knowledge structure of the field was examined through fundamental bibliometric indicators, annual scientific production, thematic mapping, and thematic evolution analyses. The findings indicate a long-term but fluctuating pattern of scientific production, with publication output increasing markedly after 2010. Thematic mapping revealed that habitat quality, ecosystems, and forestry represent well-developed and driving themes of the field, whereas biodiversity, habitat, and diversity constitute its core conceptual structure. Thematic evolution analysis further demonstrated that research initially centered on management, wildlife, and vegetation gradually expanded to encompass broader topics, including biodiversity, conservation, ecosystems, and climate change. These findings suggest that wildlife habitat research has evolved from a relatively narrow knowledge domain focused on specific concepts toward a multidimensional research field integrating conservation biology and ecosystem-based approaches. Rather than merely evaluating publication performance, this study provides a comprehensive assessment of the knowledge structure and thematic development of wildlife habitat research, highlighting current research priorities and offering an integrated perspective for identifying future research directions.

Keywords: Wildlife habitat, Science mapping, Bibliometric analysis, Habitat quality, Thematic evolution, Conservation biology

HIGH-TEMPORAL-RESOLUTION MONITORING OF AIRBORNE PARTICLE SIZE DISTRIBUTION IN URBAN MICROENVIRONMENTS: A TOOL FOR ASSESSING SHORT-TERM HUMAN EXPOSURE

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ABSTRACT

Urban microenvironments constitute the interface between anthropogenic activities and human health, where rapid fluctuations in airborne particles may substantially influence short-term human exposure. Conventional air-quality assessments rely primarily on fixed monitoring stations and time-averaged concentrations, which may not adequately capture the highly dynamic conditions experienced by pedestrians in traffic-related environments. The present study explores the potential of high-temporal-resolution monitoring to characterize exposure dynamics in urban microenvironments. Field measurements were carried out at selected urban bus stops in Burgas, Bulgaria, using a portable optical particle counter capable of simultaneously recording particle number concentrations in six size fractions (0.3, 0.5, 1.0, 2.5, 5.0, and 10.0 μm), together with air temperature and relative humidity. Measurements were performed at one-minute intervals during periods of increased traffic intensity and pedestrian activity in order to capture rapid changes in airborne particle concentrations. The monitoring demonstrated considerable short-term variability across all particle size fractions, characterized by transient concentration peaks followed by rapid recovery to background conditions. Elevated concentrations generally persisted for only a few minutes, indicating that individual exposure is governed by the interaction between particle concentration, exposure duration, and spatial position within the monitored microenvironment rather than by concentration alone. Despite these transient fluctuations, the overall measurements confirmed good ambient air quality throughout the study period. The findings demonstrate that high-temporal-resolution monitoring provides a more realistic representation of short-term exposure than conventional fixed-station measurements. This approach offers valuable support for exposure assessment, urban environmental management, and evidence-based public health recommendations, while contributing to a better understanding of human–environment interactions in urban ecosystems.

Keywords: urban microenvironments, airborne particles, particle size distribution, human exposure, high-temporal-resolution monitoring, environmental health

AIR–WATER TEMPERATURE DYNAMICS AS AN EARLY INDICATOR OF CONDITIONS FOR MOSQUITO LARVAL DEVELOPMENT

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ABSTRACT

Timely mosquito control depends on identifying when aquatic habitats begin to provide suitable thermal conditions for larval development. Measures applied before mosquito populations increase substantially are generally more targeted, effective and economically efficient than interventions initiated after adult abundance has already become high. However, assessments based solely on air temperature may not accurately represent the thermal conditions experienced by mosquito larvae in aquatic environments. This study examined air–water temperature relationships in the River Tundzha near Yambol, Bulgaria, using continuous environmental monitoring from April to July 2026. A data logger recorded water temperature, air temperature and relative humidity at 30-minute intervals, producing 4,275 synchronised observations. The analysis focused on seasonal warming, short-term air–water temperature dynamics and temporary cooling events associated with documented rainfall and related hydrological changes. Water temperature followed the overall seasonal increase in air temperature but exhibited lower short-term variability, reflecting the thermal buffering capacity of the river. Changes in water temperature generally occurred more gradually than atmospheric temperature fluctuations. Rainfall-related hydrological events temporarily interrupted the seasonal warming pattern and caused distinct declines in water temperature, even during periods of generally increasing air temperatures. These observations indicate that air temperature alone cannot reliably determine the onset or continuity of suitable thermal conditions for mosquito larval development in flowing waters. Continuous monitoring within aquatic habitats can provide an early, site-specific indication of when thermal conditions become favourable for larval development. This information can improve the timing and spatial targeting of mosquito control by distinguishing rapidly warming water bodies that may require early intervention from deeper, cooler or strongly flowing habitats where conditions remain less favourable. The proposed monitoring approach can therefore support faster, more effective and lower-cost mosquito management while reducing unnecessary treatment of aquatic environments that do not require intervention.

Keywords: mosquito larval development, water temperature, air–water temperature dynamics, environmental monitoring, rainfall events; mosquito control

FAMILY-DEPENDENT RESPONSES OF PLANT PHENOLIC ANTIOXIDANTS TO WILDFIRE IN BULGARIAN GRASSLANDS

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ABSTRACT

Wildfires are an increasingly frequent disturbance in grassland ecosystems, affecting plant physiology and potentially altering plant secondary metabolism. Understanding how fire influences the accumulation of bioactive secondary metabolites is important for evaluating both plant adaptation and the quality of plant resources. To assess post-fire responses after vegetation recovery, phenolic antioxidants were determined in medicinal and leguminous species collected from burned and adjacent unburned grasslands in Bulgaria approximately one year after a wildfire event. The study included medicinal Lamiaceae (Satureja sp., Teucrium sp.) from Krapets and Fabaceae legumes (Trifolium sp., Vicia sp., Lotus sp.) from Ponor and Karavelovo. The response to fire was family-dependent and differed between the investigated plant groups. Satureja and Teucrium collected from unburned habitats exhibited higher total phenolic content than plants from burned areas. In contrast, leguminous species showed the opposite trend, with increased phenolic accumulation in post-fire habitats compared with their respective controls. These contrasting patterns indicate that fire does not induce a uniform metabolic response across grassland species and acts as an ecological filter that reshapes plant communities and resource availability during succession. The contrasting phenolic responses among functional groups suggest family-specific recovery strategies shaped by life-history traits and ecological interactions. Fire creates open niches with reduced competition and altered resource availability, favouring species capable of rapid establishment during early succession. Leguminous species may benefit from nitrogen-fixing symbioses, allowing successful colonisation of disturbed habitats, while Satureja and Teucrium may prioritize regrowth and resource acquisition over additional secondary metabolite investment after disturbance. Studying the species composition and structure of grassland communities after a fire is important for clarifying the functioning of burned meadow ecosystems and, accordingly, for planning activities for their restoration.

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Keywords: wildfire, grassland ecosystems, post-fire recovery, phenolic antioxidants, Fabaceae, Lamiaceae

COMBINED ED-XRF ANALYSIS AND AQUEOUS EXTRACTION FOR ASSESSING THE ENVIRONMENTAL MOBILITY OF MINERAL CONSTITUENTS IN SEWAGE SLUDGE

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ABSTRACT

The environmental behaviour of sewage sludge depends not only on its total elemental composition but also on the mobility of its constituents after land application. In this study, sewage sludge samples collected from four municipal wastewater treatment plants in eastern Algeria (Jijel, Souk Ahras, Sidi Merouane and Ferdjioua) were investigated to evaluate the water-extractable fraction of their mineral constituents. The elemental composition of the sludge and the corresponding aqueous extracts was determined by energy-dispersive X-ray fluorescence spectroscopy (ED-XRF). In addition, pH, electrical conductivity, nitrate concentration and chemical oxygen demand (COD) were measured in the aqueous extracts. The sludge samples exhibited similar elemental compositions, with calcium, silicon and iron as the predominant elements. However, aqueous extraction revealed that only a limited fraction of these elements was transferred to the aqueous phase. Chlorine showed the highest extraction percentages, confirming its greater water solubility, whereas calcium, silicon and iron remained largely retained within the sludge matrix despite their high abundance. The physicochemical properties of the aqueous extracts also varied among the four wastewater treatment plants, indicating differences in the amount of dissolved mineral salts and organic matter released during extraction. These findings demonstrate that the environmental mobility of mineral constituents cannot be predicted solely from their total concentration in sewage sludge. The combined use of ED-XRF analysis and aqueous extraction provides a simple and effective approach for identifying potentially mobile elements and contributes to a more reliable assessment of sewage sludge prior to agricultural land application.

Keywords: Sewage sludge, ED-XRF, Aqueous extraction, Elemental mobility, Environmental assessment, Agricultural reuse

INTEGRATION OF RAINWATER HARVESTING (RWH) IN INDUSTRIAL ZONES: POTENTIAL, TECHNICAL ANALYSIS, AND REGULATORY FRAMEWORKS

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ABSTRACT

Accelerated climate change, increasing drought frequency, and rapid urbanization are placing growing pressure on freshwater resources and intensifying water scarcity worldwide. As conventional centralized water management strategies have become increasingly inadequate and costly, the integration of decentralized and locally available water sources has become imperative. Although the collection and storage of rainwater in cisterns has been practiced for centuries globally, including in Anatolia, these traditional systems were progressively abandoned during the rapid expansion of centralized water infrastructure in the mid- to late twentieth century. Traditional cistern systems were largely replaced by centralized, large-scale networks designed to convey water over long distances from major dams, lakes and aquifers. Today, however, increasing water demand, severe drought conditions, rising infrastructure costs, and the energy intensity of centralized water supply systems are contributing to renewed interest in rainwater harvesting (RWH) as a resilient and sustainable water management strategy. As a result, ancient rainwater harvesting is re-emerging as a decentralized alternative with the potential to provide reliable, sustainable and potentially more cost-effective water supplies. RWH systems using cisterns can be implemented in a wide range of settings, including residential buildings, housing complexes, shopping malls, sports centers, hospitals, military installations, and parking lots. Furthermore, the Organized Industrial Zones (OIZs) and the enterprises operating within them also offer significant potential for RWH due to their extensive rooftop areas and substantial non-potable water demand. While examples of such RWH applications remain limited in Türkiye, recent legislative developments, including the Planned Areas Construction Regulation and the Water Efficiency Regulation, have established a more supportive regulatory framework for their implementation. Therefore, the adoption of these technologies in both urban and industrial areas is expected to increase in Türkiye in the near future. This study examines the technical potential, practical applicability, regulatory compliance and economic feasibility of integrating RWH systems into industrial facilities located within an OIZ. The technical components and operational principles of RWH systems are reviewed, together with selected practical applications and the relevant regulatory framework in Türkiye. The potential for rainwater harvesting is then assessed for a number of pilot enterprises within an OIZ. Additionally, the potential for harvesting rainwater from the rooftops of various pilot companies within an OIZ was determined. Based on the rooftop areas and local rainfall characteristics of the selected facilities, the potential volume of harvestable rainwater is calculated, and the appropriate cistern capacities were determined. When sizing the optimal cistern volume, both the amount of harvestable water available to the enterprises and its temporal variation are taken into consideration. Finally, the required investment costs and the economic payback periods of these systems are evaluated to assess the feasibility and potential benefits of RWH implementation in industrial zones. The findings are expected to

contribute to the development of more decentralized, water-efficient, and climate-resilient water management practices in industrial areas.

Keywords: Rainwater Harvesting, Water reuse, Water Scarcity, Organized Industrial Zones, Water Efficiency, Industrial Water Management; Climate Resilience

EVALUATION OF TURKEY'S SCIENTIFIC VISIBILITY IN WILDLIFE HABITAT RESEARCH WITHIN THE CONTEXT OF GLOBAL BIBLIOMETRIC TRENDS

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ABSTRACT

The conservation and sustainable management of wildlife habitats is one of the increasingly important research areas today in terms of ensuring the continuity of biological diversity and protecting ecosystem services. In recent years, as international scientific production in this field has rapidly increased, it is important to evaluate the research performance and scientific visibility of different countries in the context of global trends. This study aims to evaluate Turkey's scientific visibility in wildlife habitat research in light of global bibliometric trends. The evaluation framework of the study is based on a global bibliometric dataset consisting of 136 publications obtained from the Web of Science and Scopus databases, covering the period from 1978 to 2026. The dataset was analyzed in the Bibliometrix/Biblioshiny environment; it was evaluated using annual scientific production, country contributions, international collaboration structures, prominent research themes, thematic evolution, and science mapping techniques. Bibliometric findings indicate that wildlife habitat research has shown significant development, especially in recent years; the focus of research has evolved from the identification of biodiversity to the axis of habitat management, restoration, and sustainability. Additionally, it is observed that scientific production is concentrated in certain countries and that international collaboration networks have a limited structure. When evaluated within this global framework, it is understood that Turkey's position and scientific visibility in the international wildlife habitat literature need to be assessed in more detail. The study evaluates Turkey's current position in wildlife habitat research within the context of global trends, offering a strategic perspective aimed at enhancing interdisciplinary research collaborations, increasing participation in international scientific networks, and strengthening conservation-focused research.

Keywords: Turkey, Wildlife habitat, Science mapping, Scientific visibility, Research trends

PROTECTING AQUATIC BIODIVERSITY THROUGH SIMULTANEOUS ANTIBIOTIC REMOVAL AND NITROGEN ELIMINATION USING 3D-BIOELECTROCHEMICAL SYSTEM

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ABSTRACT

Antibiotic residues and excess nitrogen released from municipal wastewater are major contributors to freshwater ecosystem degradation, threatening aquatic biodiversity by disrupting microbial communities and promoting the spread of antibiotic resistance. This study evaluates the performance of a 3-dimensional bioelectrochemical (3D-BE) system for the simultaneous removal of the antibiotics sulfamethoxazole (SMX) and nitrogen while investigating the responses of microbial communities under varying current intensities and pH conditions. The reactor was operated at current intensities up to 60 mA and pH values ranging from 6.5 to 7.9 to determine the optimal operating conditions for pollutant removal. Increasing the applied current significantly enhanced denitrification, with nitrate removal efficiency improving from 45.68% to 95.81%, while SMX removal increased from 15.78% to 91.50% within 4–8 h. The highest treatment performance was achieved at 60 mA and pH 6.5–7.9, whereas deviations from the optimal pH adversely affected denitrification efficiency. High-throughput Illumina sequencing revealed that the applied current and pH reshaped microbial community composition, increasing microbial diversity and enriching functional taxa associated with antibiotic biodegradation and nitrogen transformation. These microbial shifts contributed to enhanced reactor stability and pollutant removal under SMX stress. By simultaneously eliminating antibiotics and reactive nitrogen, the 3D-BE system reduces contaminant discharge into receiving waters, thereby mitigating ecological risks to freshwater ecosystems. This study demonstrates the potential of bioelectrochemical technology as a sustainable strategy for protecting aquatic biodiversity while improving municipal wastewater treatment performance.

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Keywords: Aquatic biodiversity, 3D-BE system, Nitrogen and Sulfamethoxazole removal, Microbial Communities

ASSESSMENT OF ORGANIC POLLUTION AND BDI TRENDS IN THE ERZEN RIVER, ALBANIA (2014–2024)

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ABSTRACT

The rapid increase of economic activities including agriculture, industrial development, uncontrolled gravel abstraction and unregulated urban wastewater discharges and lack of adequate infrastructure and management, has significantly increased pressure on rivers quality in Albania, thereby contributing to enhanced pollution levels. Land use particularly nearby rivers for different industrial activities and agriculture represent one of major sources of many organic and inorganic pollutants in surface and groundwater. Meanwhile untreated municipal and industrial wastewater can significantly affect the ecological functioning of river ecosystems. This study aims to assess the long-term variation of organic pollution in the Erzeni River during 2014–2024 using the biodegradability index (BDI), calculated as the ratio of five-day biochemical oxygen demand to chemical oxygen demand (BOD5/COD). Monitoring data covering the study period, reported in the annual environmental status reports published by the Albanian National Environmental Agency (NEA), together with the pressure analysis presented in the official Erzen River Basin Management Plan, were analyzed for two representative official monitoring sites. The results indicate persistent presence of organic pollution, particularly in areas affected by urban, industrial, and agricultural pressures. Individual BOD5 concentrations range from 5 to 20 mg/L, with no clearly distinguishable seasonal pattern. BDI values showed relatively limited interannual variation and generally ranged between 0.5 and 0.6. The highest individual BDI (0.89) was observed in 2021 and the lowest (0.38) in October 2014. The predominance of BDI values above 0.5 indicates that a substantial proportion of the organic matter present in the river was readily biodegradable. However, the continued occurrence of measurable BOD5 and COD concentrations throughout the studied period suggests persistent organic inputs. The EU WFD promotes the integrated management of water resources to support environmentally sustainable development and reduce pressures associated with excessive water abstraction and pollution. Albania has transposed such requirements in the national legislation and continuous to improve secondary legislation to better manage pollution control, environmental permitting, and water quality monitoring. Nevertheless, effective implementation of these requirements depends on robust monitoring systems, well-equipped laboratories, and clear data-sharing mechanisms. At present, these prerequisites are only partially established and operational. An integrated management approach is therefore required to (i) reduce organic and nutrient loads originating from urban wastewater discharges and agricultural activities, (ii) identify and control of heavy metal sources (urban/industrial

sources), including the role of sediments in their accumulation and potential remobilization; and (iii) improve monitoring programmes through the systematic inclusion of WFD priority substances, thereby enabling a comprehensive and WFD-compliant water quality assessment of the Erzeni River.

Keywords: River pollution, BOD/COD ratio, freshwater quality assessment.

CHEMICAL STATUS ASSESSMENT OF THE URBAN LANA RIVER, ALBANIA, UNDER THE EU WATER FRAMEWORK DIRECTIVE

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ABSTRACT

Maintaining or achieving Good chemical status of surface waters is a fundamental objective of the European Union Water Framework Directive (WFD) (200/60/EC). Urban rivers are particularly vulnerable to multiple anthropogenic pressures, including untreated wastewater discharges, stormwater runoff, and diffuse urban pollution, which collectively contribute to the deterioration of water quality. In Albania, comprehensive assessments of spatial variations in the chemical status of urban rivers remain limited, constraining the identification of pollution hotspots and the prioritization of effective management measures required to support WFD implementation. This study investigates how urban influence is reflected in chemical status of the Lana River, an urbanized tributary of the Ishëm River Basin. Monitoring was conducted from April 2024 to February 2026 at Lana 1, upstream, representing the key entry point of urban influence, and Lana 2, representing the site where urban pressures are accumulated. Lana 1 was monitored quarterly and Lana 2 monthly to capture pollution intensity and temporal variability. The chemical status assessment included pH, electrical conductivity (EC), biochemical oxygen demand (BOD5), chemical oxygen demand (COD), and the priority substances cadmium (Cd), nickel (Ni), and lead (Pb). Metals were determined by atomic absorption spectroscopy (AAS) and assessed against Annual Average Environmental Quality Standards (AA-EQS).

The results revealed a clear spatial deterioration in water quality along the urban reach of the river. Mean pH remained relatively stable, changing only from 7.73 at Lana 1 to 7.69 at Lana 2, whereas mean EC increased from 579 to 833 µs/cm. Median BOD5 and COD values increased from 37.05 to 60.0 mg/L and from 95.09 to 203 mg/L, indicating increased dissolved loads and intensified organic pollution consistent with urban wastewater direct inputs. Mean concentrations also increased downstream, from 0.56 to 0.71 µg/L for Cd, 18.86 to 25.49 µg/L for Pb, and 12.38 to 14.26 µg/L for Ni. Cd, Pb, and Ni exhibited frequent exceedances of their corresponding AA-EQS, with the most pronounced downstream increases observed for Cd and Pb. Overall, the integration of physicochemical indicators with priority-substance compliance revealed downstream water-quality deterioration along the urban reach of the Lana River and shows that for the investigated priority substances, for a period of two years of consistent quality monitoring, the river water failed to achieve good chemical status. The upstream-downstream monitoring approach, as applied in this case study, provides an evidence basis for prioritizing wastewater pollution control and strengthening pollutants source-oriented monitoring in compliance with WFD requirements for rivers management.

Keywords: Chemical status assessments, Priority substances, Wastewater pressure

PHARMACEUTICAL CONTAMINANTS IN AQUATIC ECOSYSTEMS AND THEIR ECOTOXICOLOGICAL EFFECTS

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ABSTRACT

Pharmaceutical compounds are widely used for the protection of human and animal health and the treatment of various diseases, and they are increasingly detected in environmental compartments due to their growing consumption. These compounds can enter the environment through domestic wastewater, hospital effluents, pharmaceutical manufacturing activities, and agricultural practices. Since they may not be completely removed by conventional wastewater treatment systems, pharmaceuticals can be detected in surface waters, groundwater, and sediments. Antibiotics, non-steroidal anti-inflammatory drugs, antidepressants, hormones, and antiviral drugs are among the most commonly detected pharmaceutical contaminants in aquatic environments. Although they generally occur at low concentrations, their continuous release into the environment and biological activity have raised concerns regarding their potential effects on non-target aquatic organisms. This review aims to evaluate the occurrence and sources of pharmaceutical contaminants in aquatic ecosystems and their ecotoxicological effects on different organisms. Available studies indicate that exposure to pharmaceuticals may adversely affect growth, development, reproduction, and behavior in various groups of organisms, ranging from algae and aquatic invertebrates to aquatic vertebrates. In addition, oxidative stress, neurotoxicity, genotoxicity, endocrine disruption, and alterations in biochemical and molecular responses are among the important ecotoxicological consequences associated with pharmaceutical exposure. In particular, chronic exposure, the combined effects of pharmaceutical mixtures, and the toxicity of transformation products have emerged as important concerns for aquatic ecosystems. Furthermore, antibiotic residues in the environment may contribute to the development and spread of antimicrobial resistance. **In conclusion**, the continuous presence of pharmaceutical contaminants in aquatic ecosystems and their potential to cause biological effects at different levels in non-target organisms highlight the importance of environmental monitoring of these compounds. Further studies focusing on the long-term and combined effects of pharmaceuticals at environmentally relevant concentrations are needed, together with integrated approaches to assess their ecological risks.

Keywords: Pharmaceutical contaminants, aquatic ecosystems, ecotoxicology, water pollution, ecological risk

COMBINED TOXICITY OF MICROPLASTICS AND CHEMICAL POLLUTANTS IN AQUATIC ORGANISMS

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ABSTRACT

Microplastics are widespread contaminants in aquatic ecosystems and have received increasing attention in recent years due to their potential environmental impacts. In aquatic environments, microplastics do not occur in isolation but coexist with heavy metals, pesticides, pharmaceuticals, and various organic contaminants. Their large surface area and physicochemical properties facilitate the adsorption of different chemicals onto their surfaces, raising concerns about their potential role in modifying the transport, bioavailability, and toxicity of coexisting pollutants. This review aims to evaluate the toxicological effects of combined exposure to microplastics and chemical pollutants in aquatic organisms. Available evidence indicates that interactions between microplastics and heavy metals, pesticides, pharmaceuticals, and other organic contaminants may vary depending on polymer type, particle size, surface characteristics, aging processes, and the physicochemical conditions of the surrounding environment. Combined exposures have been associated with oxidative stress, alterations in antioxidant defense systems, neurotoxic and genotoxic responses, as well as adverse effects on growth, development, reproduction, and behavior. However, the influence of microplastics on the toxicity of coexisting chemicals is not uniform. Depending on the properties of the contaminant, microplastic characteristics, exposure duration, and concentration, combined exposure may result in synergistic, antagonistic, or additive effects. Overall, interactions between microplastics and chemical pollutants represent an important factor that may modify the biological effects of contaminants in aquatic ecosystems. Considering combined effects alongside the toxicity of individual pollutants in environmental risk assessment may provide a more realistic understanding of exposure scenarios occurring in natural aquatic environments.

Keywords: Microplastics, combined toxicity, aquatic organisms, environmental pollutants, ecotoxicology

ENVIRONMENTAL AND SPATIAL ASSESSMENT OF SUSTAINABLE POST EARTHQUAKE SHELTER LOCATIONS IN TÜRKIYE

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ABSTRACT

Due to its location on active fault lines and high earthquake risk, Turkey is among the countries in need of disaster-resilient and sustainable settlement planning. Temporary accommodation areas established following an earthquake are not merely spaces where the basic needs of disaster victims are met; they are also settlement elements that can have long-term consequences in terms of land use, natural resource consumption, infrastructure requirements and environmental impacts. Therefore, when selecting shelter locations, it is important to consider factors such as land characteristics, natural disaster risks, the usability of existing infrastructure, environmental suitability and sustainability, in addition to safety and accessibility. The aim of this study is to examine the selection of sustainable post-earthquake shelter locations from the perspectives of environmental and spatial suitability and to assess Turkey's current conditions within this framework. Urban green spaces are important from both an environmental and functional perspective in the post-disaster planning of sustainable, long-term shelter areas. Whilst trees and vegetation help to reduce urban temperatures and the urban heat island effect, parks, gardens and permeable surfaces can help to minimise the risk of secondary disasters that may occur during periods of heavy rainfall by allowing rainwater to reach the ground more easily. Furthermore, the preservation of vegetation contributes to improving air quality and supporting biodiversity in cities. In particular, following an earthquake, open and accessible spaces play a vital role in enabling people to gather safely. For this reason, it is important to assess criteria such as population density, accessibility, existing infrastructure and usability in the event of a disaster when identifying green spaces. In this context, the selection of sustainable housing locations is considered to be of strategic importance in terms of minimising environmental impacts, making effective use of existing resources and infrastructure, developing disaster-resilient settlements, and supporting long-term sustainable urban planning. The study examined Turkey's current conditions using a SOAR (Strengths, Opportunities, Aspirations, Results) analysis. Under the 'Strengths' category, the disaster management experience gained following the earthquakes centred on Kahramanmaraş on 6 February 2023, existing disaster assembly areas, and developing institutional capacity were addressed. Under 'Opportunities', the United Nations Sendai Framework for Disaster Risk Reduction, policies aimed at sustainable and resilient cities, and emerging spatial analysis technologies were assessed. In line with 'Aspirations', the aim is to plan temporary accommodation areas in accordance with the principles of environmental sustainability, resource efficiency, accessibility and long-term urban resilience. Under the 'Results' section, the key outcomes identified are the reduction of exposure to natural and geological risks, the effective use of existing infrastructure, the improvement of accessibility, and the mitigation of environmental impacts. This approach takes the selection of sustainable shelter locations beyond post-disaster response, enabling an assessment from the perspectives of environmental sustainability and long-term urban resilience.

Keywords: Post earthquake shelter, Sustainable location selection, Environmental suitability, Urban resilience, SOAR

PERFORMANCE ASSESSMENT OF CO_2 ADSORPTION ON PRISTINE AND DOPED BIPHENYLENE NANOTUBES USING DFT AND INTEGRATED AHP-TOPSIS

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ABSTRACT

The development of efficient adsorbent materials for CO_2 capture is essential for reducing industrial carbon emissions and improving carbon-capture process efficiency. In this study, density functional theory (DFT) calculations were performed to investigate CO_2 adsorption on pristine and Al-, Si-, and Zn-doped biphenylene nanotubes (BPNTs) under gas-phase and aqueous-environment conditions. The aqueous environment was represented using the IEFPCM implicit-solvent model. The effects of heteroatom doping on structural stability, adsorption behavior, regeneration characteristics, and electronic properties were evaluated. The adsorption configurations and the energetic and electronic descriptors obtained from the available molecular calculations were used to characterize the interactions between CO_2 and the nanotube surfaces. Recovery time was estimated to assess the regeneration characteristics of the investigated adsorbents. The obtained results were subsequently evaluated using integrated Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) Multi-Criteria Decision-Making (MCDM) methods for comparative material selection. Five criteria, including adsorption distance, adsorption energy, recovery time, band-gap energy, and first hyperpolarizability, were considered in the decision-making process. These criteria represented CO_2-adsorbent interaction strength, regeneration capability, and electronic response. Their relative importance was determined using the AHP by aggregating expert assessments. The consistency analysis showed that the pairwise comparison structure was acceptable. The AHP results indicated that adsorption energy was the most influential criterion, followed by recovery time. The calculated criterion weights were incorporated into separate TOPSIS method for the gas and water phases. The TOPSIS evaluation indicated that Al-doped BPNT ranked first among the investigated alternatives under both gas- and water-phase conditions. This finding suggested that Al-doped BPNT provided the most favorable overall balance between CO_2 adsorption performance, regeneration requirements, and electronic response. The results demonstrated that adsorption strength alone was not sufficient for material selection and that regeneration and electronic properties should also be evaluated simultaneously. The integration of DFT-derived molecular information with AHP and TOPSIS provides a systematic framework for evaluating candidate CO_2 adsorbents

based on multiple performance criteria. The proposed approach converts molecular calculation results into a transparent material-ranking problem and supports process-oriented adsorbent selection for industrial CO_2-capture applications. These findings indicate that Al doping can improve the suitability of biphenylene nanotubes for CO_2 capture.

Keywords: CO_2 capture, Biphenylene nanotubes, Density functional theory, AHP, TOPSIS, Multi criteria decision making, Adsorbent selection, Carbon capture process optimization

PRIORITIZING ENVIRONMENTAL IMPACTS OVER SOLAR ENERGY SUITABILITY IN PHOTOVOLTAIC PLANT SITE SELECTION

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ABSTRACT

The rapid growth of utility-scale photovoltaic (PV) power plants plays a central role in the shift toward low-carbon energy systems. Yet large-scale PV deployment demands significant land area and can affect agricultural production, soil function, water resources, biodiversity, and other ecosystem services. Most PV site-selection studies use GIS and multi-criteria decision-making (MCDM) to identify locations with strong solar and technical potential. While these approaches have advanced spatial planning considerably, they generally merge energy and environmental criteria into one compensatory suitability score. As a result, a site with very high solar potential can still rank near the top even when it carries substantial environmental risk.
Growing evidence shows that ground-mounted PV systems affect soil moisture, soil temperature, vegetation cover, microbial communities, and overall ecosystem multifunctionality, with the size and direction of these effects shaped by land use and local conditions. Solar-planning research has also started to give more weight to water-energy conflicts, biodiversity protection, and land-use trade-offs. This shift suggests that energy adequacy and environmental compatibility should be treated as separate planning dimensions rather than merged into a single score. This study proposes an Energy-Adequacy-Constrained Environmental Conflict Framework (EAC-EC) for siting utility-scale PV plants in semi-arid regions. The framework applies the ε-constraint principle from multi-objective optimization together with the satisficing concept from decision theory, adapted specifically to environmentally conscious PV siting. EAC-EC does not introduce a new mathematical theory, nor does it replace established GIS-MCDM methods. Rather, it restructures existing spatial assessment procedures around a single guiding rule: minimize environmental conflict among locations that already meet a sufficient threshold of energy-production potential.

Keywords: photovoltaic power plant, land-use, semi-arid regions, environmental planning

A MACHINE LEARNING-BASED APPROACH FOR BIOFILM PREDICTION IN FOOD ENVIRONMENTS

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ABSTRACT

Fresh vegetables can serve as reservoirs for pathogenic and antibiotic-resistant bacteria, posing a growing challenge to food safety. One of the main factors contributing to bacterial persistence in agricultural environments is the ability to form biofilms, which enhance resistance to environmental stresses and facilitate long-term survival on plant surfaces. Accurately assessing the biofilm-forming potential of bacterial strains is essential for understanding contamination risks and supporting preventive strategies. However, conventional microbiological analyses are often time-consuming and resource-intensive. Therefore, the development of an automated prediction system represents a valuable solution for rapid and reliable assessment of bacterial behavior. In this study, experimental investigations were carried out to evaluate biofilm production under laboratory conditions and to examine its potential link with the colonization of Valerianella locusta leaves. To extract meaningful knowledge from public data, a comprehensive analytical workflow was implemented, enabling the exploration of relationships among microbiological characteristics and colonization patterns. Furthermore, statistical analyses were performed to identify key variables influencing biofilm development and bacterial adaptation to plant-associated environments. To support the automatic prediction of biofilm-forming ability, an Extreme Gradient Boosting (XGBoost) model was developed to classify bacterial strains into five categories: strong, ultra, moderate, weak, and non-biofilm producers. The proposed model achieved a classification accuracy of 94%, demonstrating its effectiveness in identifying complex patterns within microbiological datasets. The obtained results highlight the potential of machine learning for automating microbiological data analysis and improving the understanding of factors involved in bacterial persistence. Such predictive approaches can contribute to the development of more efficient monitoring systems and targeted interventions aimed at reducing microbial contamination risks throughout the food production chain.

Keywords: Biofilm formation, Food safety, Machine learning, XGBoost, Predictive analytics

A NEW INTERNATIONAL CHARACTER SET

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ABSTRACT

In the field of computer science, there are some difficulties in using character sets that are generally used in languages other than English. These difficulties include the complexity of language settings, the mixed order of letters, and the problem of standardization in character sets where each character is one byte. In this paper, a character set has been developed that ensures the letters are in the same order in every language. Localization may be done in this character set by using a code page for each language. The first 255 characters of this character set are 1-byte characters, and the 256th character is used as a descriptor for letters and symbols, and the relevant letters or symbols are defined with an additional 7 bytes of character. In addition, it is possible to introduce letters and symbols other than those in the alphabet for which a code page is defined. It is thought that the character set developed in this paper may be useful in fields such as data compression and machine learning. The character set developed in this paper has been compared with the ASCII, EBCIDIC and Unicode standards. As a result, this character set developed in this paper is recommended. In the future, these code pages of the character set may be standardized and a code page supporting all languages may be added.

Keywords: character set, internationalization, computer

SOFTWARE ENGINEERING IN AGRICULTURE

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ABSTRACT

Many progresses have been made in solving today's agricultural problems with the increasing usage of automation in agricultural processes Thus, a new innovation field has emerged by offering solutions to the pressing problems encountered in today's agriculture. The integration of artificial intelligence, machine learning, and data analysis technologies into the agricultural sector optimize resource use, increase crop yields, and improve sustainability. This study examines applications of software solutions in the fields of precision agriculture, automated irrigation systems, and crop monitoring. However, user-friendly software tools that encourage farmers and stakeholders to make data-driven decisions are also explored. As collaboration between agricultural engineers and software engineers increases, innovations in food safety and sustainable agricultural practices are inevitable. Increased efficiency and productivity on solutions will allow for the efficient use of resources such as water, fertilizers, and pesticides. The use of data analytics and machine learning algorithms helps farmers make informed decisions by analyzing large datasets related to weather patterns, soil conditions, and crop performance. Software engineering plays a crucial role in the development of automated machinery and robotics for tasks such as planting, harvesting, and weeding. Farmers can monitor and manage their environmental footprint more effectively using software tools. Software solutions result with significant cost savings by optimizing all resource usages. IoT devices and sensors implementing real-time monitoring such as the crop health, the soil moisture measurements enable timely interventions. Global population increase and the effects of climate change necessitate innovative approaches to agriculture. Software engineering provides the tools to address these challenges effectively.

Keywords: Agriculture, machine learning, artificial intelligence, Software engineering, environmental footprint

ARDUINO-BASED, LOW-COST GAS MONITORING SYSTEM WITH DYNAMIC VISUAL WARNING MECHANISM AGAINST AIR QUALITY RISKS IN AGRICULTURAL FACILITIES

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ABSTRACT

Monitoring İndoor Air Quality (IAQ), which has become a critical public health factor due to increasing industrial activities, is of paramount importance for detecting Volatile Organic Compounds (VOCs) and hazardous gases. This study presents the design of an integrated, low-cost air quality monitoring system developed to bridge the gap between complex industrial sensors and simple household monitors. Controlled by a high-performance microcontroller, the hardware architecture of the system is built upon the MQ-135 semiconductor sensor, which is highly sensitive to ammonia (NH_3), nitrogen oxides (NOx), alcohol, benzene, and carbon dioxide (CO_2). Unlike conventional devices that provide static numerical outputs, this system utilizes a 0.96-inch Organic Light-Emitting Diode (OLED) display driven by the SSD1306 driver to perform continuous data sampling, visually rendering air quality trends through a dynamic line graph in real time. Furthermore, the system incorporates a dual-layer warning mechanism. In the software layer, analog signals are processed via a calibration algorithm to establish a baseline for clean air. When the detected gas concentration exceeds a predefined safety threshold, the hardware layer activates an integrated active buzzer (YL-44) to provide an immediate acoustic alert. The developed portable and modular prototype offers a cost-effective solution that ensures both visual and acoustic safety for residential, laboratory, industrial, agricultural facilities, Animal welfare and Plant growth. Within the developed software algorithm, raw analog data is stabilized with a moving average filter, and dynamic warning messages are generated on the screen according to air quality conditions. The results show that the proposed plug-and-play system offers high cost-effectiveness, data security, and stable operational performance compared to its commercial counterparts.

Keywords: Indoor Air Quality, MQ-135, Real-Time Visualization, Smart Warning System, Volatile Organic Compounds, OLED display, Agricultural Facilities

SIMULATION ANALYSIS OF THE EFFECT OF HEMP PLANT-BASED BIOSHIELDING ON ELECTROMAGNETIC SHIELDING EFFICIENCY IN REINFORCED CONCRETE STRUCTURES

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ABSTRACT

Developing wireless communication technologies and widespread network infrastructures have increased the level of electromagnetic (EM) radiation in indoor spaces, making EM shielding solutions a crucial parameter in building design. In this study, the effect of using hemp (Cannabis sativa L.) plants with high biomass density and moisture content as a passive bioshielding element around a building on electromagnetic shielding efficiency (EMSE) was investigated in a simulation environment. In the research, two reinforced concrete shed models with the same geometric and material properties were designed. The first model was considered as a simple reinforced concrete structure (control group); the second model was modeled surrounded by a hemp plant garden of a certain width and density. The complex dielectric constant and conductivity parameters of the vegetation were integrated with biophysical data from the literature; Analyses were performed based on wave transmission in the 1 GHz – 6 GHz frequency band (Wi-Fi, 4G, and Sub-6 GHz 5G). Simulation results show that the hemp-cultivated area significantly increases the EMSE values inside the shed due to its absorption, scattering, and reflection mechanisms of EM waves. This study demonstrates that, in line with sustainable architecture and green building concepts, plant boundaries offer a viable and environmentally friendly alternative for improving the electromagnetic hygiene of structures.

Keywords: Electromagnetic Shielding, Electromagnetic Shielding Efficiency, Reinforced Concrete Structures, Hemp, Cannabis sativa, Bio-Shielding, Green Building, Electromagnetic Shielding Efficiency of Hemp

CONTRIBUTION OF INDUSTRIAL FOOD PRODUCTS TO SALT INTAKE AND ITS ASSOCIATION WITH HIGH BLOOD PRESSURE IN THE POPULATION OF ORAN

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ABSTRACT

High blood pressure is a significant public health concern frequently associated with excessive salt consumption. This study aimed to determine the average salt intake of individuals in Oran, assess their blood pressure levels, and examine how salt intake influences the risk of developing high blood pressure. A descriptive survey was conducted among a representative sample of the population of Oran (220 participants). The questionnaire used collected information on age, gender, anthropometric measurements, and dietary habits. Salt intake was assessed using the Ex-Sel questionnaire, while blood pressure was measured three times a day (morning, noon, and evening) for three consecutive days. High consumption of salted nuts (83%), canned foods (82%), and pizza (81%) was observed during the week. In addition, 73% (75% women, 25% men) often consumed cheese, and 37-40% of the population consumed cold cuts, chips, industrial quiches, and burgers at least twice during the week. Our survey also shows that 80% of participants use salt in cooking water, with 34% also adding salt to their dishes. The results of this study show that Oran residents consume an average of 6 to 10 grams of salt per day. Systolic and diastolic blood pressure readings were 111.34±11.37 mmHg and 68.77±8.21 mmHg, respectively. Although these blood pressure readings appear relatively normal, this unhealthy diet may contribute to the development of hypertension in the long term. Our study shows that the amount of salt consumed by our population exceeds the recommended levels. This excess is associated with high consumption of highly processed foods. These data highlight the importance of reducing salt intake in order to limit the risk of hypertension in the population of Oran.

Keywords: Salt intake, High blood pressure, Ex-sel questionnaire, Industrial products, Oran

PROTECTIVE AND BENEFICIAL EFFECT OF CLOVE (SYRYGIUMAROMATICUM) AND STAR ANISE (ILLICUMVERUM) ON ANTIOXIDANT STATUS IN DIABETIC RATS

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ABSTRACT

The objective of this study is to identify the main bioactive molecules of clove (Syrygiumaromaticum) and star anise (illicumverum) on the one hand, and to observe their protective antioxidant effect in diabetic rats on the other. First, the detection of phenolic compounds is carried out by two different methods to confirm the presence of phenolic compounds in the samples. In the second, The diabetics rats were then divided into 3 homogeneous groups and consumed each for 30 days, the HFD supplemented with clove (HFD-C), HFD supplemented with star anis (HFD-Anis) or not supplemented (HFD group).After 1 month of nutritional experimentation, Compared with the HFD group, in the HFD-C and HFD-A groups, TBARS levels were decreased by 37% and 29%, respectively, in the liver and by 68% and 62%, respectively. In HFD –C and HFD-A groups, the reduction of pro-oxidant markers was concomitant with increased activities of serum antioxidant enzymes (glutathione peroxidase (GSH-Px) and catalase (CAT)) *($p<0.05$)*; of erythrocytes (superoxide dismutase (SOD) and CAT) and tissues (SOD in aorta, muscle and adipose tissue); GSH-Px (liver, heart, muscle, kidney and adipose tissue) *($p <0.05$).* In conclusion, in rats with T2D and exposed to a diet enriched in lipids. **In conclusion,** Clove and star anise have compounds that are very useful from a nutritional point of view and medicinal by their richness in antioxidants and volatile compounds (essential oil). These substances can be used for the production of food additives in the industrial sector or of healthy foods in the pharmaceutical and nutraceutical sector (food supplements).

Keywords: Clove, Star Anis, Antioxidants, Diabet

ROLE OF CARBOHYDRATE CARRIER MATRICES ON VOLATILE FLAVOUR RELEASE IN SEASONINGS

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ABSTRACT

Seasonings are widely used to deliver flavour in dry food systems, yet the role of carbohydrate carrier matrices is often overlooked and treated as inert. This study demonstrates that these bases actively govern aroma release through their physicochemical properties and particle morphology, fundamentally influencing flavour delivery and perception. A model cheese and onion seasoning was plated onto five representative bases: maltodextrin, corn starch, wheat starch, corn flour, and wheat flour. Volatile release was characterised using HS-SPME–GC–MS and GC–O–MS, identifying aroma-active compounds spanning a wide range of polarity, volatility, and functional groups. Scanning electron microscopy revealed clear structural differences between carriers, with flours forming aggregated, protein-associated matrices, while starches exhibited more discrete granules and maltodextrin a more amorphous structure. These physical differences are expected to influence surface area, adsorption, and diffusion pathways. Flavour release varied significantly between bases. Maltodextrin produced the highest overall release, while flours retained flavour compounds, particularly those with higher hydrophobicity. Starches showed intermediate behaviour. A strong relationship between compound hydrophobicity (Log $K_o w$) and release was observed, with responses dependent on matrix type, suggesting complex interactions between compound partitioning and matrix structure. These findings reposition seasoning carriers as active design parameters rather than passive fillers. By selecting or blending carbohydrate bases, flavour delivery can be tuned to selectively enhance or suppress specific aroma compounds. This provides a route towards predictive seasoning design, enabling targeted flavour performance, improved consistency, and new opportunities in snack formulation, flavour optimisation, and ingredient reduction strategies where aroma delivery can compensate for reduced taste intensity, for example in sodium reduced products.

Keywords: Flavour release, Aroma compounds, Carbohydrate matrices, Seasoning systems, Physicochemical properties

FORTIFICATION OF TUNISIAN PASTA WITH GRAPE SEEDS FLOUR AND EVALUATION OF ITS PHYSICOCHEMICAL AND SENSORY PROPERTIES

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ABSTRACT

Considering their substantial nutritional value and health advantages, grape derivatives used for clinical trials may be formulated in capsule form, incorporated into functional foods such as common beans or supplemented in various cereal-based products, including bread and pasta. The physicochemical qualities of dried pasta produced with a partial substitution of semolina by grape seed powder remain largely unexplored. Hence, this work aimed to investigate the impact of fortification with grape seed powder (PPR) on the properties of typical wheat pasta. Wheat flour was substituted with 5%, 10%, and 15% of grape seed powder. Control pasta PN (without addition) and PPR-enriched pasta: PPR 5%, PPR 10%, and PPR 15%, are analyzed for protein, fat, phenolic content and phenolic and fatty acid (FA) profiles. The effects on lipid oxidation and sensory assessment were also evaluated. The fortification of pasta with PPR considerably enhanced ($p< 0.05$) the levels of protein, fat, and phenolic compounds compared to PN ($p< 0.05$). All formulations reduced the percentage of saturated fatty acids and raised the percentage of polyunsaturated fatty acids, while enhancing the omega-3 fatty acid content. The antioxidant activity, assessed via FRAP, hydroxyl and DPPH tests, was enhanced following fortification. The substitution of semolina with PPR significantly decreased ($p < 0.05$) TBARS values in a dose-dependent manner for lipid oxidation. In terms of sensory evaluation, the fortification did not influence the taste, flavor, or aroma of cooked pasta; nonetheless, no significant differences were observed for the score for overall acceptability. The findings suggested the potential benefits of developing pasta supplemented with PPN as a functional food.

Keywords: grape seed powder, pasta, fatty acids, phenolic compounds, lipid oxidation, antioxidant activity.

SUSTAINABLE RECOVERY OF PHENOLIC COMPOUNDS FROM ARONIA MELANOCARPA POMACE USING NATURAL DEEP EUTECTIC SOLVENTS

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ABSTRACT

Sustainability in the food industry represents a priority development direction, focused both on the optimisation of food production processes and on the efficient valorisation of agro-industrial by-products. In this context, Aronia melanocarpa pomace, generated as a by-product of juice processing, represents a valuable plant matrix due to its content of dietary fibre, phenolic compounds and other bioactive constituents with potential beneficial effects on human health. The aim of this study was to recover polyphenolic compounds from Aronia melanocarpa pomace powder using ultrasound-assisted extraction and natural deep eutectic solvents (NaDES). Among the tested systems, the acidic NaDES composed of choline chloride and lactic acid, at a molar ratio of 1:2 and with the addition of 20% water, enabled the recovery of total polyphenol content comparable to that obtained using 80% v/v ethanol, with no statistically significant differences. In contrast, the total flavonoid content was significantly higher compared with the conventional solvent and with the other NaDES systems analysed. HPLC analysis confirmed the efficient extraction of selected flavonoid compounds using the choline chloride–lactic acid NaDES system. The extract displayed a relevant α-amylase inhibitory capacity, with an IC_{50} value of 0.28 ± 0.01 mg/mL. Moreover, the in silico results suggested that catechin, epicatechin and epigallocatechin may interact with the active site of α-amylase, supporting a possible competitive inhibition mechanism. Overall, the findings indicate that NaDES represent promising green solvents for the recovery of polyphenols with α-amylase inhibitory potential from Aronia melanocarpa pomace, supporting the principles of sustainability, circular economy and environmental protection.

Keywords: Aronia melanocarpa pomace, sustenability, α-amilase, NaDES

EFFECTS OF STORAGE TEMPERATURE ON BIOACTIVE COMPOUNDS AND ANTIOXIDANT CAPACITY OF GARLIC (ALLIUM SATIVUM L.) POWDER

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ABSTRACT

This study investigated the changes in biochemical and functional properties of Taşköprü garlic (Allium sativum L.) powder stored at −18 °C, 0 °C, +4 °C, and 24 °C for one year. Garlic samples were dried at 65 °C and ground into powder, which was then transferred into 50 mL Falcon tubes wrapped in aluminium foil to prevent light exposure. After the storage period, total phenolic compounds, specific phenolic acids, flavonoids, antioxidant activity (DPPH and FRAP methods), pyruvate, glucose and sucrose, proline, MDA and H_2O_2 concentrations, organosulphur compounds (alliin), APX, POD, SOD and PPO activities, and mineral content were analysed and compared with initial values. Samples stored at low temperatures (−18 °C and 0 °C) largely retained their total phenolic and flavonoid contents along with antioxidant activity. In contrast, significant reductions in these parameters were observed at +4 °C and, most notably, at 24 °C. Specific phenolic acids and pyruvate levels decreased with storage duration, with losses being more pronounced at higher temperatures. Soluble carbohydrate content showed relatively limited temperature-dependent variation. At 24 °C, PPO, APX, POD, and SOD activities decreased by 31–50%, while MDA and H_2O_2 concentrations increased by 71% and 82%, respectively. These findings indicate that storage at room temperature markedly intensifies oxidative stress and diminishes antioxidant defence capacity in garlic tissue. Overall, low-temperature storage was identified as the most suitable method for preserving the bioactive compounds and antioxidant capacity of garlic powder. The data obtained will contribute to the development of appropriate storage strategies for garlic powder products.

Keywords: Garlic powder, storage temperature, phenolic compounds, antioxidant activity, oxidative stress, alliin

HYPERSPECTRAL IMAGING UNLOCKS PRECISION BREAD QUALITY

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ABSTRACT

We have developed hyperspectral imaging (HSI) as a transformative technology for cereal processing, enabling rapid, non-destructive assessment of grain composition at the single-kernel level. While HSI has demonstrated strong predictive capability for wheat composition, its application to targeted breadmaking through precision grain sorting remains underexplored. This study investigated whether HSI-enabled sorting could improve flour functionality, dough performance, and final bread quality. Importantly, this approach moves beyond conventional bulk grain assessment by recognising and exploiting natural compositional variability that exists within a single wheat batch. A single batch of KWS Ladum wheat was separated into high-protein and low-protein fractions using an industrial-scale HSI sorting system operating in the near-infrared range. Sorted fractions were milled independently and evaluated through compositional analysis, DoughLab rheology, confocal microscopy, bread quality assessment, and volatile flavour analysis. HSI sorting generated distinct grain fractions with significantly different protein distributions. Wheat fractions exhibited bespoke functional performances. In this presentation we will explain the underlying mechanism at play from gluten network formation to microstructural design and final bread quality. Particular emphasis will be placed on how grain composition influences dough architecture and ultimately governs bread texture, structure and flavour development. These findings demonstrate that HSI sorting can be used to generate segregated population of wheat within a single batch, and provides a practical route to tailoring grain for targeted end-use performance. The work highlights next-generation sorting as a powerful tool for improving bread quality while supporting more efficient and value-driven cereal processing. More broadly, the work illustrates how precision sorting technologies may contribute to future cereal manufacturing systems that are increasingly data-driven, targeted and quality-focused.

Keywords: Seed Sorting, Wheat Quality, Structural Design

EFFECT OF HEAT TREATMENT ON THE VITAMINS, PROTEINS AND AMINO ACIDS COMPOSITION OF CAMEL MILK

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ABSTRACT

Introduction: Camel milk is generally consumed freshly. Therefore, to improve to extend its shelf life different heat treatments such as pasteurization and boiling for home use may be applied. **Aim**: The present study aim to investigate the effect of heat treatment on the camel milk vitamins, proteins and amino acids composition. **Methods**: Raw, pasteurized (63°C during 30 min) and boiled (for 2 min) camel milk samples were used to determine the effect of heat treatment on these components. The concentration of each protein was obtained after separation using High Performance Liquid Chromatography (HPLC) method. Amino acids composition was obtained using Ultra-high Performance Liquid Chromatography (UPLC). **Results**: It was clear that boiling temperature caused a significant decrease of some proteins concentration in particular kappa-caseins and beta casein fraction: β-Casein showed the highest sensitivity to boiling temperature of camel milk (from 14613.4±21.2 mg/l in raw milk to 2728±20.33 mg/l after boiling), κ-casein concentration was also decreased in boiled camel milk (from 826.33±12.33 mg/l to 300±12.33mg/l). Lactoferrin was completely destroyed after boiling. Compared to raw milk boiled camel milk showed a significant decrease in some vitamins composition especially Vit C (169.73±5.12 to 49.69±3.23 mg/l) and vit B3 (391.2±3.38 to 70.55±3.14 mg/l). Amino acids composition showed a decrease in the amount of essential amino acids. After boiling (from 67.2±4.33 g/100g in raw milk to 52.33±3.66 g/100g in boiled camel milk). Although pasteurized camel milk didn't shows any significant effect on the amino acids composition of camel milk. Only kappa casein concentration significantly decreased in pasteurized camel milk. **Conclusion**: Pasteurization could be the greatest heating process to ensure the stability of micronutrients of milk.

Keywords: camel milk, heat treatment, proteins, vitamins, amino acids

THE DIETARY FAT CHANGE IN A DIET IMPROVED PARAOXONASE ACTIVITY AND ANTIOXIDANT ENZYMES IN WISTAR RATS

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ABSTRACT

The aim of this study was to investigate the impact of consuming a diet rich in vegetable and/or marine fats on paraoxonase activity and enzymatic antioxidant defense in Wistar rats. Thirty-six 6-week-old male Wistar rats were divided into two groups. An experimental group of 24 rats consumed a high-fat diet supplemented with 10% sheep fat, 5% sugar, and 10% milk for 12 weeks. This experimental group was then divided into two homogeneous groups (n = 12). One group consumed a diet of either 20% marine oil from “sardine” (SAROil) or 20% emulsified vegetable fats “margarine” (MHyD) for 60 days. The third group consumed 20% sunflower oil throughout the experiment and served as the control diet. After 12 weeks on the diet, the rats in each group were sacrifices. After 2 months, Triglyceridemia was lower in MHyD d60 (-25%) and SAROil d60 (-41%) compared to that of the control, this reduction is concomitant with the reduction of triacyl glycerol (TAG) of low density lipoproteins (VLDL, LDL-HDL1) and high density lipoproteins (HDL2) (P

Keywords: Rat, hypercholesterolemia, paraoxonase, glutathione reductase, glutathione peroxidase

EXPLORING THE ANTIBACTERIAL POTENTIAL OF HIBISCUS SABDARIFFA L. CALYX EXTRACTS: INFLUENCE OF PHENOLIC AND FLAVONOID COMPOSITION

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ABSTRACT

The growing demand for natural antimicrobial agents has encouraged the exploration of plant-derived bioactive compounds as alternatives to synthetic preservatives and antibiotics. The present study aimed to evaluate the antibacterial activity of Hibiscus sabdariffa L. calyx extracts obtained from two geographical origins, Egypt and Mali, and to investigate their relationship with total phenolic and flavonoid contents. Phenolic compounds were quantified using the Folin–Ciocalteu method, while total flavonoids were determined by the aluminum chloride colorimetric assay. Antibacterial activity was assessed against Escherichia coli (Gram-negative) and Staphylococcus aureus (Gram-positive) using the agar diffusion method. The Egyptian sample exhibited higher concentrations of total phenolics (329.8 mg GAE/100 g DW) and flavonoids (145.6 mg QE/100 g DW) compared with the Malian sample (222.8 mg GAE/100 g DW and 106.5 mg QE/100 g DW, respectively). Both extracts demonstrated inhibitory effects against the tested bacterial strains, confirming the antimicrobial potential of H. sabdariffa. The observed antibacterial activity may be attributed to the richness of the extracts in phenolic compounds and flavonoids, which are known for their antimicrobial and antioxidant properties. These findings highlight the potential of H. sabdariffa calyces as a valuable natural source of bioactive compounds for applications in food preservation, nutraceuticals, and pharmaceutical products.

Keywords: Hibiscus sabdariffa L., Antibacterial activity, Phenolic compounds, Flavonoids, Escherichia coli, Staphylococcus aureus, Natural bioactive compounds

ANTIBACTERIAL POTENTIAL OF SEA BUCKTHORN (HIPPOPHAE RHAMNOIDES L.) EXTRACTS AGAINST FOODBORNE PATHOGENIC BACTERIA

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ABSTRACT

Introduction. Foodborne diseases remain a major global public health concern due to their high morbidity and substantial socioeconomic burden on individuals, communities, and healthcare systems. According to the World Health Organization, an estimated 600 million people, approximately one in ten individuals worldwide, develop foodborne illnesses each year. These infections are predominantly caused by pathogenic bacteria, including Salmonella spp., Escherichia coli, Listeria monocytogenes, Staphylococcus aureus, and Campylobacter spp., which continue to constitute significant challenges to food safety and public health. In recent years, antimicrobial resistance has emerged as one of the greatest challenges in the management of foodborne bacterial infections. The excessive and inappropriate use of antibiotics in both human medicine and animal production has accelerated the emergence and dissemination of multidrug-resistant bacterial strains, reducing the effectiveness of conventional antimicrobial therapies and increasing the risk of treatment failure. In this context, medicinal plants have attracted considerable attention as promising sources of novel antimicrobial agents, and their extracts are increasingly being investigated as natural alternatives for controlling pathogenic bacteria and enhancing food safety. **Materials and methods.** The antibacterial activity of hydroalcoholic and aqueous sea buckthorn (Hippophae rhamnoides L.) extracts was evaluated using the agar well diffusion assay. The minimum inhibitory concentration (MIC) was determined by the two-fold serial broth dilution method according to CLSI guidelines. The extracts were tested against Gram-positive bacteria (Staphylococcus aureus ATCC 25923 and Listeria monocytogenes ATCC 19115) and Gram-negative bacteria (Salmonella Enteritidis ATCC 13076 and Escherichia coli ATCC 25922). **Results.** The hydroalcoholic extract demonstrated greater antibacterial activity than the aqueous extract, producing inhibition zones ranging from 18.2 ± 0.5 to 30.3 ± 0.4 mm compared with 14.3 ± 0.3 to 22.0 ± 0.2 mm, respectively. Staphylococcus aureus was the most susceptible strain (30.3 ± 0.4 mm; MIC 1.95 ± 0.12 mg/mL), whereas Escherichia coli exhibited the lowest susceptibility to the aqueous extract (15.2 ± 0.3 mm; MIC 65.21 ± 0.37 mg/mL). Gram-positive bacteria were generally more susceptible than Gram-negative bacteria, and the hydroalcoholic extract consistently demonstrated lower MIC values. **Conclusions.** Hydroalcoholic sea buckthorn extracts showed greater antibacterial activity and lower MIC values than aqueous extracts, supporting their potential as natural antibacterial agents for food preservation.

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Keywords: Hippophae rhamnoides L., sea buckthorn, antibacterial activity, foodborne pathogens, food safety

PHYSICOCHEMICAL AND TECHNOLOGICAL QUALITY ASSESSMENT OF BREAD WHEAT (TRITICUM AESTIVUM L.) FLOUR PRODUCED IN RELIZANE (ALGERIA)

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ABSTRACT

Bread wheat (Triticum aestivum L.) flour is a fundamental raw material for the bakery industry, and its technological performance depends largely on its physicochemical composition and rheological properties. This study aimed to evaluate the physicochemical and technological quality of bread wheat flour produced by the Merine Sassi Mill (Relizane, Algeria) and to compare flour batches obtained during different milling seasons. Three flour samples collected in April, July, and October 2025 were analyzed according to national and international standard methods. The physicochemical analyses included moisture, ash content, protein content, and fat acidity, whereas the technological evaluation focused on wet and dry gluten contents, Zeleny sedimentation index, falling number, alveographic baking strength (W), and swelling index (G). The results indicated that all flour samples complied with Algerian quality standards. Moisture content remained below the maximum permitted level (15.5%), ensuring good storage stability, while the ash content (0.53–0.58%) classified the samples as Type T55 flour, suitable for bread production. Protein content averaged 10.82%, accompanied by a high wet gluten content (32.27%), reflecting satisfactory gluten-forming capacity. The Zeleny sedimentation value (28 mL) confirmed good protein quality, whereas the falling number (200 s) indicated balanced α-amylase activity. Baking strength reached 200×10^{-4} J in the October sample, demonstrating improved dough strength and baking performance. Overall, the study confirms the consistent technological quality of the evaluated flour and highlights the effectiveness of quality control throughout the milling process. Seasonal variations had only a limited influence on flour characteristics, with the October batch exhibiting the most favorable rheological properties. These findings provide valuable information for optimizing flour utilization in the baking industry and maintaining compliance with quality standards.

Keywords: Triticum aestivum, Physicochemical analysis, Technological quality, Gluten, Baking strength, Quality control, Algeria

BEESWAX CONCENTRATION GOVERNS THE COLOR, TEXTURE AND SENSORY ACCEPTABILITY OF GLUTEN-FREE BUCKWHEAT MINI CAKES

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ABSTRACT

The replacement of trans fats and margarine in bakery products is a priority for healthier formulations. This study assessed soybean oil structured with beeswax into oleogels as a natural fat replacer in gluten-free buckwheat mini cakes, focusing on sensory, textural and color quality. Six variants were produced: a control with liquid soybean oil and five samples in which the fat phase was fully (100%) substituted with oleogels containing 2, 4, 6, 8 and 10% beeswax. Sensory evaluation was performed by a nine-member trained panel on a 5-point scale using a weighted scoring system; instrumental color was measured in the CIELab system (L*, a*, b*, ΔE, with derived chroma, hue angle, browning and yellowness indices); and texture profile analysis quantified hardness, adhesiveness, cohesiveness and gumminess. Oleogel incorporation improved overall sensory acceptability, with the 4% and 6% samples reaching the maximum weighted score and showing the best balance of taste, odor, crumb structure and shape, whereas 8–10% beeswax introduced a faint waxy aftertaste and a firmer crumb. In the CIELab system, increasing wax content produced a progressively lighter crumb (L* rising from 49.31 to 54.61), with decreasing redness (a*), yellowness (b*), browning index (96.84 → 72.35) and yellowness index (85.19 → 69.34), indicating attenuated Maillard browning; the total color difference (ΔE) rose steadily to 6.18 at 10% wax. Texture profile analysis showed hardness increasing progressively from 837 to 1273 g, adhesiveness rising up to 6% before declining slightly, a small reduction in cohesiveness, and gumminess remaining close to the control up to 6% but increasing markedly at 8-10%. Overall, beeswax-soybean oil oleogels are a viable natural alternative to margarine and trans fats in gluten-free buckwheat mini cakes, with 4-6% beeswax offering the best compromise between texture, color and sensory quality.

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Keywords: oleogel, soybean oil, fat replacement, margarine substitution, Maillard browning, pseudocereal flour

EFFECT OF CONVENTIONAL AND MICROWAVE-ASSISTED ALKALINE EXTRACTION ON THE YIELD, PHENOLIC CONTENT, AND ANTIOXIDANT ACTIVITY OF HIPPOPHAE RHAMNOIDES L. SEED CAKE PROTEIN CONCENTRATES

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ABSTRACT

Sea buckthorn (*Hippophae rhamnoides L.*) by-products generated after cold pressed oil extraction represent a valuable but underutilized source of polyphenols and other bioactive compounds with antioxidant and antimicrobial properties. The seed cake retained a high phenolic content (24.42 mg GAE/g DW) and antioxidant potential (17.72 mg TE/g DW by DPPH and 34.91 mg TE/g DW by ABTS), confirming that a substantial proportion of bioactive compounds remained in the by-product after oil extraction. This study evaluated the effect of conventional extraction (CE; 3 h, 60°C) and microwave-assisted extraction (MAE; 100 W, 5 min, intermittent mode), both performed at pH 10, on the yield of protein concentrates (SPC) from cold-pressed sea buckthorn seed cakes. Total phenolic content (TPC) and antioxidant activity (AA), determined by DPPH and ABTS assays, were also evaluated in hydroethanolic extracts of SPC. CE led to a higher yield of SPC (40.6%) than MAE (37.1%), but the heating time in the first method was 180 min vs 5 min of microwave action in the second method. However, MAE produced SPC with a significantly higher TPC (82.38 vs. 51.67 mg GAE/g DW). The antioxidant activity of SPC derived from MAE was 27.92 mg TE/g DW (DPPH) and 108.45 mg TE/g DW (ABTS), while SPC derived from CE exhibited 24.06 mg TE/g DW (DPPH) and 167.94 mg TE/g DW (ABTS). Although CE resulted in a higher yield of protein concentrate, MAE extraction improved the recovery of phenolic compounds, producing SPC with a higher TPC. The effect of the extraction method on AA depended on the assay used, with MAE presenting higher DPPH values, related to polyphenol activity, while CE presented higher ABTS activity. The effect of the extraction method on AA depended on the assay used, with MAE showing higher DPPH values, correlated with polyphenol activity, while CE showed higher ABTS activity. At the same time, the ABTS free radical can be quenched by both hydrophilic (polyphenols, amino acids) and lipophilic (pigments) antioxidants. These results indicate that MAE is more efficient for the recovery of polyphenols, but may degrade sensitive compounds such as carotenoids, chlorophylls, etc. Also, the long extraction time with CE could be favorable for the release of amino acids with antioxidant activity. These findings demonstrate that the extraction method influences the yield, phenolic recovery, and antioxidant properties of protein concentrates from sea buckthorn seed cake, highlighting the potential of this by-product as a source of functional food ingredients.

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Keywords: sea buckthorn, seed meal, polyphenols, antioxidant activity, conventional, microwave extraction, protein concentrate

OCHRATOXIN A-PRODUCING FUNGI IN GRAPES AND GRAPE-DERIVED PRODUCTS: OCCURRENCE, RISK FACTORS, AND CONTROL STRATEGIES — A REVIEW

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ABSTRACT

Ochratoxin A (OTA) is a nephrotoxic and potentially carcinogenic mycotoxin (IARC Group 2B) that poses a significant food safety concern worldwide. Contamination is predominantly attributed to fungal species belonging to the Aspergillus section Nigri, commonly referred to as "black aspergilli," associated with grapes and grape-derived products worldwide. Within this section, Aspergillus carbonarius (Bainier) Thom is consistently identified as the principal OTA producer in vineyards across the Mediterranean basin, owing to its high OTA-producing capacity and thermotolerance under warm viticultural conditions. Temperature is the most studied abiotic driver of OTA production by *A. carbonarius* and *A. niger* on grapes. Growth of *A. carbonarius* occurs across a range of approximately 10–42°C, with optimal growth between 30 and 35°C. Water activity (aw) is a critical determinant of both fungal growth and OTA biosynthesis. *A. carbonarius* can grow at aw as low as 0.78–0.80, though optimal production requires aw > 0.95. The interaction between temperature and aw is therefore the primary biophysical determinant of OTA risk in any given vintage. Solar ultraviolet radiation exerts a further fungicidal effect on conidial populations at the berry surface, with vineyards of high solar exposure and open canopy architecture showing consistently lower black Aspergillus loads than shaded or poorly ventilated plots. The projected increase in mean temperatures and the northward shift of warm Mediterranean-climate zones are expected to expand the geographic range and seasonal window for OTA-producing Aspergillus species in European viticulture. Modeling studies predict increased risk of OTA contamination not only in traditionally affected Mediterranean regions—Spain, Italy, Greece, and the Western Balkans—but also in other regions. For Albania, situated at the interface of Mediterranean and continental climatic influences and experiencing documented warming trends over the past three decades, these projections imply a potentially increasing OTA risk in both coastal and inland wine-producing regions, warranting enhanced monitoring and adaptive vineyard management strategies. Current knowledge on the ecology and toxigenic potential of OTA-producing Aspergillus species in grapes and grape-derived products evaluates the biophysical and climatic drivers of contamination and critically assesses biological, chemical, and physical control strategies applicable to Mediterranean and Balkan viticulture, with particular reference to the emerging OTA risk context of Albanian wine-producing regions.

Keywords: Ochratoxin A, Aspergillus carbonarius, Aspergillus niger, grapes; wine, mycotoxin contamination, climate change, biocontrol, food safety, Mediterranean viticulture, Albania

CHARACTERIZATION OF HYDROPHILIC AND LIPOPHILIC EXTRACTS OBTAINED FROM SEA BUCKTHORN POMACE

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ABSTRACT

Natural plant extracts contain a wide range of phytochemicals with biological activity and are widely used in food products either as coating materials or as functional ingredients. The aim of this study was to evaluate water-soluble and lipid-soluble extracts obtained from sea buckthorn pomace as a source of natural antioxidants for potential applications in the food industry. The water-soluble extract was obtained by ultrasound-assisted extraction using ethanol under the following conditions: water bath temperature of 25°C, ultrasound power of 40%, extraction time of 25 min, and frequency of 37 kHz. The obtained extract was subsequently centrifuged and concentrated using a rotary evaporator. To improve its stability and extend shelf life, the extract was encapsulated in a starch matrix at extract-to-starch ratios of 50:50%, 60:40%, and 70:30%. The lipid-soluble extract was obtained using sunflower oil as the extraction solvent. Experimental samples were obtained by incorporating sea buckthorn pomace into the lipid matrix at concentrations of 5%, 10%, 15%, and 20%, followed by Vortex mixing (1 min), ultrasonication, centrifugation (10 min at 8,000 rpm), filtration, and storage of the resulting extracts. The samples were then divided into three experimental groups: extracts obtained after 24 h of static extraction, and extracts subjected to ultrasound treatment for 5 min and 15 min, respectively, at a frequency of 37 kHz and a power of 510 W. The antioxidant activity of both water-soluble and lipid-soluble extracts was determined using the DPPH and ABTS radical scavenging assays. The water-soluble sea buckthorn extract exhibited the highest antioxidant activity at the 60:40% extract-to-starch ratio, reaching 3.36 mg TE/g DW (DPPH) and 3.57 mg TE/g DW (ABTS). This result may be attributed to a more efficient dispersion of the extract within the starch matrix, which enhanced the retention and availability of bioactive compounds with antioxidant properties. Although starch encapsulation enables efficient stabilization and incorporation of the extract into food products, a significant reduction in antioxidant activity was observed after encapsulation, decreasing to 1.31 mg TE/g DW (DPPH) and 1.05 mg TE/g DW (ABTS). Samples obtained after 24 h of static extraction exhibited antioxidant activity ranging from 0.41 to 0.50 mg TE/g DW (ABTS) and from 0.32 to 0.42 mg TE/g DW (DPPH). Ultrasound treatment for 5 min increased the antioxidant activity to 0.62 mg TE/g DW (ABTS) and 0.48 mg TE/g DW (DPPH) in the sample containing the highest pomace concentration (20%). A further increase was observed after 15 min of ultrasound-assisted extraction, with antioxidant activity reaching 0.75 mg TE/g DW (ABTS) and 0.59 mg TE/g DW (DPPH), again in the sample containing 20% pomace. Compared with conventional

extraction (24 h), ultrasound-assisted extraction resulted in a progressive increase in antioxidant activity, with the most pronounced effect observed after 15 min of treatment. These findings demonstrate that the obtained extracts have considerable potential for use as natural functional food ingredients, contributing to enhanced antioxidant capacity, improved oxidative stability, and the sustainable valorization of sea buckthorn pomace as a valuable source of bioactive compounds.

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Keywords: sea buckthorn pomace, water-soluble extract, fat-soluble extract, antioxidant activity.

CHANGES IN THE CONTENT OF LACTOSE AND FREE AMINO ACIDS DURING THE RIPENING OF UNSALTED CHEESE

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ABSTRACT

This study investigated the changes in lactose content and free amino acid (FAA) levels during the ripening of cow's milk cheese produced without salt treatment. Two cheese variants were prepared from pasteurised cow's milk (3.8% fat): one coagulated with chymosin only (DLKP) and one with chymosin supplemented with a microbial starter culture (DLK-SP). Cheese samples were stored at 14–15 °C and analysed on days 1, 3 (or 5) and 7 of ripening for moisture, pH, titratable acidity, lactose and free amino acids. In the chymosin-only variant (DLKP), lactose decreased from 5 and 7, and FAA levels fell over the same period, reflecting limited proteolytic activity in the absence of a defined starter culture. The starter-supplemented variant (DLK-SP) exhibited an accelerated pattern: lactose declined on day 1 to day 3 and fell below the detection limit by day 7, while FAA levels were high, rising on days 1, 3 and 7. The pH of DLK-SP dropped accompanied by an increase in titratable acidity. The results demonstrate that in the absence of salt, the addition of a microbial starter culture stimulates both lactose catabolism and proteolysis from the earliest stages of ripening. The FAA content in the starter-supplemented unsalted cheese (DLK-SP) was higher than in any of the salted variants, indicating that the omission of salt with starter inoculation, creates conditions highly favourable for the enzymatic degradation of caseins and the release of flavour precursors. These findings suggest that unsalted cheese produced with a starter culture develops flavour and aroma compounds more rapidly than its salted counterparts.

Keywords: cheese ripening, unsalted cheese, lactose metabolism, free amino acids, proteolysis, starter culture, chymosin, cow's milk

CHANGES IN THE CONTENT OF LACTOSE AND FREE AMINO ACIDS DURING THE RIPENING OF SALTED CHEESE

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ABSTRACT

This study examined the changes in lactose content and free amino acid (FAA) levels during the ripening of cow's milk cheese treated with 20% brine (14–16 °C, 24 h). Two cheese variants were prepared from pasteurised cow's milk (3.8% fat): one coagulated with chymosin only (DLK) and one with chymosin supplemented with a microbial starter culture (DLK-S). Cheese samples were stored at 14–15 °C and analysed on days 12, 22 and 32 of ripening for moisture, pH, titratable acidity, sodium chloride, lactose and free amino acids. In the chymosin-only variant (DLK), the lactose content decreased gradually on days 12, 22 and 32. The FAA content remained low and essentially unchanged indicating that lactic acid bacteria originating from the milk alone exerted limited lactose-metabolising and proteolytic activity during the 32-day ripening period. By contrast, the starter-supplemented variant (DLK-S) showed a marked acceleration in both processes: lactose declined on day 12 and fell below the detection limit by day 32, while FAA levels increased steadily. A positive correlation between lactic acid production and lactose consumption was observed in both variants. These results confirm that the addition of a microbial starter culture to brine-salted cheese markedly enhances lactose catabolism and proteolysis during ripening. While the indigenous lactic acid bacteria in DLK maintained only a basal level of metabolic activity, the defined starter in DLK-S drove lactose to exhaustion by day 32 and produced FAA levels approximately five times higher than those in the chymosin-only cheese. The findings highlight the essential role of starter cultures in the development of flavour and aroma compounds in salted cheese during extended ripening.

Keywords: cheese ripening, salted cheese, brine treatment, lactose metabolism, free amino acids, proteolysis, starter culture, chymosin, cow's milk

INFLUENCE OF WATER-SOLUBLE EXTRACTS FROM SEA BUCKTHORN POMACE ON THE QUALITY CHARACTERISTICS OF CHICKEN SAUSAGES

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ABSTRACT

Sea buckthorn pomace (Hippophae rhamnoides L.) represents a valuable source of bioactive compounds with antioxidant and antimicrobial properties. The aim of this study was to evaluate the influence of a water-soluble extract obtained from sea buckthorn pomace on the sensory, microbiological, and oxidative properties of chicken sausages. Four experimental formulations containing different extract-to-starch ratios (50/50, 60/40, 70/30, and 90/10) were developed and compared with a control sample without extract addition. Sensory evaluation demonstrated that sample P2 (60/40) exhibited the highest overall acceptability, achieving a total score of 4.69 points compared to 4.50 points for the control sample. Microbiological analyses revealed a progressive reduction in microbial load with increasing extract concentration. The total viable count in the meat batter decreased from 2×10^3 CFU/g in the control sample to 1×10^2 CFU/g in sample P4. Furthermore, after 15 days of refrigerated storage, sausages supplemented with the extract exhibited lower microbial counts than the control, confirming the antimicrobial activity of sea buckthorn bioactive compounds. The antioxidant activity of the incorporated extract was assessed using DPPH and ABTS radical scavenging assays. The highest antioxidant activity was observed in sample P3, reaching 0.28 mg TE/g (DPPH) and 0.86 mg TE/g (ABTS), compared with 0.20 mg TE/g and 0.71 mg TE/g, respectively, in the control sample. The antioxidant effect was further reflected in the oxidative stability of the products. After 20 days of storage, the peroxide value reached 1.14 in the control sample, whereas a substantially lower value of 0.71 was recorded for sample P4, indicating a significant reduction in lipid oxidation processes. The obtained results demonstrate that the water-soluble extract derived from sea buckthorn pomace can be successfully applied as a functional ingredient in emulsified meat products, contributing to enhanced antioxidant activity, improved oxidative stability, and increased microbiological safety of the final product.

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Keywords: antioxidant activity, oxidative stability, peroxide value, antimicrobial activity

FUNCTIONAL HERBAL TEA BLENDS: PHENOLIC PROFILES, ANTIOXIDANT ACTIVITIES, AND IN VITRO DIGESTIBILITY ASSESSED BY SOTAX DISSOLUTION

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ABSTRACT

Interest in herbal teas is growing steadily due to their positive effects on health. In this study, we examined fennel (*Foeniculum vulgare*), lemon balm (*Melissa officinalis* L.), hibiscus (*Hibiscus sabdariffa* L.), green tea (*Camellia sinensis* L.), freeze-dried strawberries (a blend of black strawberries, hairy strawberries and Ottoman strawberries) and lavender, and compared their phenolic contenti, antioxidant properties and in vitro digestibility. We prepared three different prototypes based on their targeted effects on the digestive system. Prototype 1 (formulated with fennel (30%), lemon balm (24%), hibiscus (16%), green tea (14%), freeze-dried strawberry (12%), and lavender (4%). This blend was designed to promote balanced digestion. prototype 2 Contains fennel (26%), lemon balm (20%), hibiscus (24%), green tea (12%), freeze-dried strawberry (14%), and lavender (4%). This formulation was adjusted to stimulate bowel activity. Prototype 3 (Made with fennel (34%), lemon balm (30%), hibiscus (10%), green tea (10%), freeze-dried strawberry (12%), and lavender (4%). This prototype emphasizes digestive comfort by increasing fennel and lemon balm while reducing hibiscus and green tea. Fourier Transform Infrared Spectroscopy (FTIR) spectrums showed that wave number range between 1600 and 1350 cm^{-1} corresponds to the region of stretching vibrations of polyphenolic compounds, especially phenolic acids (C-O), in the mixture formulation. Ten different phenolic compounds were identified by High Performance Liquids Chromotograpgy (HPLC) anaylsis. P1, P2, P3 contained amounts of chlorogenic acid, with values of 1852.02, 1836.53, and 1783.1 µg/g, respectively. Ferulic acid was determined to be the second most dominant phenolic acid in the extracts of P1, P2 and P3, with concentrations of 1211.09, 1230.26, and 1227.46 µg/g, respectively. Whilst the IC50 values related to total phenolic content were found to be similar across the prototypes, the lowest IC50 values and the highest radical scavenging activity were observed in prototype 3. In the ABTS assay, prototype 3 exhibited the highest antioxidant capacity, whilst in the DPPH assay, the strongest radical scavenging effect was similarly observed in prototype 3. In all tested formulations, the Trolox-equivalent antioxidant capacity was calculated to be above 90 µmol TE g^{-1}. Strong positive correlations were identified between phenolic content and ABTS and DPPH antioxidant activities, with R^2 values exceeding 0.99 for ABTS and 0.93 for DPPH. The Sotax test applied to plant mixtures was determined as the appropriate dissolution method according to the USP monograph. The bioactive compositions of the plant mixture samples were essentially the same, and the dissolution results after 30 minutes reached the maximum in vitro dissolution limit, with average values above 99% for the pilot plant mixture sample compositions at pH:1.2, pH:4.5, and pH:6.8. Consequently, Prototype 3-in which the proportions of fennel and lemon balm were increased whilst those of hibiscus and green tea were reduced-emerged as the most

successful formulation in terms of antioxidant efficacy. These findings suggest that combining plant-based ingredients in appropriate ratios can enhance the biological efficacy of functional beverages. In conjunction with future gastrointestinal and bioavailability studies, it appears feasible to evaluate these formulations in the development of functional food products.

Keywords: Ottoman strawberries, herbal tea, in-vitro digestibility, SOTAX, antioxidant activity, total phenolic content

PRODUCTION AND CHARACTERIZATION OF PLA BIOCOMPOSITE FILMS INCORPORATING HEMP (CANNABIS SATIVA L.) FIBER AND HEXAGONAL BORON NITRIDE

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ABSTRACT

Interest in biodegradable food packaging materials has been steadily increasing with the aim of reducing global plastic pollution. In this study, ternary biocomposite films were fabricated via dispersion casting, using cellulose fibers extracted from hemp stalks through a three-stage alkali–acid–alkali method, a poly(lactic acid) (PLA) matrix, and hexagonal boron nitride (h-BN) as a nanofiller, with PEG400 as a plasticizer. The h-BN loading was investigated at five levels (0%, 2%, 3%, 5%, and 6% w/w), and the films were characterized in terms of thickness, surface morphology (SEM), mechanical properties (stress–strain curves), thermal properties (DSC), chemical resistance, and biodegradability, and compared with commercial PLA and polyethylene (PE) samples. Film thickness decreased with increasing h-BN content up to 5% (w/w) loading (by a maximum of 34.5%), while SEM images revealed a "pebble-like" rough surface morphology at low h-BN contents and a porous morphology at intermediate contents. The 3% (w/w) h-BN loading maximized tensile strength (≈19.8 MPa) and elastic modulus, albeit at the expense of elongation at break. DSC thermograms showed that the glass transition temperatures of all composite films (Tg ≈ 49.7–50.0 °C) were approximately 7 °C lower than that of neat PLA, and that 3% (w/w) h-BN contributed to thermal stability by forming heterogeneous crystallization regions. In food-simulant media (acid, salt, water), the 3% (w/w) loading enhanced chemical resistance by 30–50%; in biodegradation tests, the same loading supported environmental degradability by retarding degradation during the packaging service life while accelerating it during the waste stage. The findings revealed that 3% (w/w) h-BN represents the optimum composition in the PLA/hemp cellulose/h-BN system, whereas the 5% (w/w) level corresponds to the percolation threshold.

Keywords: Biodegradable composite, hemp fiber, poly(lactic acid) (PLA), hexagonal boron nitride (h-BN), film characterization, food packaging

MASS TRANSFER IN PLA/HEMP CELLULOSE/H-BN COMPOSITE FILMS: A COMPARISON OF TORTUOSITY MODELS WITH EXPERIMENTAL FINDINGS

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ABSTRACT

In the search for sustainable food packaging, the ability to predict the barrier performance of biodegradable composite films within a theoretical framework is a critical tool for accelerating material design. In this study, the oxygen and water vapor permeability of ternary composite films containing poly(lactic acid) (PLA), hemp (Cannabis sativa L.) cellulose, and hexagonal boron nitride (h-BN, 0–6% w/w) was investigated within a theoretical framework based on Fick's first law of diffusion and Henry's law. The assumptions of steady-state and purely diffusion-controlled transport in the experimental setups were verified through the calculated Fourier and Biot numbers. The effect of h-BN platelets within the film was quantified using the Nielsen (fully exfoliated single platelet, N=1) and Nazarenko (stacked/aggregated platelet, N>1) tortuosity models on the basis of filler volume fraction and aspect ratio ($\alpha = 98.75$), and the relative permeability ratios (P/P_0) were compared with the experimental data. Relative to the cellulose-only film, the 3% (w/w) h-BN loading reduced the effective diffusion coefficient by 48% and the oxygen and water vapor permeability by 47.5% and 63.7%, respectively. At low-to-intermediate h-BN concentrations (BN2–BN3), the Nielsen model agreed well with the oxygen permeability data, whereas above the 5% (w/w) percolation threshold the Nazarenko model proved more suitable, as platelet stacking/aggregation became dominant. The deviations observed in water vapor permeability could not be explained by increased tortuosity alone; the difference in kinetic diameter between water and oxygen molecules was also found to play a role in the permeation mechanism. The results demonstrate that the ordered, single-platelet dispersion of h-BN in the polymer matrix is the principal mechanism enhancing barrier performance by lengthening the tortuous diffusion path, but that stacking effects must be incorporated into theoretical tortuosity models for them to adequately reflect experimental barrier performance at high filler concentrations.

Keywords: Tortuosity, composite film, composite food packaging, barrier properties, fick's law of diffusion, pla, hexagonal boron nitride

SYNERGISTIC INACTIVATION OF ESCHERICHIA COLI AND STAPHYLOCOCCUS AUREUS ON MINIMALLY PROCESSED CARROT SURFACES USING COMBINED PLASMA-ACTIVATED WATER AND ULTRASOUND

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ABSTRACT

Chlorine-based methods used for the decontamination of minimally processed vegetables require residue-free alternatives owing to their limited efficacy, formation of carcinogenic by-products, and increasing legal restrictions. In this study, the individual and combined antimicrobial efficacy of plasma-activated water (PAW) and power ultrasound (US) was evaluated on carrot, selected as a model food due to its rough surface that hinders disinfection. PAW produced with an atmospheric plasma jet and found to be most effective in the planktonic model at pH 2.50 was used for surface treatments. Carrot samples inoculated with E. coli and S. aureus (5–6 log CFU/g) were subjected, in a paired design, to Control, US, PAW, and PAW-US treatments at different amplitudes (50–100%) and durations (3–9 min); synergy was quantified using the Synergy Index (SII). Under the optimum condition (pH 2.50 PAW, 100% amplitude, 6 min), individual treatments were insufficient (PAW: 1.88 log for E. coli, 0.68 log for S. aureus; US: 1.26 and 1.22 log, respectively). In contrast, the combined PAW-US treatment achieved complete inactivation below the detection limit for both bacteria, with reductions of 5.67 log for E. coli and 4.81 log for S. aureus. The obtained SII values (E. coli +2.53; S. aureus +2.91) confirmed true synergism; ultrasonic cavitation disrupted the thick peptidoglycan layer, facilitating the penetration of reactive species into the cell and overcoming Gram-positive resistance. Consequently, the PAW-US combination meets the targeted 4–5 log safety level, offering a residue-free and effective alternative to chlorine-based disinfectants. This is the first comprehensive study to quantitatively demonstrate PAW-US synergy on carrot using the SII.

Keywords: Plasma-activated water, power ultrasound, synergistic inactivation, minimally processed vegetables, food safety, decontamination

CHANGES IN THE QUALITY PARAMETERS OF MINIMALLY PROCESSED CARROT DECONTAMINATED WITH PLASMA-ACTIVATED WATER AND ULTRASOUND DURING THREE WEEKS OF COLD STORAGE

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ABSTRACT

The success of decontamination technologies for fresh produce depends not only on microbial efficacy but also on the preservation of the nutritional and sensory quality of the product. In this study, the quality parameters of minimally processed carrot decontaminated with plasma-activated water (PAW), power ultrasound (US), and their combination (PAW-US) under the optimum condition (pH 2.50 PAW, 100% amplitude, 6 min, 20:10 pulsation) were compared with a control group in a paired design over three weeks of storage at +4 °C. Colour (CIELAB), β-carotene (HPLC), ascorbic acid (HPLC), total antioxidant activity (TAA; ABTS), and pH were monitored. Initially (week 0), transient losses correlated with treatment intensity were observed due to oxidative pressure, with the greatest effect recorded in the PAW-US group (total colour difference ΔE = 6.05; ascorbic acid −11.93%; TAA −9.00%). However, a marked recovery began across all parameters from week 1 onwards: ΔE fell below the commercial acceptability limit (5.0) and, by week 2, reached a level indistinguishable from the control (ΔE < 1.0). β-carotene, ascorbic acid, and TAA values exceeded the control in weeks 2–3 (at week 3, β-carotene +4.3–5.4%; ascorbic acid ~+4%); this increase indicates that the applied mechanical and chemical stress stimulated a defence response in the tissue (biosynthesis of carotenoids, vitamin C, and phenolics). pH changes remained below the sensory perception threshold throughout the period (< 0.15 units). This consistent three-phase pattern in the quality parameters (transient loss, defence response, convergence) shows that the PAW-US combination preserves carrot quality at an acceptable level within a 14-day consumption window. The results indicate that the combined treatment can provide high microbial safety without loss of nutritional quality.

Keywords: Plasma-activated water, power ultrasound, minimally processed carrot, quality retention, cold storage, abiotic stress, antioxidant activity

DEVELOPMENT OF GLUTEN-FREE CHICKPEA CHIPS ENRICHED WITH COLD-PRESSED BLACK CUMIN SEED CAKE

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ABSTRACT

The valorization of agro-industrial by-products has gained increasing attention as a sustainable strategy for developing functional foods while reducing environmental waste. Black cumin (Nigella sativa L.) seed cake, the by-product remaining after cold-pressed oil extraction, is rich in dietary fiber, protein, and bioactive compounds, making it a promising ingredient for gluten-free food formulations. This study investigated the effects of incorporating black cumin seed cake powder into gluten-free chickpea chips. Gluten-free chips were produced using chickpea flour as the main ingredient, and black cumin seed cake powder was incorporated at levels of 1, 2, 3, 4, and 5%. Instrumental color (L*, a*, b*, SI, and Hue), physical properties (diameter, thickness, and spread ratio), and textural characteristics (hardness and fracturability) were determined. Increasing the level of black cumin seed cake significantly influenced the quality characteristics of the chips ($P < 0.05$). Lightness (L*) progressively decreased with increasing seed cake concentration, producing darker chips because of the intrinsic dark color of the by-product. Redness and yellowness were also reduced, indicating substantial modification of chip appearance. In contrast, diameter slightly increased, whereas thickness remained statistically unchanged, resulting in similar spread ratios among formulations. Texture analysis revealed a progressive reduction in hardness with increasing seed cake incorporation, while fracturability remained unaffected, indicating that the chips became easier to bite without losing their crisp characteristics. Overall, incorporation of black cumin seed cake successfully produced gluten-free chickpea chips with acceptable physical quality while providing a sustainable alternative for the utilization of an oil-processing by-product. The findings demonstrate the potential of black cumin seed cake as a value-added functional ingredient for clean-label gluten-free snack products.

Keywords: black cumin seed cake, gluten-free chips, chickpea flour, by-product utilization, texture, color.

VEGETABLE POWDERS AS NATURAL COLORANTS IN BREAD: EFFECTS ON COLOR, PHYSICAL, TEXTURAL, MOISTURE, AND SENSORY PROPERTIES

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ABSTRACT

The replacement of synthetic food colorants with natural alternatives has become an important strategy for developing clean-label bakery products. This study investigated the effects of pumpkin, red cabbage, spinach, red beet, and red bell pepper powders on the color, physical, textural, moisture, and sensory properties of wheat bread. Bread samples were prepared by replacing wheat flour with 4% vegetable powder using the straight dough method. Instrumental color measurements (L*, a*, b*, SI, and hue) were performed on both crust and crumb. Loaf weight, loaf volume, specific volume, moisture content, and texture profile parameters (hardness, adhesiveness, springiness, cohesiveness, chewiness, and resilience) were determined. Sensory evaluation was conducted using a 7-point hedonic scale to assess appearance, taste, odor, crumb structure, and overall acceptability. Vegetable powder incorporation significantly affected bread quality characteristics ($P < 0.05$). Spinach bread exhibited the lowest lightness, loaf volume, and specific volume, together with the highest hardness and chewiness, indicating the formation of a compact crumb structure. In contrast, red beet and red bell pepper breads maintained loaf volume and specific volume comparable to the control while producing attractive natural coloration. Moisture content varied significantly among formulations, ranging from approximately 36.4% to 39.2%, with spinach bread showing the highest moisture level and red beet bread the lowest. Sensory evaluation revealed that pumpkin and red bell pepper breads received sensory scores comparable to the control for most attributes, whereas red cabbage bread showed significantly lower consumer acceptance, particularly for taste and odor. Overall, the results demonstrate that vegetable powders can successfully replace synthetic colorants in bread production while generating distinctive natural colors. Among the evaluated vegetables, red bell pepper and pumpkin showed the greatest potential for developing clean-label colored breads by maintaining desirable technological quality together with high consumer acceptability.

Keywords: bread, vegetable powders, natural colorants, clean-label, sensory evaluation, texture profile analysis.

DETERMINATION OF A-GLUCOSIDASE AND A-AMYLASE INHIBITORY ACTIVITIES OF SELECTED CHERRY LAUREL (PRUNUS LAUROCERASUS L.) GENOTYPES

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ABSTRACT

The Black Sea Region is an important center of genetic diversity for many fruit species due to its favorable ecological conditions. One of these species is cherry laurel (Prunus laurocerasus L.), which is among the region's important local fruit species because of its rich genetic variation and nutritionally valuable fruits. Owing to the bioactive compounds present in its fruits, cherry laurel is considered to have potential benefits in the prevention and management of major metabolic diseases such as diabetes. In the present study, the α-amylase and α-glucosidase inhibitory activities of fruit extracts obtained from selected genotypes among 89 cherry laurel genotypes were determined in order to evaluate their antidiabetic potential. The α-amylase inhibitory activities of a total of 68 genotypes were evaluated, revealing a wide range of variation. The inhibition values ranged from 31.0% to 95.1%, with a mean activity of 74.70 ± 17.9%. The high coefficient of variation (24.1%) indicated substantial differences among the genotypes. The majority of the genotypes exhibited high (>75%) or moderate (60–75%) inhibitory activity, whereas only a limited number of genotypes showed low (75%) and 18 genotypes exhibited low (

Keywords: Prunus laurocerasus, cherry laurel, antidiabetic activity, α-amylase inhibition, α-glucosidase inhibition

ANTIDIABETIC PROPERTIES OF CAMEL MILK: SCIENTIFIC ADVANCES AND MECHANISMS OF ACTION

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ABSTRACT

Camel milk is garnering increasing interest due to its specific nutritional composition and its therapeutic potential in managing metabolic diseases, particularly diabetes. Several studies suggest that its bioactive compounds, notably whey proteins and peptides derived from their proteolysis, may exert a modulating effect on glucose homeostasis. Furthermore, camel milk stands out for its relatively high concentrations of certain vitamins, particularly vitamins C, B3, D, and A, which are likely to contribute to improved glycemic control. The objective of this work is to review the major literature data regarding the antidiabetic properties of camel milk and to elucidate the underlying molecular mechanisms. Analysis of research studies reveals that camel milk peptides possess significant inhibitory activity against dipeptidyl peptidase IV (DPP-IV). By limiting the action of this enzyme, which is responsible for degrading incretins—primarily GLP-1—these peptides prolong glucose-dependent insulin secretion. Concurrently, it has been demonstrated that camel whey proteins and their hydrolysates modulate the activation of the human insulin receptor (hIR), thereby potentializing the intracellular signaling cascades responsible for cellular glucose uptake. Clinically, data corroborate these observations, showing that regular consumption induces an increase in circulating insulin concentrations and a notable reduction in fasting blood glucose levels in patients with type 2 diabetes. Furthermore, experimental studies have shown that the administration of fresh camel milk helped regulate average blood glucose levels from the third week of treatment in alloxan-diabetic dogs. These findings support the value of further research to better define the potential role of camel milk in nutritional strategies for the prevention and management of diabetes.

Keywords: Diabetes, Camel milk, Bioactive peptides, Insulin, Antidiabetic effect, Glucose homeostasis.

PHYSICAL CHARACTERIZATION OF MASTIC FRUIT OIL (DROU) FROM JIJEL

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ABSTRACT

Algeria's flora is remarkably diverse, boasting a rich Mediterranean, Saharan, and paleotropical botanical heritage estimated to comprise over 3,000 species. Among them, Pistacia lentiscus L. (mastic tree) is widely distributed along the entire coastline, thriving across various habitats along a changing climatic gradient. An edible oil is extracted from its fruit and traditionally used in folk medicine to treat respiratory, digestive, and skin disorders. Given its diverse applications, further research is needed to fully characterize this valuable resource. To address this, the present study focuses on the physical characterization of mastic oil sourced from the Jijel region, where the species is abundant and oil extraction is a well-established practice. Physical analysis revealed low ultraviolet absorbance at 232nm (K232), indicating a low concentration of primary oxidation products (conjugated dienes). Similarly low values were recorded for K270, which corresponds to secondary oxidation products. Furthermore, the obtained pH values were found to be inversely proportional to the acidity percentages. The water content of the analyzed oils ranged from 0.85 ± 0.05 and 1.42 ± 0.11% depending on the specific harvesting area. Regarding thermal properties, traditionally extracted oils exhibited the highest melting and solidification points (ranging from 16.5 ± 0.45 / 14.3 ± 0.16 and 12.1 ± 0.82 / 9.6 ± 0.18) respectively). In contrast, oils obtained via the semi-automatic method showed the lowest values (11.7 ± 0.76 for melting and 9.1 ± 0.14 for solidification). The smoke point for all samples ranged between 105 ± 1.63 and 120.3 ± 0.47. Additionally, relative densities and refractive indices showed only marginal, non-significant variations. Finally, color analysis—expressed in red and yellow units—revealed that the red units in all Pistacia lentiscus L. fruit oils ranged from 0.5 to 4.2, while the yellow units spanned from 14 to 60.

Keywords: Mastic fruit oil, Pistacia lentiscus L., physical characterization, Jijel.

ANTIBACTERIAL ACTIVITY OF BITTER AND SWEET ORANGE ESSENTIAL OILS ON SELECTED FOODBORNE PATHOGENS

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ABSTRACT

The modern consumer is increasingly aware of the negative effects of preservatives used in food protection and is therefore turning to natural procedures and compounds whose impact on human health is minimal, while simultaneously inhibiting pathogenic microorganisms and food spoilage agents. In this research, we investigated the effect of sweet and bitter orange essential oils on selected pathogenic bacteria: Gram-negative *Escherichia coli* and *Salmonella* Enteritidis, and Gram-positive *Listeria monocytogenes* and *Staphylococcus aureus*. The antibacterial effect was determined by the disc diffusion method using control antibiotics (tetracycline 30 mg, penicillin G 2 IU, cefotaxime 30 mg, erythromycin 2 mg, ceftazidime 30 mg and piperacillin 100 mg). Ten microlitres of each essential oil sample – N: commercial sweet orange, G: commercial bitter orange, and three essential oils obtained by supercritical CO2 extraction (temperature 40°C, pressure 300 bar, flow rate 2 kg/h, time 60 min), LN: freeze-dried sweet orange, LG: freeze-dried bitter orange, and GP: partially dried (40% total dry matter) bitter orange, were applied to 5 mm sterile blank diameter discs. Statistical analysis (ANOVA + Tukey HSD, p*E. coli* and *S.* Enteritidis. The bacterium *S. aureus* proved to be the most resistant, as oil G had zero inhibition against it, while *L. monocytogenes* was the most sensitive and showed consistent inhibition across all samples.

Keywords: sweet and bitter orange essential oil, inhibition, foodborne pathogens, natural preservatives

A COMPARATIVE STUDY OF MINERAL CONTENT BETWEEN CULTIVATED AND SPONTANEOUS LAMIACEAE SPECIES ENDEMIC TO MOROCCAN MOUNTAINS

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ABSTRACT

Intensive wild harvesting of endemic Moroccan Lamiaceae has prompted conservation-oriented domestication programmes, yet the effect of this transition on mineral composition remains poorly documented. Three endemic species Thymus saturejoides, Thymus pallidus, and Origanum compactum were collected from two community nurseries in the High Atlas (Azilal and Oukaimden) and compared with wild populations from Agoundis Valley and Chefchaouen. Fifteen elements (Ca, Na, K, Mg, P, Fe, Zn, Cu, Mn, Se, B, Ni, Pb, As, and Cd) were quantified by ICP-OES from acid-digested aerial parts. Wild thyme populations accumulated significantly higher calcium and sodium, consistent with the calcareous lithology of their native substrates, while cultivated accessions were enriched in potassium, magnesium, phosphorus, and iron a pattern attributed to regular irrigation and organic fertilisation in nursery soils. Manganese, boron, and zinc were highest in wild T. pallidus, and selenium was detectable only in cultivated plants. Heavy metal levels were low across all provenances, with cadmium absent in all samples and arsenic and lead within WHO permissible limits, confirming the food safety of both wild and cultivated material. Principal component analysis identified domestication status as the primary structuring factor in mineral variability, and hierarchical cluster analysis resolved three independent mineral sources linked to soil geochemistry, fertilisation inputs, and pH-dependent chemistry. These findings provide the first systematic evidence of domestication-driven mineral remodelling in these endemic species and support their valorisation as safe and nutritionally relevant ingredients in functional foods and herbal preparations.

Keywords: Mineral profile, Endemic, Wild, Cultivated, Thymus saturejoides, Thymus pallidus, Origanum compactum, principal components analysis, ICP-OES.

INACTIVE SOURDOUGHS AS FUNCTIONAL INGREDIENT FOR IMPROVING THE QUALITY OF SODIUM CHLORIDE-FREE WHEAT BREAD

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ABSTRACT

In the context of developing safe, sustainable, and functionally enhanced food products, inactive sourdoughs represent promising ingredients for the bakery industry. *Saccharomyces cerevisiae* biomass is authorized for food use under European legislation and, owing to its high content of essential amino acids, B-complex vitamins, and bioactive compounds, has the potential to improve the quality of bakery products. The aim of this study was to evaluate the effects of inactive wheat flour-based sourdoughs from the Sapore (Puratos) on the sensory quality (9-point hedonic scale), physicochemical properties (porosity and specific volume), and CIELab color parameters (lightness (L*), yellowness index (YI), browning index (BI), and total color difference (ΔE*)), of sodium chloride-free wheat bread produced from type 650 wheat flour. Two inactive sourdoughs, Sapore Traviata (DS1) and Sapore Medea (DS2), were incorporated at concentrations ranging from 1.0% to 4.0% (relative to wheat flour) and compared with a control sample (CS) prepared without sourdough. The bread samples were produced using the classic bread-making process. The results demonstrated that inactive sourdoughs significantly improved chloride-free wheat bread quality, with the most favorable effects observed at concentrations of 1% - 3%. Compared with the CS, the addition of 3% DS1 and DS2 increased the specific volume by 1.79-fold and 1.86-fold, respectively, while crumb porosity increased by 1.03-fold for both sourdough types, indicating improved gas retention during fermentation and a more homogeneous crumb structure. Both crust and crumb color were influenced by sourdough concentration. At moderate concentrations, chromatic changes were characterized by a gradual decrease in L* values and an increase in yellow tones, without adversely affecting the overall appearance of the bread. At the 4% concentration, color changes became more pronounced, as reflected by lower L* values and higher ΔE*, YI, and BI values, with the effect being more evident for DS1. Sensory evaluation confirmed the beneficial impact of inactive sourdoughs on bread quality. The overall acceptability score increased from 7.46 for the CS to 8.83 and 8.81 for breads containing 3% DS1 and 3% DS2, respectively, reflecting improvements in crumb structure, flavor, and aroma. Overall, inactive sourdough is an effective functional ingredient for sodium chloride-free wheat bread production, enhancing the physicochemical properties, visual appearance, and sensory acceptability of the final product. Their application offers promising opportunities for the development of sodium chloride-free bakery products with improved functional and nutritional value.

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Keywords: inactive sourdough, functional ingredient, sodium chloride-free bakery product, sensory and physicochemical quality, chromatic parameters.

CURRENT APPROACHES TO THE VALORIZATION OF FERMENTED FOOD BY-PRODUCTS FOR FUNCTIONAL PRODUCT DEVELOPMENT

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ABSTRACT

Rapid population growth, uncontrolled industrial expansion, and changing consumption patterns have led to a significant increase in food industry waste, making it one of the most critical challenges threatening environmental and economic sustainability globally. This ecological crisis has necessitated minimizing food processing waste and reintegrating it into the economy through value-added applications, thereby highlighting the concepts of the circular bioeconomy, biorefineries, and green technology approaches. Solid and liquid by-products generated during the industrial production of fermented products, particularly wine, beer, dairy, soy, vinegar, and kombucha, exhibit remarkable functional and therapeutic potential owing to their high-value biological constituents, including proteins, free amino acids, polyphenolic antioxidants, and prebiotic oligosaccharides. To recover these bioactive compounds from cellular matrices while preserving their natural structural integrity, next-generation green technologies, such as ultrasound-assisted extraction, microwave-assisted extraction, supercritical fluid systems, and solid-state fermentation, have been widely employed. These recovered, or microbially resynthesized functional compounds can be utilized in a wide range of applications within the food, materials, biomedical, and healthcare sectors as antimicrobial preservatives capable of suppressing pathogenic microorganisms and cellular signaling mechanisms, nanotechnologically encapsulated nutraceuticals, active and intelligent packaging films, and biodegradable polymers (PLA/PHA) serving as sustainable alternatives to petrochemical-based materials. Fermented food by-products have also been successfully incorporated into functional foods, with brewer's spent grain being used in bread, pasta, and snack formulations and cheese whey being utilized in functional and sports beverages. These innovative valorization strategies not only drastically reduce the organic load associated with Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD), thereby mitigating environmental impacts, but also provide promising solutions for producing functional products that support human health at the molecular level. Accordingly, this article reviews the most recent advances in the utilization of fermented food by-products as a source of bioactive compounds, the green technologies employed for their recovery, and their potential applications in functional product development.

Keywords: Fermented food by-product, functional products, fermentation, sustainability, valorization.

VALORIZATION OF PLANT-BASED BY-PRODUCTS FOR ALTERNATIVE PROTEIN PRODUCTION IN SUSTAINABLE FOOD SYSTEMS: CURRENT APPROACHES AND FOOD APPLICATIONS

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ABSTRACT

The accelerating expansion of the world population, changing dietary habits, and the continuous increase in protein consumption necessitate a re-evaluation of traditional animal and plant-based protein production systems in terms of environmental, economic, and sustainability. In particular, the high greenhouse gas emissions, intensive land and water use, and adverse effects on biodiversity associated with animal-based protein production have positioned the development of sustainable alternative protein sources as one of the leading research priorities on a global scale. In this regard, the utilization of plant-based by-products generated in the food industry for alternative protein production has emerged as a significant strategy in terms of both the circular bioeconomy and the zero-waste approach. By-products such as fruit and vegetable processing residues, brewer's spent grain, spent coffee grounds, oilseed meals, cereal bran, and legume hulls are among the potential raw materials that can be converted into high-value-added protein sources, owing to their rich content of protein, dietary fiber, polyphenols, and other bioactive compounds. However, lignocellulosic components such as cellulose, hemicellulose, pectin, and lignin present in the plant cell wall limit the recovery of protein; consequently, conventional extraction methods exhibit significant disadvantages, including low yield, prolonged processing time, and high chemical consumption. To overcome these limitations, green technologies such as ultrasound-, enzyme-, and microwave-assisted extraction, supercritical fluid extraction, deep eutectic solvents, pulsed electric field, high hydrostatic pressure, and membrane filtration have emerged as alternative approaches. In addition, the production of microbial proteins—particularly single-cell protein—from lignocellulosic biomass through fermentation bioprocesses, as well as algae- and insect-based bioconversion systems, stand out as innovative approaches that enable the conversion of low-value biomass into protein sources with high added value. These technologies not only enhance protein yield, purity, and functional properties but also significantly reduce energy consumption, organic solvent use, and environmental impact. Owing to their superior techno-functional properties such as emulsification, foaming, water- and oil-binding capacity, and gelation the recovered proteins are utilized in numerous food applications, including plant-based meat analogues, dairy alternatives, functional beverages, and enriched bakery products. Nevertheless, variability in raw material composition, the industrial scalability of extraction processes, food safety, regulatory frameworks, and consumer acceptance remain among the key challenges in this field. In this review examines current extraction and bioconversion approaches for the utilization of plant-based by-products in alternative protein production, along with the functional food applications of these proteins and their potential contributions to sustainable food systems.

Keywords: Alternative proteins, plant-based by-products, green extraction, Sustainable food systems

FOODBORNE MYCOTOXINS AND THE HUMAN MICROBIOME: A HACCP BASED RISK ASSESSMENT APPROACH

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ABSTRACT

Mycotoxins, toxic secondary metabolites produced by fungi such as Aspergillus, Fusarium, and Penicillium, represent one of the most significant chemical hazards in food systems. They contaminate cereals, nuts, fruits, and processed products, posing risks not only through acute toxicity but also via chronic exposure that can disrupt the human gut microbiome. The microbiome, a complex ecosystem of bacteria, fungi, and archaea, plays a central role in digestion, immune regulation, and metabolic homeostasis. Evidence suggests that mycotoxins such as aflatoxins, ochratoxin A, fumonisins, and deoxynivalenol can alter microbial diversity, reduce beneficial taxa, and promote dysbiosis, thereby increasing susceptibility to gastrointestinal disorders, metabolic dysfunction, and immune imbalance. This review synthesizes current knowledge on the ecological interactions between foodborne mycotoxins and the human microbiome, emphasizing the need for integrated risk assessment. The Hazard Analysis and Critical Control Points (HACCP) framework provides a systematic approach to identifying and controlling hazards at critical points in food production and processing. Applying HACCP principles to mycotoxin contamination involves monitoring agricultural practices, storage conditions, and processing steps where fungal growth and toxin production are most likely. By incorporating microbiome-focused biomarkers, such as microbial diversity indices, short-chain fatty acid levels, NF-κB activation, and metabolomic signatures, into HACCP risk assessment, food safety management can evolve beyond traditional toxicological thresholds to include microbial resilience and host health outcomes. Case studies highlight how HACCP interventions, including improved grain storage, rapid detection methods, and biocontrol strategies, reduce mycotoxin exposure. Ultimately, aligning HACCP with microbiome research offers a proactive strategy to mitigate the long-term health consequences of mycotoxin contamination. This interdisciplinary approach underscores the importance of integrating food safety, microbiology, and public health perspectives to safeguard consumer wellbeing and ensure sustainable food systems.

Keywords: Foodborne mycotoxins, Human gut microbiome, Microbiome dysbiosis, HACCP framework, Critical control points, Risk assessment, Food safety management

ENVIRONMENTAL EFFECTS ON THE PREVALENCE OF THE PARASITE EUSTRONGYLIDES SP. IN BIG-SCALE SAND SMELT (ATHERINA BOYERI) CATCH FROM TRASIMENO LAKE

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ABSTRACT

Eustrongylides sp. is an emerging zoonotic freshwater fish nematode which, in Trasimeno Lake, affects the marketability of commercially valuable fish such as the Big-scale sand smelt (*Atherina boyeri*). Despite a literature-documented increase in prevalence over the long term, recent fishing seasons (October 1–March 31) have recorded a drastic decline. To evaluate catch infestation levels for commercial approval, the Big-scale sand smelt undergoes threshold-based sampling. This sampling method is based on the regulatory basis adopted for Anisakis, a highly zoonotic parasite, using an acceptability threshold. A random selection of 29 subjects per batch (daily catch) was performed. This sample size, according to the Epitools instrument, is statistically significant for batches exceeding 4,000 subjects, assuming a 10% sensitivity and a 95% confidence interval (CI). Visual inspection involves examining the whole fish under transillumination, followed by opening the coelomic cavity, evisceration, and evaluation of the musculature and head. Batches are categorized as follows: i) massive infestation and repulsive appearance, leading to disposal; ii) ≥3 positive subjects or between 3 and 10 parasites found, requiring preventive freezing; iii). During the 2023–24, 2024–25, and 2025–26 fishing seasons, 1,305 subjects were examined annually. Results showed a progressive decline in parasitized fish (350, 307, and 150, respectively), with prevalences of 0.27, 0.24, and 0.11. Mean intensity remained constant at 1.03 across all three seasons. Despite larval resistance to temperatures between 20°C and 30°C, the shallow nature of Trasimeno Lake, combined with recent extreme summer heatwaves (2024 and 2025) driving water temperatures well above 30°C for extended periods, likely caused the observed decline in prevalence by affecting the survival of both larvae and intermediate hosts (oligochaetes). Concurrently, the mean intensity remained stable.

Keywords: Eustrongylides sp., parasitic hazard, freshwater fish, prevalence, mean intensity

PROXIMATE COMPOSITION AND NUTRITIONAL POTENTIAL OF FOUR MARINE MACROALGAE FROM THE ALGERIAN COAST

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ABSTRACT

Marine macroalgae represent promising renewable resources for nutritional and biotechnological applications. This study evaluated the proximate composition of four macroalgae collected from the Algerian coast: the green alga Ulva linza, the brown algae Ericaria amentacea and Dictyota dichotoma, and the red alga Halopithys incurva. Moisture, ash, protein, and lipid contents were determined using appropriate gravimetric and colorimetric methods. Significant interspecific differences were detected for all investigated parameters according to Tukey's test ($p < 0.05$). Moisture content ranged from 69.20 ± 0.20% in U. linza to 74.03 ± 0.15% in E. amentacea. U. linza showed the highest ash and protein contents, reaching 31.00 ± 0.13% dry weight (DW) and 17.20 ± 0.06% DW, respectively. Ash contents in E. amentacea, H. incurva, and D. dichotoma were 21.00 ± 0.67, 18.10 ± 0.11, and 16.15 ± 0.006% DW, respectively. Protein content decreased in the following order: U. linza > E. amentacea > D. dichotoma > H. incurva. Lipid contents were relatively low in all species, ranging from 1.30 ± 0.30% DW in H. incurva to 2.71 ± 0.17% DW in D. dichotoma. These results demonstrate marked species-specific variations in the biochemical composition of Algerian macroalgae. U. linza appears to be a valuable source of proteins and minerals, whereas D. dichotoma showed the highest lipid content. These species may therefore represent promising marine resources for nutritional and sustainable biotechnological applications.

Keywords: Algerian coast, macroalgae, proximate composition, proteins, minerals, lipids.

INTEGRATED CULTURE, PCR AND MALDI-TOF WORKFLOW FOR IMPROVED DETECTION OF LISTERIA SPP. IN ALBANIAN DAIRY PROCESSING ENVIRONMENTS

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ABSTRACT

Listeria monocytogenes remains a major concern in dairy processing due to its persistence on environmental surfaces and its potential to contaminate ready-to-eat products. This study evaluated an integrated workflow combining selective culture, conventional PCR and MALDI-TOF MS for the confirmation of Listeria isolates recovered from Albanian dairy processing environments. A total of 100 environmental swab samples were collected from three Albanian dairy processing plants. Following a two-step enrichment and selective cultivation protocol, presumptive colonies were confirmed by conventional PCR targeting the 16S rRNA and hly genes and subsequently identified by MALDI-TOF MS. Among the 100 environmental samples, 13 samples produced presumptive Listeria colonies after selective cultivation. PCR analysis confirmed the presence of nine Listeria spp. isolates and one Listeria monocytogenes isolate, while the remaining presumptive colonies were PCR-negative. MALDI-TOF analysis demonstrated that Listeria innocua was the predominant environmental species (90%), whereas L. monocytogenes represented only 10% of confirmed isolates. Positive isolates originated from both food-contact and non-food-contact surfaces, indicating multiple potential contamination niches within dairy facilities. The findings demonstrate that integrating selective culture with molecular and proteomic confirmation significantly improves the reliability of environmental Listeria surveillance. The combined workflow provides an effective approach for identifying contamination hotspots, supporting targeted sanitation strategies, improving routine microbiological monitoring, and strengthening food safety management systems in dairy processing plants.

Keywords: Listeria monocytogenes, Listeria innocua, dairy industry, environmental monitoring, PCR, MALDI-TOF MS.

WINE QUALITY AND SAFETY: THE ROLE OF SULFITES, SULFATES AND PHOSPHATES IN MICROBIOLOGICAL STABILITY

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ABSTRACT

Sulphites, Sulphates and phosphates play a significant role in microbiological stability, quality and safety of wines. This study aims to evaluate the impact of Sulphur dioxide (SO2), sulphates SO_4^{2-} and Phosphate (PO_4^{3-}) compounds on control of microbial growth and on key physicochemical properties of wine. Sulphites are widely used as preservatives due tu their antimicrobial and antioxidant activity, effectively inhibiting the growth of undersirable microorganisms such as wild yeasts, lactic acid bacteria and acetic acid bacteria. In contrast, phosphates contribute indirectly by supporting yeast metabolism during fermentation and stabilizing the chemical environment of the wine. Wine samples were analyzed for free and total SO2, phosphate content, pH, acidity and microbial load using standard analytical and microbiological methods. The results demonstrate that appropriate level of sulphites significantly reduce microbial contamination and prevent spoilage, thereby enhancing shelf life and sensory quality. However, excessive sulphite concentrations may pose health concerns and negatively affect organoleptic properties. Phosphates were found to influence fermentation efficiency and microbial balance, although their direct antimicrobial effect is limited. In conclusion, the combined management of sulphites and phosphates is essential for maintaining wine stability, ensuring microbiological safety, and achieving high-quality products. Optimizing their concentrations in accordance with regulatory limits is crucial for balancing technological benefits and consumer health protection.Sulphites, Sulphates and phosphates play a significant role in microbiological stability, quality and safety of wines. This study aims to evaluate the impact of Sulphur dioxide (SO2), sulphates SO_4^{2-} and Phosphate (PO_4^{3-}) compounds on control of microbial growth and on key physicochemical properties of wine. Sulphites are widely used as preservatives due tu their antimicrobial and antioxidant activity, effectively inhibiting the growth of undersirable microorganisms such as wild yeasts, lactic acid bacteria and acetic acid bacteria. In contrast, phosphates contribute indirectly by supporting yeast metabolism during fermentation and stabilizing the chemical environment of the wine. Wine samples were analyzed for free and total SO2, phosphate content, pH, acidity and microbial load using standard analytical and microbiological methods. The results demonstrate that appropriate level of sulphites significantly reduce microbial contamination and prevent spoilage, thereby enhancing shelf life and sensory quality. However, excessive sulphite concentrations may pose health concerns and negatively affect organoleptic properties. Phosphates were found to influence fermentation efficiency and microbial balance, although their direct antimicrobial effect is limited. In conclusion, the combined management of sulphites and phosphates is essential for maintaining wine stability, ensuring microbiological safety, and achieving high-quality products. Optimizing their concentrations in accordance with regulatory limits is crucial for balancing technological benefits and consumer health protection.

Keywords: SO_4^{2-} , SO2, $PO_4^{3-,}$ Acetobacter spp., microbial load, assurance quality, food safety,

EFFECT OF PROBE-TYPE ULTRASOUND-ASSISTED MACERATION ON SELECTED QUALITY CHARACTERISTICS OF COLD-PRESSED ARONIA JUICE

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ABSTRACT

Aronia (Aronia melanocarpa) is a fruit rich in phenolic compounds, particularly anthocyanins. However, the susceptibility of these compounds to oxidation and processing conditions necessitates the careful selection of pretreatment methods used in aronia juice production. In this preliminary study, probe-type ultrasound-assisted maceration conditions suitable for the production of cold-pressed aronia juice were evaluated. Frozen aronia berries were destemmed, thawed under controlled conditions, crushed without damaging the seeds, and divided into five groups. The control samples were held at 35 °C without ultrasound treatment. The U1 samples were treated at 20% amplitude for 5 min, the U2 samples at 20% amplitude for 10 min, and the U3 samples at 30% amplitude for 5 min. The U4 samples were treated at 30% amplitude for 10 min at 50 °C. Ultrasound treatments were performed at a frequency of 20 kHz in pulsed mode. Following maceration, the samples were subjected to cold pressing, and juice yield, soluble solids content, pH, total phenolic content (TPC), and total antioxidant activity (TAA), as determined by the ABTS assay, were evaluated. The highest mean TPC value was observed in the U2 group at 13,561.17 mg GAE/L, corresponding to a numerical increase of 41.73% compared with the control. The same treatment also produced the highest mean TAA value of 140.53 mM Trolox/L, while the reduction in juice yield remained limited to 5.66% relative to the control. Increasing the amplitude from 20% to 30% at a constant treatment duration of 5 min improved juice yield; however, it resulted in decreases of 26.06% and 17.83% in TPC and TAA, respectively. Soluble solids content was lower in all ultrasound-treated groups than in the control, whereas changes in pH were limited. These findings demonstrate that the effect of ultrasound-assisted maceration does not vary linearly with increasing amplitude and suggest that an optimum processing range exists for the aronia matrix. Among the conditions investigated, the most balanced results were obtained in the U2 group, which was treated at 20% amplitude for 10 min.

Keywords: aronia (Aronia melanocarpa), ultrasound-assisted maceration, probe-type ultrasound, phenolic compounds

IDENTIFICATION OF BIOFILM-ASSOCIATED MICROORGANISMS IN ALBANIAN DAIRY PROCESSING ENVIRONMENTS USING SELECTIVE CULTURE MEDIA AND MALDI-TOF MASS SPECTROMETRY

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ABSTRACT

Biofilms formed on food-contact surfaces in dairy processing environments represent a major challenge to food safety due to their ability to harbor persistent microorganisms that can withstand routine cleaning and disinfection procedures. The present study aimed to identify the cultivable microbiota associated with biofilm-positive environmental samples collected from dairy processing facilities by integrating conventional microbiological cultivation with matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS). Environmental swab samples previously confirmed as biofilm-positive were cultured on Bengal Rose Chloramphenicol Agar, de Man, Rogosa and Sharpe (MRS) Agar, Baird-Parker Agar supplemented with Egg Yolk Tellurite, Coliform Chromogenic Agar, and Tryptic Soy Agar. Colonies displaying distinct morphological characteristics were purified and identified by MALDI-TOF MS. A total of 47 representative isolates were successfully identified, corresponding to 14 bacterial species belonging to eight genera. The identified microbiota was dominated by members of the genera Staphylococcus, Enterococcus, and Escherichia, while Citrobacter, Corynebacterium, Klebsiella, Enterobacter, and Rothia were recovered less frequently. The predominant species included *Staphylococcus aureus, Escherichia coli, Enterococcus faecalis, Enterococcus hirae, Staphylococcus saprophyticus, Citrobacter freundii, Corynebacterium falsenii, and Klebsiella oxytoca*. Additional isolates comprised *Staphylococcus lugdunensis, Staphylococcus warneri, Staphylococcus haemolyticus, Staphylococcus carnosus, Enterobacter cloacae*, and *Rothia kristinae.* The recovery of hygiene indicator bacteria together with opportunistic pathogens demonstrates the high microbial diversity associated with dairy biofilms and emphasizes their potential role as reservoirs of persistent contamination. The combined approach enabled comprehensive characterization of microorganisms colonizing biofilm-positive surfaces, demonstrating the coexistence of diverse bacterial and fungal populations within dairy processing environments. Selective culture media facilitated the targeted isolation of specific microbial groups, while MALDI-TOF MS provided rapid, accurate, and reproducible identification, significantly reducing the time required for microbial characterization compared with conventional biochemical methods. The findings contribute to a better understanding of microbial persistence in food-processing environments and provide valuable information for improving environmental monitoring programs, optimizing sanitation protocols, and developing effective biofilm control strategies to enhance dairy product safety and quality.

Keywords: Biofilms, Dairy processing environment, MALDI-TOF MS, Selective culture media, Microbial identification, Food safety.

NUTRITIONAL COMPOSITION AND PHYTOCHEMICAL PROFILE OF MOROCCAN DESERT TRUFFLES

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ABSTRACT

Desert truffles, locally known as "Terfez" in Morocco, belong mainly to the genera Terfezia and Tirmania and represent an important non-timber forest product harvested naturally in the arid and semi-arid regions of southern and eastern Morocco. These hypogeous edible fungi have long been appreciated and consumed by local and indigenous populations both as a prized culinary delicacy and for their traditional medicinal applications. Despite their high socio-economic, ecological, and cultural significance in rural arid communities, detailed scientific insights into their comprehensive nutritional quality, macro- and micro-nutrient profiles, and specific bioactive constituents remain limited compared to well-studied European forest truffles. The present study aims to evaluate the nutritional composition, elemental mineral profile, fatty acid and amino acid distributions, as well as the phytochemical and bioactive potential of wild Moroccan desert truffles (Terfezia spp. and Tirmania spp.). Standard international analytical procedures were rigorously applied to determine proximate chemical parameters, including moisture, total proteins, crude lipids, dietary fibers, ash, and carbohydrates. In addition, mineral concentrations were quantified alongside specific profiles of essential fatty acids and amino acids. Total phenolic and total flavonoid contents were evaluated spectrophotometrically, accompanied by in vitro antioxidant capacity assays. Overall, Moroccan desert truffles demonstrate a remarkably nutrient-dense profile characterized by substantial high-quality protein levels, low lipid content, essential dietary minerals, and valuable natural antioxidant properties. These findings emphasize their strong prospective applications in functional food formulation, nutraceutical development, and sustainable arid-land food security strategies.

Keywords: Desert truffles, Terfezia, Tirmania, Nutritional profile, Bioactive compounds, Morocco, Functional foods.

ZINC NANO-FERTILIZATION FOR ENHANCING FOOD QUALITY

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ABSTRACT

The increasing demand for sustainable agricultural practices has accelerated the development of innovative fertilization strategies that improve crop productivity while enhancing food quality. Among these approaches, zinc (Zn) nano-fertilization has emerged as a promising alternative to conventional zinc fertilizers due to its improved nutrient use efficiency, controlled nutrient release, and enhanced bioavailability. Zinc is an essential micronutrient involved in numerous physiological and biochemical processes in plants, including enzyme activation, protein synthesis, photosynthesis, and antioxidant defense. Zinc deficiency is common in agricultural soils worldwide, leading to reduced crop performance and lower nutritional quality of edible plant products. This review examines the effects of zinc nano-fertilization, particularly zinc oxide nanoparticles (ZnO NPs), on the quality attributes of food crops. Recent studies indicate that ZnO nanoparticles can significantly improve zinc accumulation in edible plant tissues, contributing to crop biofortification and enhanced nutritional value. In addition, zinc nano-fertilization has been associated with increased concentrations of vitamins, phenolic compounds, flavonoids, and other bioactive metabolites, resulting in improved antioxidant capacity. Positive effects on fruit and vegetable quality parameters, including soluble solids, sugar content, firmness, and shelf life, have also been reported in several horticultural crops. These improvements are primarily attributed to the efficient uptake and translocation of zinc, which promotes metabolic activity and strengthens plant physiological responses under both optimal and stress conditions. Despite these advantages, the effectiveness of zinc nano-fertilizers depends on factors such as nanoparticle size, concentration, application method, crop species, and environmental conditions. Excessive application may adversely affect plant growth and nutrient balance, emphasizing the need for optimized application strategies and standardized protocols. Overall, zinc nano-fertilization represents a promising tool for improving food quality while supporting more efficient and sustainable crop production. Further research is required to better understand the long-term effects of zinc nanoparticles under field conditions and to establish agronomic practices that maximize their benefits while ensuring environmental sustainability. This review highlights the current knowledge on zinc nano-fertilization and emphasizes its potential role in producing high-quality food through sustainable agricultural systems.

Keywords: Zinc nano-fertilization, zinc oxide nanoparticles, food quality, biofortification, sustainable agriculture.

DAIRY WASTEWATER AS A SUBSTITUTE OF FAT IN GLUTEN FREE COOKIES FORMULATION: A CHALLENGE FOR AGROFOOD SUSTAINABILITY SECTOR

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ABSTRACT

Sustainable development has seen significant growth in recent years in agriculture, particularly in food industry sector. As a part of this initiative, the food industry has focused on the valorization and recycling of industrial waste from food production in order to reduce costs and protect the environment. The most common example is the use of dairy effluents, such as dairy wastewater. Our study focused on the use of dairy wastewater, specifically first rinse water (excluding CIP system water), in the formulation of gluten-free and low-fat cookies. In this type of formulation, the purpose of dairy wastewater was to replace fat. First, a sample of this dairy wastewater, obtained from processed cheese production, was sampled and its quality was tested. The quality control included standard physicochemical, nutritional, and microbiological analyses. The physicochemical analysis involved measuring pH, Dornic acidity, density, conductivity, and freezing point; the nutritional analysis consisted of dry matter content, ash content, butyric acid content, protein content, and lactose content; the microbiological analysis encompassed the enumeration of E. coli, Enterococci, and sulfite-reducing Clostridium. Second, the cookies made with dairy wastewater were prepared using two gluten-free flours: oat and quinoa. After baking the cookies, a sensory evaluation by a panel of 30 tasters was conducted. The questionnaire of the sensory test determined the evaluation of the parameters of appearance, shape, taste, persistence, mouthfeel, smell and texture. Therefore, a total of 30 samples of dairy wastewater were analyzed. These samples were found to be relatively acidic, with a pH of approximately 6 and an acidity assessed at 53.33°D. The fat content was high, compared to the protein content, estimated at approximately 8.5% and 1.7% respectively. The tasters unanimously approved of the use of dairy wastewater in the preparation of the reduced-fat, gluten-free cookies.

Keywords: Sustainable development, Dairy wastewater, Valorization, Recycling dairy effluent, Cookies.

LEAN MANUFACTURING APPLICATION IN FOOD INDUSTRY

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ABSTRACT

Globalization, increasing competition, and rapidly changing customer demands have made it imperative for the manufacturing sector to adopt more efficient, flexible, and cost-effective production systems. In the food industry in particular, the short shelf life of products highlights the necessity for continuous and fast-paced production processes, thereby exposing the limitations of the traditional mass production approach. Mass production systems can lead to various problems in food manufacturing facilities, including high inventory levels, long production lead times, excessive waste, and low flexibility. At this point, the lean manufacturing approach offers a customer-oriented, flexible, and efficient production model by eliminating waste. Lean manufacturing not only transforms physical processes but also enhances workforce management, equipment efficiency, and information flow. This study analyzes the transition process to lean manufacturing in a food production factory. The main objective of the study is to eliminate inefficiencies in the production line, reduce unnecessary inventories, lower costs, and increase production efficiency. Throughout this transformation, tools such as the Kaizen philosophy, 5S practices, Value Stream Mapping (VSM), fishbone (Ishikawa) analysis, and Industry 4.0 technologies have been integrated holistically. Based on this analysis, various lean manufacturing tools were utilized to develop appropriate solutions. In particular, the use of value stream mapping played a critical role in identifying non-value-added activities and planning a future-state lean flow. This transformation process represents not only an operational shift but also a cultural change within the organization.

Keywords: Lean Lean Manufacturing, Mass Production, Efficiency, Value Stream Mapping, Fishbone Analysis

COMPARATIVE EFFECTS OF EDTA AND DTPA ON THE STABILITY OF ASCORBIC ACID DURING CAPILLARY ELECTROPHORETIC DETERMINATION IN LEMON JUICE

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ABSTRACT

The oxidation of ascorbic acid especially in presence of metal catalysts can occur during sample preparation, resulting in an inaccurate measurement of its capillary electrophoretic determination. This study was performed in order to compare the effect of ethylenediaminetetraacetic acid (EDTA) and diethylenetriaminepentaacetic acid (DTPA) on the stability of ascorbic acid in lemon juice. Lemon juice was prepared freshly and then mixed (1:1 v/v) with EDTA or DTPA at concentrations of 0 (untreated), 0.5, 1.0 and 2.0 mM and measured either immediately or after 6 h waiting at room temperature. The external calibration curve ranged from 1.56125 to 100 µg/mL and had a higher linearity (R2=0.99985), with limits of detection and quantification of 1.57 and 4.77 µg/mL, respectively. The recovery percentage of this method was 95% which revealed a satisfactory analytical accuracy. The concentration of chelator had a significant effect on the initial ascorbic acid concentration measurement ($P < 0.001$). However, after waiting for 6 h, both the type ($P < 0.01$) and concentration ($P < 0.001$) of chelator significantly influenced ascorbic acid stability. The highest ascorbic acid concentration was found in samples treated with DTPA in comparison with EDTA-treated ones. These results showed that oxidation begins during sample preparation and suggested that adding approximately 1.0 mM of DTPA is an effective strategy to improve the reliability of capillary electrophoretic determination of ascorbic acid in food matrices.

Keywords: Oxidation, Ascorbic acid, Lemon juice, Metal-chelate complexes

EFFECTS OF HIGH HYDROSTATIC PRESSURE AND FREEZING ON THE SHELF-LIFE PROPERTIES OF LOW-ACID VEGETABLE JUICE

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ABSTRACT

Low-acid vegetable juices are particularly susceptible to microbial spoilage, which restricts their shelf life under refrigerated storage. This study investigated the effect of high hydrostatic pressure (HHP, 450 MPa / 4500 bar, 5 min), applied alone or combined with freezing (-80°C), on the shelf-life-related properties of carrot juice, and examined how lowering the pH through the addition of red grapefruit juice (70% carrot - 30% red grapefruit, w/w) modifies this effect. Eight sample groups were established by combining two juice formulations (pure carrot juice and the carrot-red grapefruit blend) with four pretreatment conditions (untreated control, freezing only, HHP only, and combined freezing plus HHP). Samples were stored at 4°C for 48 days and analyzed at six time points (days 0, 11, 22, 32, 40, and 48) for total aerobic mesophilic count, yeast-mold count, pH, titratable acidity, ascorbic acid content, soluble solids content, and color parameters. Throughout storage, groups subjected to combined freezing and HHP treatment exhibited the most stable microbiological profile among all groups, while HHP applied alone provided a comparatively limited, though generally favorable, contribution to microbial stability. Visible mold development was observed by day 48, particularly in untreated and singly treated groups. Physicochemical parameters followed patterns broadly consistent with expected preservation trends, with HHP-treated samples generally showing better retention. These findings suggest that combined freezing and HHP application, together with pH reduction via grapefruit juice addition, may support the microbiological stability of carrot juice during refrigerated storage; however, the observed extent of shelf-life extension was modest rather than pronounced. Further studies incorporating replicated sampling are recommended to confirm these preliminary observations.

Keywords: Carrot juice, Red grapefruit juice, High hydrostatic pressure, Freezing, Shelf life, Microbiological stability

DIETARY PATTERNS, GUT MICROBIOME MODULATION, AND MENTAL HEALTH OUTCOMES: EVIDENCE FROM A PRISMA-BASED SYSTEMATIC REVIEW

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ABSTRACT

Introduction: Mental health disorders, including depression and anxiety, represent a growing global public health concern. Emerging evidence points to diet as a key modulator of gut microbiome composition, with downstream effects on mental health through the gut–brain axis. Despite growing research interest, findings remain inconsistent across study designs and populations. This systematic review synthesizes human evidence on dietary patterns, microbiome-targeted interventions, and mental health outcomes. **Methods:** A PRISMA 2020-based systematic review was conducted using PubMed, ScienceDirect, and Google Scholar (2009–2024; final search: January 2026). Included studies involved human participants examining associations between diet, gut microbiota, and mental health outcomes (depression, anxiety, stress, psychological well-being). Eligible designs included RCTs, cohort, and cross-sectional studies. From 1,248 records identified, 36 studies met inclusion criteria. Methodological quality was assessed using Cochrane RoB 2 for RCTs and the Newcastle–Ottawa Scale for observational studies. **Results and Discussion:** The 36 included studies comprised 12 RCTs, 14 cohort, and 10 cross-sectional studies. Of these, 15 examined dietary patterns, 10 probiotics, 5 prebiotics, and 6 functional foods. Mediterranean diet adherence was consistently linked to reduced depressive symptoms and better psychological well-being. The SMILES trial reported significant reductions in depression scores following dietary intervention. Western-style diets were associated with higher rates of depression and anxiety. Probiotic and prebiotic interventions showed beneficial but variable effects depending on strain, dosage, and duration. Diet-induced microbiome changes appear to affect mental health through inflammatory pathways, neurotransmitter production, and short-chain fatty acid signaling. A notable research gap was identified in Southeastern Europe, including Albania.
Conclusions: Diet is a practical and accessible factor that may improve mental health through microbiome-related mechanisms. Future studies should adopt standardized methods and longer follow-up periods to clarify causal pathways and inform nutrition-based approaches in mental health care.

Keywords: diet, gut microbiome, mental health, depression, Mediterranean diet, probiotics, gut–brain axis, systematic review, PRISMA

SUSTAINABLE RECOVERY OF HIGH-VALUE BIOACTIVE COMPOUNDS FROM FOOD PROCESSING BY-PRODUCTS: INTEGRATING GREEN EXTRACTION AND MEMBRANE SEPARATION TECHNOLOGIES

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ABSTRACT

Food processing generates substantial quantities of by-products that remain rich in valuable bioactive compounds, including phenolics, anthocyanins, and carotenoids. Their recovery offers opportunities to reduce waste while producing natural ingredients for food, nutraceutical, and related applications. However, conventional recovery methods often rely on prolonged extraction, high solvent consumption, and energy-intensive concentration steps, limiting their environmental and economic sustainability. This review examines integrated strategies that combine green extraction technologies with membrane-based separation for the sustainable valorization of food processing by-products. Green extraction approaches, including ultrasound-assisted extraction, microwave-assisted extraction, enzyme-assisted extraction, pressurized liquid and subcritical water extraction, supercritical fluid extraction, and the use of green solvents such as natural deep eutectic solvents, are discussed in terms of their potential to enhance mass transfer, improve recovery efficiency, and reduce solvent, energy, and processing requirements. Their applicability to the recovery of phenolic compounds, anthocyanins, carotenoids, and other valuable bioactive constituents from food processing residues is comparatively evaluated. Following extraction, pressure-driven membrane processes, including microfiltration, ultrafiltration, nanofiltration, and reverse osmosis, are assessed for clarification, fractionation, purification, and concentration of bioactive-rich extracts. Special attention is given to membrane fouling, which remains a major limitation when processing complex plant-derived matrices, and to fouling-mitigation strategies involving appropriate pretreatment, hydrodynamic enhancement, process optimization, and ultrasound-assisted membrane processing. The effects of processing conditions on recovery yield, selectivity, membrane performance, and the stability of heat-sensitive bioactive compounds are also discussed. Overall, coupling green extraction with membrane separation provides a promising framework for transforming food processing residues into value-added ingredients while reducing solvent use, thermal exposure, and waste generation. Future research should focus on process integration, scale-up, energy efficiency, membrane durability, and techno-economic and environmental assessment to enable industrial implementation within a circular bioeconomy.

Keywords: food processing by-products, bioactive compounds, green extraction, membrane separation, process intensification, circular bioeconomy

POTENTIAL USE OF BIOCHARS IN THE BLEACHING STAGE OF VEGETABLE OIL REFINING

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ABSTRACT

The bleaching stage of vegetable oil refining is one of the most critical processing steps, as it removes chlorophylls, carotenoids, oxidation products, soap residues, trace metals, and other undesirable compounds, thereby improving the color, oxidative stability, and shelf life of edible oils. Bentonite-based bleaching earths and coal-derived activated carbons are widely employed as adsorbents during this process. However, the reliance of these conventional adsorbents on non-renewable resources, together with the generation of large quantities of spent adsorbents and their associated environmental impacts, has created an urgent need for sustainable and cost-effective alternatives. In recent years, biochars produced from agricultural and agro-industrial residues through pyrolysis, gasification, carbonization, and related thermochemical conversion processes have attracted considerable attention for adsorption applications owing to their high specific surface area, well-developed porous structure, abundant surface functional groups, low production cost, and environmentally friendly characteristics. In particular, biochars derived from coconut shells, hazelnut shells, rice husks, olive stones, walnut shells, almond shells, and woody biomass, as well as activated carbons produced through their physical or chemical activation, have demonstrated excellent adsorption performance for the removal of dyes, heavy metals, pesticides, pharmaceutical residues, and various organic contaminants in numerous studies. Nevertheless, research investigating the application of these biochars as adsorbents in vegetable oil refining, particularly during the bleaching stage, remains very limited. Current literature indicates that the physicochemical properties of biochars are strongly influenced by feedstock type, pyrolysis temperature, activation method, and production conditions, all of which directly affect their adsorption performance. This review comprehensively examines the production technologies, physicochemical characteristics, and adsorption mechanisms of biochars derived from different biomass sources and evaluates the key factors influencing their bleaching performance in vegetable oil refining. Furthermore, the potential effects of biochar application on pigment removal, free fatty acid reduction, elimination of oxidation products and trace contaminants, preservation of natural antioxidants, process efficiency, and overall sustainability are critically discussed based on recent literature. Particular emphasis is placed on the valorization of agricultural by-products, such as hazelnut shells generated in large quantities in Türkiye, the world's leading hazelnut producer, as promising biochar feedstocks for vegetable oil refining, thereby contributing to both sustainable waste management and the circular bioeconomy. Overall, biochars exhibit significant potential as sustainable and economically viable alternatives to conventional bleaching adsorbents. However, further research is required to elucidate their adsorption mechanisms, optimize processing conditions, evaluate their effects on oil quality, and assess their techno-economic feasibility prior to large-scale industrial implementation.

Keywords: Biochar, Vegetable oil refining, Bleaching, Adsorbents, Adsorption, Pyrolysis.

SHELF LIFE EXTENSION OF ARONIA JUICE BY THE COMBINED APPLICATION OF FREEZING AND HIGH HYDROSTATIC PRESSURE

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ABSTRACT

Aronia (Aronia melanocarpa) is a functional fruit rich in phenolic compounds and anthocyanins. However, microbiological deterioration and quality changes occurring during storage limit the shelf life of its juice. The aim of this study was to investigate the effects of freezing and high hydrostatic pressure (HHP) on the shelf life of aronia juice. Freshly harvested aronia berries were cleaned and stored at -80 °C. Before processing, the fruits were thawed at +4 °C and pressed to obtain juice. The juice samples were divided into four groups: control (+4 °C), frozen control (-80 °C), HHP-treated after storage at +4 °C (450 MPa for 5 min), and HHP-treated after frozen storage (-80 °C) (450 MPa for 5 min). All samples were stored at +4 °C throughout the shelf-life study and analyzed at predetermined sampling intervals. During storage, total aerobic mesophilic bacteria (TAMB), yeast and mold counts, Salmonella spp., and Listeria monocytogenes (at the beginning and the end of storage) were determined. In addition, pH, total soluble solids (°Brix), titratable acidity, CIE Lab* color values, total phenolic content, antioxidant activity, and sensory properties were evaluated. Preliminary results indicated that HHP-treated samples exhibited lower microbial loads than the control groups, with a particularly pronounced inhibitory effect on yeasts and molds. Salmonella spp. and Listeria monocytogenes were not detected in any of the samples. While only minor changes were observed in physicochemical properties during storage, time-dependent changes were detected in color parameters and physical stability.

Keywords: Aronia juice, high hydrostatic pressure, shelf life

FERMENTED MICROGREENS AS NATURAL BIOPRESERVATIVES FOR FRESH CHEESE: OPTIMIZATION OF ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES AND EVALUATION OF STORAGE STABILITY

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ABSTRACT

The increasing demand for natural alternatives to synthetic food preservatives has stimulated research on bioactive plant-based ingredients with antimicrobial and antioxidant properties. This study investigated the potential of fermented microgreens from basil (Ocimum basilicum L.), lentil (Lens culinaris Medik.), and garden cress (Lepidium sativum L.) as natural biopreservatives for fresh cheese. The seeds were germinated and subjected to lactic fermentation using a mixed starter culture containing Bifidobacterium longum, Lactobacillus helveticus, Lactococcus lactis, and Streptococcus thermophilus for 24, 48, and 72 h. Fermentation progress was monitored through pH, lactic acid bacteria counts, reducing sugars, proteins, total phenolics, and flavonoids. Antioxidant activity was evaluated by DPPH, ABTS, and FRAP assays, while antimicrobial activity was assessed using agar diffusion method. A mixture design was applied to optimize extract formulation. The fermented extracts were incorporated into fresh cheese at 2% (w/w), and their preservative effect was evaluated during 10 days of refrigerated storage. The results showed a significant increase in phenolic compounds and flavonoids after 48 h of fermentation, accompanied by enhanced antioxidant and antimicrobial activities. Lepidium sativum exhibited the strongest antioxidant activity, with IC_{50} values of 55.5 µg/mL and 124.6 µg/mL for DPPH and ABTS assays, respectively. The optimized mixture demonstrated synergistic antimicrobial effects against several pathogenic strains. In fresh cheese, fermented extracts reduced microbial spoilage, limited lipid oxidation, and maintained lactic acid bacteria viability during storage. Sensory evaluation confirmed good acceptability of the enriched cheeses. These findings highlight fermented microgreens as promising natural biopreservatives for dairy applications.

Keywords: Microgreens, lactic fermentation, antioxidant activity, antimicrobial activity, fresh cheese, natural preservatives.

ENZYMATIC TRANSGALACTOSYLATION OF MILK LACTOSE AND STORAGE STABILITY OF GALACTOOLIGOSACCHARIDES IN KEFIR

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ABSTRACT

Galactooligosaccharides (GOS) are prebiotic carbohydrates that can be produced from lactose through β-galactosidase-catalyzed transgalactosylation. Integrating this reaction directly into a dairy matrix before fermentation may provide an alternative to the conventional addition of commercial GOS preparations while simultaneously modifying residual lactose and monosaccharide composition. This study aimed to evaluate enzymatic GOS production in concentrated milk and to determine the changes in the sugar profile of kefir produced from GOS-enriched milk during refrigerated storage. Pasteurized milk was concentrated by lyophilization and adjusted to an initial lactose concentration of approximately 110±5 g/L. Enzymatic synthesis was performed using β-galactosidase from Aspergillus oryzae at 45 °C and an enzyme level of 0.098 U/g substrate. Changes in lactose, glucose, galactose, GOS-3, and GOS-4 during the reaction were monitored by HPLC. For kefir production, three groups were prepared: kefir from normal pasteurized milk (NSK), kefir from concentrated milk (KSK), and kefir from enzymatically GOS-enriched concentrated milk (GOSK). Samples were fermented at 25 °C for 24 h and stored at 4 °C for 28 days. During enzymatic synthesis, GOS-3 reached a maximum of 14.6±0.7% at 45±10 min, whereas GOS-4 reached 3.9±0.3% at 120±10 min. Maximum total GOS yield was 17.5±0.5% at 50±15 min, indicating that prolonged reaction promoted secondary hydrolysis rather than further GOS accumulation. During storage, GOSK maintained a distinct carbohydrate profile. GOS-3 changed from 13.15% on day 1 to 14.29% on day 28, while GOS-4 changed from 2.69% to 2.22%. Over the same period, lactose decreased from 52.60% to 47.14%, whereas galactose increased from 13.13% to 18.01%. In contrast, GOS-3 remained low in NSK and KSK, reaching maximum values of only 0.71% and 1.06%, respectively. These results demonstrate that pre-fermentation enzymatic transgalactosylation effectively restructures the milk carbohydrate profile and enables substantial GOS enrichment that remains largely stable throughout kefir storage under refrigerated storage conditions overall.

Keywords: Galactooligosaccharides, β-galactosidase, transgalactosylation, kefir, prebiotic, storage stability

EVALUATION OF HARDALIYE IN INSTANT SOLUBLE POWDER FORM: FUNCTIONAL ADVANTAGES OF LYOPHILIZATION AMONG ALTERNATIVE METHODS

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ABSTRACT

This review systematically addresses innovative and current approaches aimed at extending the shelf life of hardaliye, a traditional fermented beverage unique to the Thrace region. Today, hardaliye is produced at both local and industrial scales and is offered to consumers in domestic and international markets. However, its limited shelf life necessitates the use of additives during production and gives rise to standardization problems; this results in both a weakening of its functional properties and a loss of commercial value. Although the addition of preservatives provides a short-term solution, it negatively affects the product's sustainability in the market and prevents its regional potential from being fully utilized. Within this framework, lyophilization (freeze-drying) stands out as an alternative for converting hardaliye into an instant soluble powder. Based on the removal of water under low-temperature and vacuum conditions, this method contributes to the preservation of heat-sensitive attributes such as anthocyanins/proanthocyanidins, aroma compounds, and potential probiotic viability, while reducing the need for additives and facilitating storage and logistics. In addition, the literature has demonstrated that the choice of carrier/wall material (inulin, gum arabic, pectin, maltodextrin, etc.) is a determining factor for powder quality parameters such as stickiness, flowability, and solubility, and that optimal ratios vary according to product composition and process conditions. In conclusion, current findings indicate that lyophilization, together with alternative non-thermal processes, is a powerful technology for the standardization of hardaliye, preservation of functional components, and extension of shelf life without additives. Nevertheless, further empirical studies are needed regarding carrier optimization, process economics, and industrial scalability.

Keywords: Hardaliye, hardaliye powder, lyophilization

EVALUATION OF THERMAL AND PRESSURE DYNAMICS DURING FREEZE-DRYING OF BANANA SLICES

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ABSTRACT

Freeze-drying is a low-temperature dehydration technique that can provide high-quality dried fruit products; however, understanding temperature and pressure dynamics throughout the process is important for evaluating drying behaviour. In this study, the thermal and vacuum profiles occurring during the freeze-drying of banana slices were investigated using process data continuously recorded by an industrial-scale freeze dryer. Set temperature, shelf temperature, chamber pressure, condenser temperature, and product temperatures measured at four different locations were evaluated as a function of process time. During the freezing stage, the set temperature was maintained at −40 °C and the product temperatures progressively decreased toward the freezing temperature while the chamber pressure remained at approximately 1000 Pa. During the subsequent drying stages, shelf temperature was progressively increased. At a set temperature of 35 °C, product temperatures gradually increased while chamber pressure reached approximately 0.1 Pa. Following the transition to the 45 °C stage, product temperatures progressively approached the shelf temperature, while the chamber pressure remained stable at approximately 0.1 Pa. At the later stage of drying, product temperatures reached approximately 45 °C, indicating a marked reduction in the temperature difference between the product and shelf. The results demonstrate distinct thermal and pressure patterns throughout the freeze-drying cycle of banana slices. In particular, the progressive convergence of product and shelf temperatures, together with stabilization of chamber pressure, provided useful process indicators for monitoring the progression of drying. These findings demonstrate the potential of routinely recorded freeze-dryer process data for characterizing freeze-drying behaviour and supporting process monitoring in fruit applications.

Keywords: banana, freeze-drying, lyophilization, product temperature, shelf temperature, chamber pressure, process monitoring

EVALUATION OF THE EFFECT OF DIFFERENT FREEZE-DRYING CYCLES ON THE DRYING PERFORMANCE OF KIWIFRUIT

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ABSTRACT

Freeze-drying is widely used for the dehydration of fruits due to its ability to remove water at low temperatures while maintaining desirable product characteristics. However, drying performance is strongly influenced by the design of the freeze-drying cycle, particularly the temperature–time profile applied during primary and secondary drying. This study aimed to evaluate the effect of two different freeze-drying cycles on the drying performance and final moisture content of sliced kiwifruit. Kiwifruit slices were subjected to two freeze-drying cycles differing in their temperature–time profiles. In the first cycle, the temperature was progressively increased through −40, −35, −30, −25, 0, 5, 10, 20, 25, 35, and 40 °C. In the modified cycle, a prolonged freezing stage at −40 °C was followed by drying stages at −25, 0, 5, 10, 20, 25, 35, 40, and 45 °C. Process data, including product temperature, shelf temperature, condenser temperature, and chamber pressure, were continuously recorded during freeze-drying. In the modified cycle, the transition from the freezing stage to −25 °C coincided with the initiation of vacuum and a subsequent decrease in chamber pressure. Excluding the freezing stage, the total drying times were 24.5 and 25.5 h for the first and modified cycles, respectively. The final moisture content of kiwifruit obtained using the first cycle was approximately 5.00%, whereas the modified cycle resulted in a moisture content of 2.77%. Thus, a substantial reduction in residual moisture was achieved with only a limited increase in drying time. Differences in the distribution of temperature stages throughout the process, particularly the extended higher-temperature drying period in the modified cycle, may have contributed to more effective moisture removal during the later stages of freeze-drying. These findings indicate that the drying performance of kiwifruit is influenced not only by total drying time but also by the design and distribution of temperature stages throughout the freeze-drying cycle. Appropriate modification of the temperature–time profile may therefore provide an effective strategy for achieving lower residual moisture without substantially extending the drying process. Further studies with independent process replicates and additional quality parameters are required to confirm the effectiveness of the modified cycle.

Keywords: kiwifruit, freeze-drying, lyophilization, drying performance, process cycle, moisture content.

POST-FIRE ASSESSMENT OF VEGETATION STRUCTURE AND BIODIVERSITY AS A TOOL FOR THE PROTECTION AND RESTORATION OF EL-HAMDANIA CORK OAK FOREST-ALGERIA

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ABSTRACT

Wildfires are among the most significant disturbances affecting Mediterranean forest ecosystems, causing profound changes in vegetation composition, biodiversity, and ecosystem functioning. Understanding post-fire vegetation dynamics is essential for developing effective strategies for plant protection, ecological restoration, and sustainable forest management. This study aimed to evaluate the impact of wildfire on the diversity and structure of the El-Hamdania cork oak forest located in Blidean Atlas, Algeria. To achieve this objective, a systematic vegetation survey was conducted along four transects established in burned and unburned areas under a sub-humid Mediterranean climate, at elevations ranging from 480 to 700 m. Floristic composition, biological spectra, biodiversity indices, and the horizontal and vertical structures of the vegetation were analyzed to characterize post-fire ecosystem responses and identify indicator species. The floristic inventory recorded 173 plant species belonging to 52 botanical families, with Asteraceae being the dominant family. Herbaceous therophytes predominated, indicating a high level of post-fire ecosystem disturbance. Conversely, the remarkable regeneration of heliophytic species, including Ampelodesmos mauritanicus, Calycotome spino.sa, Cistus salvifolius, Genista tricuspidata, and Erica arborea, reflected the early stages of natural vegetation recovery. These species can serve as valuable bioindicators for monitoring post-fire recovery and guiding ecological restoration efforts. Vertical stratification revealed a sparse tree layer, mainly composed of fire-resistant cork oaks (Quercus suber), whose thick cork bark enables them to survive fire and facilitates the rapid development of a dense herbaceous layer following disturbance. This vegetation structure reflects the ecological changes induced by wildfire. This study demonstrates the resilience of the El-Hamdania cork oak forest to wildfire and highlights the importance of post-fire vegetation monitoring for plant protection and sustainable ecosystem management. Identifying resilient species and vegetation recovery patterns provides valuable insights for designing restoration programs, conserving biodiversity, and enhancing the long-term protection of this important Mediterranean ecosystem against recurrent wildfires.

Keywords: Forest fires, Cork Oak forest, post-fire recovery, biodiversity, vegetation structure, heliophytic species

INFLUENCE OF BASAL WOUNDING AND AUXIN APPLICATIONS ON ROOTING PERFORMANCE OF HARDWOOD CUTTINGS OF PODOCARPUS MACROPHYLLUS VAR. MACROPHYLLUS

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ABSTRACT

Vegetative propagation through stem cuttings is widely used for the large-scale production of ornamental plants because it enables the preservation of desirable parental characteristics and the multiplication of selected cultivars and varieties. *Podocarpus macrophyllus* (Thunb.) Sweet var. *macrophyllus* is an ornamental evergreen conifer native to East Asia and widely cultivated in parks, gardens, and urban landscapes because of its attractive foliage, adaptability to pruning, and aesthetic value. Therefore, enhancing the rooting success of hardwood cuttings is important for the efficient vegetative propagation of this taxon. This study aimed to evaluate the effects of basal wounding and different auxin applications on the rooting performance of hardwood cuttings of *P. macrophyllus* var. *Macrophyllus*. The experiment included eight treatments consisting of a control, basal wounding, and applications of indole-3-butyric acid (IBA) and α-naphthalene acetic acid (NAA) at concentrations of 6,000, 8,000, and 10,000 ppm. At the end of the rooting period, rooting percentage, callus percentage, root length, and root number were determined. The data were subjected to one-way analysis of variance (ANOVA). Although no statistically significant differences were detected among the treatments ($p > 0.05$), clear differences in rooting responses were observed. The highest mean rooting percentage (53.3%) was achieved with the IBA 6,000 ppm treatment, compared with only 16.7% in the control treatment, whereas the highest mean callus percentage (30.0%) was obtained in the basal wounding, IBA 8,000 ppm, and NAA 6,000 ppm treatments. The greatest mean root length (6.4 cm) was recorded following NAA 10,000 ppm application. Likewise, the highest mean root number (10.6 roots per cutting) was obtained with NAA 6,000 ppm, followed closely by NAA 8,000 ppm (10.5 roots per cutting). In contrast, the control treatment generally produced lower rooting performance than auxin-treated cuttings. Overall, IBA applications were more effective in improving rooting percentage, whereas NAA treatments promoted root system quality by increasing both root length and root number. These findings suggest that auxin application may improve the rooting potential of *P. macrophyllus* var. *macrophyllus* hardwood cuttings, thereby supporting the large-scale production of high-quality nursery stock for ornamental landscape use.

Keywords: Ornamental plant, clonal propagation, stem cuttings, adventitious rooting

EFFECTS OF SEEDLING AGE AND GROWING SEASON ON TOTAL SOLUBLE CARBOHYDRATE CONTENT IN GINKGO BILOBA L. SEEDLINGS

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ABSTRACT

Carbohydrates play a fundamental role in plant growth and development by serving as the primary source of metabolic energy and by contributing to physiological adaptation under changing environmental conditions. The present study aimed to determine the variation in total soluble carbohydrate content of Ginkgo biloba L. seedlings with respect to seedling age and sampling time during the growing season. Two-, three-, and four-year-old seedlings were used as plant material. Leaf samples were collected from 20 seedlings in each age class (60 seedlings in total) at the beginning and at the end of the growing season. Total soluble carbohydrate content was determined using the phenol–sulfuric acid method described by Dubois et al. (1956), and the results were expressed as mg g^{-1} dry weight. Within each sampling period, differences among seedling ages were evaluated by one-way analysis of variance (ANOVA), followed by Duncan's multiple range test to identify homogeneous groups. In addition, changes in carbohydrate content between the beginning and the end of the growing season were compared for each seedling age using the independent samples t-test. At the beginning of the growing season, total soluble carbohydrate content increased with seedling age, with mean values of 90.77, 93.94, and 98.24 mg g^{-1} in two-, three-, and four-year-old seedlings, respectively. The differences among age classes were statistically significant ($p < 0.05$), and Duncan's test identified the four-year-old seedlings as the group with the highest carbohydrate content. In contrast, this pattern was reversed at the end of the growing season, when the highest carbohydrate content was recorded in two-year-old seedlings (133.77 mg g^{-1}), whereas the lowest value was observed in four-year-old seedlings (116.35 mg g^{-1}). Differences among age classes at the end of the growing season were highly significant ($p < 0.01$). Furthermore, independent samples t-tests revealed significant differences in total soluble carbohydrate content between the beginning and the end of the growing season for each seedling age. The findings demonstrate that total soluble carbohydrate content in Ginkgo biloba seedlings is influenced not only by seedling age but also by the stage of the growing season. The reversal in carbohydrate distribution among age classes from the beginning to the end of the growing season suggests age-dependent differences in carbohydrate accumulation, utilization, and reserve allocation during seasonal growth. These results provide new insights into the physiological dynamics of carbohydrate metabolism in Ginkgo biloba seedlings and contribute to a better understanding of age-related physiological processes that may support future nursery management and silvicultural practices.

Keywords: Maidenhair tree, carbohydrate metabolism, seedling age, seasonal dynamics, physiological development

CONTRIBUTION OF FISH AND ARRAY-CGH IN THE DIAGNOSIS OF MICRODELETION SYNDROMES: A MONOCENTRIC RETROSPECTIVE STUDY

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ABSTRACT

Background: Submicroscopic chromosomal abnormalities represent a major cause of syndromic intellectual disability (ID) and escape detection by standard karyotyping. Molecular cytogenetic techniques, particularly fluorescence in situ hybridization (FISH) and array comparative genomic hybridization (array-CGH), significantly improve their detection. The objective of this study was to evaluate the contribution of these two approaches in the diagnosis of microdeletion syndromes. **Methods:** This is a retrospective monocentric study conducted between 2008 and 2025 at the cytogenetics laboratory of the Pierre and Marie Curie Center (Algiers). Patients older than 2 years presenting with syndromic intellectual disability associated with a clinical suspicion of a microdeletion syndrome were included. Cases with chromosomal numerical or structural abnormalities detected by standard karyotyping, as well as confirmed metabolic disorders, were excluded. Targeted FISH analysis was performed in 304 patients. Ten selected cases underwent complementary analysis by array-CGH in collaboration with the Mother and Child Hospital of Lyon (France). **Results:** Among the 304 suspected cases of microdeletion syndromes, 96 were confirmed by FISH, corresponding to a diagnostic yield of 31.6%. Complementary array-CGH analysis, performed in 10 selected patients, identified additional submicroscopic rearrangements, including a 1p36 deletion and Phelan–McDermid syndrome. It also enabled precise delineation of chromosomal breakpoints and refinement of the extent of certain abnormalities initially detected by FISH. **Conclusion:** Targeted FISH represents an effective first-line diagnostic approach in patients with syndromic intellectual disability and suspected microdeletion syndromes. Array-CGH, used as a complementary tool in selected cases, allows for more precise characterization of chromosomal abnormalities and the detection of additional submicroscopic rearrangements, thereby improving diagnostic accuracy and genetic counseling.

Keywords: Chromosomal microdeletion, Syndromic intellectual disability, Array-CGH, FISH

INTEGRATED MULTI-OMICS ANALYSIS IN BREAST CANCER: FROM DIFFERENTIAL EXPRESSION TO THE IDENTIFICATION OF MASTER REGULATORS

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ABSTRACT

Breast cancer (BC), despite numerous innovations, poses several major challenges in prognosis and targeted therapies due to its inherent transcriptomic heterogeneity and dynamic regulatory networks. The transition to precision oncology requires deciphering hidden regulatory foci and remapping tumor signaling pathways. In this study, to explore the molecular architecture of breast cancer, expression microarrays corresponding to the identifiers GSE198650 were constructed from the NCBI GEO database. After assessing the quality of the arrays with ArrayQualityMetrics data, preprocessing, background software design, and smoothing with the limma package algorithms were performed in the R computing environment. By applying comparative statistical filters (P-value < 0.05 and LogFC >-5), transcriptome profiles of selected mRNAs and lncRNAs with differential expression were drawn. In order to apply one-dimensional abundance analyses to the topological interpretation of the system, product production (PPI) networks were reconstructed and dense subnetworks with high biological stability were created via the MCODE algorithm in Cytoscape. Finally, using the OmicsNet platform for multi-omics integration, a 3D regulatory network consisting of cross-interactions of transcription factors (TFs), lncRNAs, and target genes was constructed. This integrated modeling led to the identification of master regulators and spatial hub nodes that command the rearrangement of oncogenic pathways and phenotypic initiation towards malignancy. The findings of this study, by providing a picture of regulatory coherence, systemic dynamics for the introduction of novel biomarkers for stratifying and prioritizing therapeutic approaches in personalized medicine for breast cancer.

Keywords: Breast cancer, long non-coding RNA, systems biology, regulatory networks

ANCIENT DNA TELLS THE STORY OF RESULOĞLU: GENETIC TRACES FROM THE EARLY BRONZE AGE TO THE PRESENT

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ABSTRACT

Mitochondrial DNA analyses were carried out in order to determine the haplogroups of 6 individuals obtained from the cemetery of Resuloğlu and dated to the Early Bronze Age (EBA III). The individuals to be included in the bioinformatics analysis were evaluated according to their sequence quality and it was decided that 3 individuals could be used in further analysis. Using bioinformatics tools, it was determined that three individuals belonged to the T2e+152, H2a2a2 and JT haplogroups. These results support a link between the origins of the present- day European population and the farmers of the Anatolian Neolithic period. Furthermore, a detailed analysis of single nucleotide polymorphisms revealed T16189C and C150T mutations in the two of three individuals, which are associated with the risk of melanoma and cervical cancer-HPV infection. These molecular findings are consistent with the health profiles of the excavated skeletons, which indicate that the community struggled with infectious and metabolic diseases. The entire study was carried out in the Ancient DNA and Metagenomics Research Laboratory of the Department of Molecular Biology and Genetics, Istanbul University.

Keywords: Bioinformatics analysis, Anatolian neolithic period, Molecular anthropology, Reactive oxygen species, Polymorphism

A NOVEL HYBRID ALGORITHM FOR ROBUST PARAMETER ESTIMATION IN Q-GAUSSIAN REGRESSION: APPLICATION TO AGRICULTURAL WATER INFILTRATION

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ABSTRACT

We propose a novel q-Gaussian regression model that leverages the exceptional flexibility of the q-Gaussian distribution N_q(m, \sigma^2) to provide a more adaptable and robust modeling approach compared to traditional Gaussian regression. The q-Gaussian distribution, which emerges from the principle of maximum entropy under appropriate constraints, generalizes the standard normal distribution by incorporating an additional shape parameter q. For q = 1, the classical Gaussian distribution is exactly recovered. For 1 < q < 3, the distribution exhibits heavier tails than the normal, making it particularly suitable for datasets containing outliers, extreme values, or exhibiting excess kurtosis. Conversely, for q < 1, the distribution becomes compact-supported, which can be useful for bounded phenomena. This rich flexibility is crucial in numerous real-world applications where the strict normality assumption is frequently violated. In this work, we establish rigorous sufficient conditions for the asymptotic normality of the model's parameter estimators, thereby providing a solid theoretical foundation for statistical inference, including the construction of confidence intervals and hypothesis testing. A central contribution of our paper is the development of a new hybrid algorithm for parameter estimation that strategically combines the strengths of moment estimation and maximum likelihood techniques. This hybrid approach overcomes the well-known computational challenges associated with direct maximum likelihood estimation in q-Gaussian models, including numerical instabilities and convergence issues, while ensuring computational efficiency and robustness. The proposed methodology is extensively validated through comprehensive numerical experiments, including Monte Carlo simulations conducted under various scenarios with different sample sizes, noise levels, and degrees of tail heaviness. These simulations systematically assess the bias, variance, mean squared error, and coverage probabilities of the estimators, demonstrating their robustness against outliers and model misspecification. Furthermore, we showcase the practical utility of our model on a real-world water infiltration dataset collected from agricultural soils. In this application, the q-Gaussian regression model significantly outperforms classical Gaussian regression across multiple criteria, including goodness-of-fit measures (AIC, BIC), predictive accuracy (cross-validated MSE), and residual diagnostics. The results highlight the strong potential of the q-Gaussian framework for environmental and hydrological modeling, opening new and promising perspectives for robust regression analysis in the presence of heavy-tailed errors and complex data structures.

Keywords: q-Gaussian distribution, maximum likelihood estimator, regression model, simulation study, soil water infiltration.

FROM PRECISION AGRICULTURE TO HARMONIC ANALYSIS: A GENERALIZED LAPLACE TRANSFORM ON NILPOTENT LIE GROUPS

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ABSTRACT

The Laplace transform is a fundamental mathematical tool for modeling and analyzing dynamic processes arising in applications such as precision agriculture, including soil moisture evolution, soil heat transfer, irrigation control, crop growth, nutrient transport, and pest population dynamics. By converting differential equations into algebraic equations, it provides an efficient framework for the analysis and optimization of complex dynamical systems. Closely related to the Fourier transform, which may be regarded as a particular case of the Laplace transform, it is the following relation between the two operators illustrated by the formula which aloows us to extend the Laplace operator transform beyond the classical Euclidean setting, Fourier analysis admits a natural extension to non-abelian groups through the theory of unitary representations. In this work, inspired by the operator-valued Fourier transform on nilpotent Lie groups, we introduce a generalized Laplace transform that extends the classical Laplace transform from the real line to a broader non-commutative framework. The proposed construction is compatible with the classical definition on (\mathbb{R}) and is formulated in terms of the representation theory of nilpotent Lie groups. Particular attention is devoted to the Heisenberg group, which serves as a fundamental example of a non-abelian nilpotent Lie group. We investigate the main properties of the generalized Laplace transform in this setting and establish uniqueness results that extend corresponding classical results from the Euclidean framework to the Heisenberg group. Next step will be to formulate an uncertainty principle on the real line extendible to the non-abelian groups as we did with Muntz-Szasz Theorem.

Keywords: Laplace Transform

DEEP LEARNING APPROACH FOR ORANGE FRUIT DISEASES DETECTION

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ABSTRACT

Orange production plays a significant role in the agricultural sector worldwide; however, fruit diseases remain a major constraint, leading to considerable reductions in both yield and quality. Early and accurate disease detection is therefore essential for effective crop management, the optimization of phytosanitary treatments, and the promotion of sustainable agricultural production. In this context, this paper presents a deep learning-based approach for the automatic detection and classification of orange fruit diseases, aiming to support farmers and agricultural experts with a reliable decision-making tool. A deep learning model, based on convolutional neural networks, was developed and trained using a comprehensive dataset composed of high-resolution images of diseased orange fruits exhibiting various pathological symptoms. To enhance model robustness and generalization capabilities, several data preprocessing and augmentation techniques were applied, including normalization, random rotations, scaling, flipping, and brightness adjustments. These techniques help reduce overfitting and improve model performance when exposed to real-world field conditions. Experimental results demonstrate that the proposed model achieves high accuracy in identifying different disease categories, such as citrus canker, black spot, scab, and fruit rot. Comparative analyses show that our deep learning model significantly outperforms conventional machine learning methods, including support vector machines and random forests, in terms of classification accuracy, precision, recall, and F1-score. The developed system offers a fast, reliable, and cost-effective solution for supporting precision agriculture. By enabling early disease detection, it contributes directly to minimizing economic losses associated with fruit diseases, reducing unnecessary pesticide use, and improving overall orchard management. Future work will focus on expanding the dataset to include more disease variants and deploying the model on mobile platforms for real-time in-field diagnosis.

Keywords: Deep Learning, Orange Fruit Diseases, Disease Detection, Precision Agriculture, Artificial Intelligence.

MATHEMATICAL AND MACHINE LEARNING APPROACHES FOR SUSTAINABLE WATER AND AGRICULTURAL MANAGEMENT

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ABSTRACT

Salinity is a major constraint to agricultural productivity, particularly where irrigation water quality affects crop growth. Magnetic treatment of irrigation water offers a promising physical approach for improving plant responses under saline conditions. This study developed a mathematical and machine learning framework to predict early barley growth and identify favorable magnetic irrigation conditions. Barley (*Hordeum vulgare* L.) was exposed to irrigation water of different salinity levels and magnetic field intensities of 0.29, 0.33, and 0.50 T for different magnetization durations. Random Forest (RF), Polynomial Regression (PR), and Artificial Neural Network (ANN) models were evaluated using experimental growth data. All models showed high predictive performance ($R^2 > 0.90$), with Random Forest achieving the best performance ($R^2 = 0.922$, RMSE = 0.388, MAE = 0.401). Feature analysis identified germination time as the most influential predictor, while magnetic intensity and its interaction with treatment duration also contributed to model performance. The 0.33 T treatment for 30 min was associated with the highest relative growth response among the tested conditions (1.00). These findings demonstrate that mathematical modeling and machine learning can effectively capture complex relationships between magnetic irrigation conditions and barley growth, providing a quantitative basis for selecting favorable treatment conditions and supporting sustainable irrigation management under salinity stress.

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Keywords: Magnetized Water; Mathematical Modeling; Machine Learning; Barley Growth; Salinity.

THE EFFECT OF FLOW MODIFICATION METHODS ON THE OCCURRENCE OF CAVITATION IN ROTATING MACHINES

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ABSTRACT

Flow modification methods significantly influence cavitation in rotating machinery by optimizing pressure distribution and stabilizing fluid dynamics. These techniques, such as integrating inducers to boost suction pressure or applying casing treatments to manage tip leakage flows, directly increase the Net Positive Suction Head (NPSH) margin. By refining blade geometry (e.g., skew angles) and utilizing active flow control, these methods prevent local pressures from dropping below the vapor pressure limit. Consequently, this suppresses the formation and violent collapse of vapor bubbles, effectively reducing erosive pitting, mechanical vibrations, and performance degradation, while extending the operational lifespan, minimizing unsteady flow, and maximizing hydraulic efficiency and dynamic stability of pumps and turbines. This study presents a comparative analysis of flow regulation strategies in rotating machines and their impact on the cavitation phenomenon. Beyond the classical methods of throttling (valve) and speed variation (VFD), this work examines the effectiveness of modifying the blade tilt angle (Pivoting blades) as an alternative mechanical solution. The analysis shows that while rolling remains the simplest method, it is the riskiest because it maintains a high required NPSH and dissipates considerable energy. On the other hand, adjusting the blade angle allows the aerodynamic profile of the machine to be adapted to the desired flow rate, thus reducing turbulence at the inlet. However, speed variation remains the superior solution, as it reduces the NPSHr quadratically according to the affinity laws. The results confirm that the choice of regulation mode must reconcile hydraulic safety (anti-cavitation) and energy efficiency, while minimizing mechanical stresses on the machine components.

Keywords: Cavitation, Mechanical Reliability, Rotating Machines, Operating Point, Performance Curve, Affinity Laws, Vibrations and Noise

A REVIEW OF THE MECHANICAL BEHAVIOR OF AUXETIC TPMS-BASED FUNCTIONALLY GRADED STRUCTURES

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ABSTRACT

Functionally graded materials (FGMs) provide superior mechanical and thermal performance by gradually varying the spatial distribution of their constituent phases, thereby eliminating the abrupt interfacial stress concentrations commonly encountered in conventional composite materials. In recent years, the incorporation of triply periodic minimal surface (TPMS) geometries and auxetic cellular structures with a negative Poisson's ratio into the core regions of these materials has attracted considerable attention due to their advantages in lightweight design, energy absorption, and impact resistance. TPMS geometries, such as Gyroid, Primitive, Diamond, and I-WP, possess continuously smooth surface topologies that effectively reduce stress concentrations, while auxetic behavior, characterized by lateral expansion under tensile loading, enhances impact and indentation resistance. The integration of these mechanisms with functional grading enables the optimization of the static bending, free vibration, buckling, and dynamic responses of sandwich panel cores. TPMS-based mechanical metamaterials have attracted significant interest in aerospace, automotive, and biomedical engineering because of their high strength-to-weight ratio, excellent energy absorption capability, and unique acoustic and thermal properties. The incorporation of functional grading and auxetic characteristics into these structures represents a significant advancement in tailoring material performance to meet specific engineering requirements. This review comprehensively examines the design approaches, additive manufacturing techniques, and mechanical behavior of auxetic functionally graded TPMS structures. Existing studies in the literature are systematically reviewed to evaluate the influence of different cell topologies on deformation mechanisms. Furthermore, current manufacturing limitations, existing challenges, and future research directions are discussed to provide a comprehensive perspective on the development and application of these advanced metamaterials.

Keywords: Auxetic structures, triply periodic minimal surfaces (TPMS), functionally graded materials (FGMs), sandwich structures, mechanical behavior.

ACOUSTIC METAMATERIALS FOR LOW-FREQUENCY SOUND ABSORPTION: RESONANCE MECHANISMS, DESIGN APPROACHES, AND CURRENT TRENDS

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ABSTRACT

Effectively controlling low-frequency sounds is one of the most challenging problems in acoustic engineering due to their long wavelengths. Traditional porous sound-absorbing materials perform well in the mid and high frequencies thanks to energy dissipation mechanisms based on viscous and thermal losses, but they require high material thicknesses to provide effective sound absorption at low frequencies. This creates significant limitations, especially in engineering applications where volume and weight constraints exist. Acoustic metamaterials developed in recent years offer an alternative approach to traditional materials in controlling low-frequency sounds thanks to their properties based on local resonance and subwavelength structural design principles. In this study, acoustic metamaterials developed for low-frequency sound absorption are evaluated based on a comprehensive literature review. First, the historical development and theoretical foundations of acoustic metamaterials are discussed, and then Helmholtz resonators, membrane-type metamaterials, local resonance-based structures, and hybrid metamaterial systems are examined in terms of their working principles, advantages, and limitations. Furthermore, the possibilities offered by additive manufacturing technologies for the production of complex metamaterial geometries were evaluated, and the effects of geometric parameters, resonance characteristics, and material properties on sound absorption performance were compared in line with findings reported in the literature. The studies examined show that low-frequency sound absorption performance depends significantly not only on material properties but also on cell geometry, resonator configuration, and multi-scale structural design parameters. In conclusion, the potential of acoustic metamaterials to offer high-performance and compact solutions in low-frequency noise control has been demonstrated; current research trends, key challenges encountered, and future research requirements have been evaluated.

Keywords: Acoustics, Metamaterials, Sound absorption, Low frequency, Noise control

ANALYSIS OF RELIABILITY AND MAINTAINABILITY AND THEIR ECONOMIC IMPACT ON THE OPERATION OF THE FILFILA MARBLE QUARRY

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ABSTRACT

The mining sector constitutes a major strategic lever for diversifying the economy beyond hydrocarbons, particularly in regions rich in mineral resources. Within this environment characterized by extreme operating conditions—heavy dust exposure, mechanical stress, and continuous operation—the continuity of production depends directly on the availability and reliability of equipment. Unplanned downtime not only disrupts the production chain but also generates significant financial losses, making equipment reliability a critical concern for operational efficiency. This work aims to study the reliability and maintainability of the various equipment required for exploitation at the FILFILA marble quarry, located in an industrial context where extraction, crushing, and transport machinery operate under demanding conditions. Through the collection and analysis of historical failure data, this study identifies the main failure modes affecting critical equipment, evaluates key reliability indicators (MTBF, MTTR, availability), and examines the recurring technical problems encountered during daily operations. Furthermore, the financial impact of equipment downtime is assessed by quantifying production losses and maintenance costs associated with unplanned stoppages. The results obtained provide a basis for proposing preventive maintenance strategies aimed at improving equipment availability, reducing failure frequency, and minimizing the economic consequences of downtime, thereby contributing to a more sustainable and cost-effective exploitation of the marble quarry.

Keywords: Reliability, Maintainability, Equipment Availability, Industrial Maintenance, Failure, Marble Quarry

COMPOSITE MATERIALS USED IN THE AEROSPACE INDUSTRY AND THEIR REPAIR METHODS

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ABSTRACT

The use of composite materials in the aerospace industry has increased significantly in recent years due to their outstanding advantages, including a high strength-to-weight ratio, superior fatigue performance, and excellent corrosion resistance. In particular, carbon fiber-reinforced polymers (CFRPs), glass fiber-reinforced polymers (GFRPs), aramid fiber-reinforced composites, and honeycomb sandwich structures are widely employed in the fuselage, wings, tail sections, and internal structural components of modern aircraft. Despite these advantages, composite materials are susceptible to various types of damage, such as delamination, matrix cracking, fiber breakage, and debonding, resulting from impact loading, fatigue, environmental exposure, and manufacturing defects. Accurate damage detection and the implementation of appropriate repair techniques are therefore essential for maintaining the structural integrity, operational safety, and economic efficiency of aircraft. This review comprehensively examines the major composite materials used in the aerospace industry, the damage mechanisms affecting these materials, and current repair techniques. In addition, non-destructive testing (NDT) methods, including ultrasonic testing, thermography, radiography, and acoustic emission, as well as widely adopted repair techniques such as bonded repair, scarf repair, step-lap repair, resin injection, and hot bonder repair, are discussed. Various repair methods are compared in terms of their mechanical performance, applicability, cost, and maintenance time. Furthermore, emerging technologies, including self-healing composites, artificial intelligence-based damage detection, and robotic repair systems, are reviewed to highlight future developments in aircraft maintenance. Based on the findings of this review, it is concluded that the combination of appropriate damage detection techniques and suitable repair methods can significantly extend the service life of composite aircraft structures, reduce maintenance costs, and enhance flight safety.

Keywords: Aerospace industry, composite materials, composite repair, non-destructive testing, CFRP, damage mechanisms.

STRUCTURAL MODELING OF COMBINE HARVESTER CUTTERBAR SERRATED KNIFE SECTIONS USING A STEPWISE FUNCTIONALLY GRADED MATERIAL APPROACH

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ABSTRACT

Serrated knife sections used in combine harvester cutterbars are critical components responsible for efficient crop cutting during harvesting operations. Owing to continuous reciprocating motion and repeated cutting loads, these components are exposed to severe mechanical stresses, localized stress concentrations, edge wear, and progressive cutting edge dullness, which eventually reduce harvesting efficiency and service life. Conventional knife sections are generally manufactured from homogeneous steel, making it difficult to simultaneously achieve the high hardness required at the cutting edge and the toughness needed around the mounting holes to resist impact and fracture. In this study, a stepwise functionally graded material (FGM) approach is proposed as an alternative structural design concept for combine harvester serrated knife sections. The proposed model is designed to provide enhanced hardness in the cutting region while maintaining improved toughness in the mounting region through a gradual variation of material properties represented by a stepwise configuration. A three-dimensional model of the existing knife geometry is established, and both homogeneous and stepwise functionally graded material models are developed. Their structural behaviors are intended to be comparatively evaluated under identical loading conditions using the finite element method. The proposed numerical approach aims to provide a preliminary assessment of the structural feasibility of functionally graded material applications in agricultural cutting components. The findings are expected to contribute to the development of more durable and structurally efficient cutterbar knife sections and to provide a basis for future investigations involving advanced material design, optimization, and experimental validation.

Keywords: Combine harvester, Serrated knife section, Functionally graded material (FGM), Finite element analysis (FEA), Structural modeling.

EXPERIMENTAL INVESTIGATION OF AN ALTERNATIVE FUEL CONTAINING TWO DIFFERENT VEGETABLE OILS IN AN INDUSTRIAL DIESEL ENGINE

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ABSTRACT

In this study, an alternative fuel blend consisting of 90% diesel fuel, 5% corn germ oil, and 5% canola oil was experimentally evaluated in terms of its effects on the performance and exhaust emissions of a single-cylinder industrial diesel engine. The tests were performed at engine load levels of 25%, 50%, 75%, and 100% to assess the response of the engine under different operating conditions.The experimental findings indicated that the combined use of two vegetable oils in the alternative fuel blend maintained engine performance while providing improvements in selected emission parameters. A notable reduction in CO (carbon monoxide) emissions relative to neat diesel fuel was observed at all load levels, representing one of the most significant environmental benefits of the tested blend. Despite the incorporation of vegetable oils, engine power output remained unchanged, with power values equivalent to those obtained using neat diesel fuel across the entire load range. The influence of the blend on fuel consumption was generally limited. In particular, hourly fuel consumption at 50% load was lower than that of neat diesel fuel, whereas only minor increases were recorded at 25%, 75%, and 100% load levels. Although a favorable reduction in CO emissions was achieved, NOx emissions exhibited an overall increase compared with neat diesel fuel at all load conditions. This increase in NOx formation is considered to be associated with the oxygen content of the vegetable oils, which can influence the combustion process and in-cylinder combustion temperature. Overall, the alternative fuel containing corn germ oil and canola oil demonstrated the ability to reduce CO emissions without compromising engine power, while maintaining relatively stable fuel consumption. These findings suggest that the tested fuel combination may represent a viable alternative for use in diesel engines.

Keywords: Corn oil, canola oil, diesel engine, exhaust emissions

EXPERIMENTAL INVESTIGATION OF THE EFFECT OF DIFFERENT CORN OIL BLENDING RATIOS IN DIESEL FUEL ON ENGINE PERFORMANCE AND EXHAUST EMISSIONS

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ABSTRACT

In this study, the effects of fuel blends prepared by adding 5% and 10% corn germ oil by volume to conventional diesel fuel on the engine performance and exhaust emissions of a single-cylinder industrial diesel engine were experimentally investigated. The experiments were conducted at 25%, 50%, 75%, and 100% load levels to evaluate the engine behavior under different operating conditions. The results demonstrated that the addition of corn germ oil produced both favorable and unfavorable effects on engine performance and emission characteristics. As the proportion of corn germ oil increased, a clear and consistent reduction in CO (carbon monoxide) emissions was observed at all load levels. Despite the use of the alternative fuel blends, no significant decrease in engine power output was detected, and performance values close to those obtained with conventional diesel fuel were maintained. On the other hand, the addition of corn germ oil was found to progressively increase hourly fuel consumption across all load levels. Furthermore, an increasing trend in NOx emissions compared with neat diesel fuel was observed, which can be attributed to the effect of the oxygen content of the biofuel on the combustion process. Overall, the corn germ oil-diesel blends were found to have the potential to reduce CO emissions without significantly compromising engine power performance. However, considering the increases in fuel consumption and NOx emissions, further optimization of these blends is required in terms of fuel economy and emission control.

Keywords: Energy, fuel blends, diesel engine, exhaust emissions

EFFECT OF NANO-COATING APPLICATION AGAINST SHIPYARD BLASTING DUST ON PV PANEL ENERGY EFFICIENCY: AN EXPERIMENTAL INVESTIGATION

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ABSTRACT

As solar energy becomes one of the most critical components of the global energy transition, operating photovoltaic (PV) panels with sustainable high efficiency is of paramount importance. However, abrasive blasting operations in the shipbuilding industry generate significant dust emissions, leading to severe soiling and substantial energy efficiency degradation on nearby PV panels. This study experimentally investigates the performance of an innovative anti-soiling liquid nano-coating designed to mitigate dust accumulation in heavy industrial environments. The experimental setup utilized two identical PV panels; one was treated with the nano-coating, while the other remained untreated as a standard control. Dust samples collected directly from a shipyard blasting site were uniformly applied to the cell surfaces of both panels. The panels were exposed to outdoor conditions for 37 days without any cleaning or washing. Throughout the monitoring period, voltage and current values were continuously recorded at 5-minute intervals to plot daily cumulative energy generation. At the end of the 37-day evaluation period, the data revealed that the nano-coated PV panel achieved a 3.8% higher total energy yield compared to the standard control panel. These findings demonstrate that liquid nano-coating technologies offer an effective and sustainable solution to preserve solar energy efficiency and minimize maintenance overheads in industrial zones characterized by high dust exposure.

Keywords: Energy, Photovoltaic Panel Efficiency, Soiling Effect, Nano-Coating

OPTIMIZING COMBUSTION EFFICIENCY AND EMISSION CONTROL IN LOW-NOX GAS BURNERS WITH HYDROGEN BLENDED NATURAL GAS COMBUSTION

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ABSTRACT

Green energy usage and the lowest pollutant emission demands of fire-tube hot water boilers have gained importance in line with the 2050 European zero-carbon targets. In the present study, the combustion efficiency of a low NOx gas burner was increased by using different diffusers and natural gas–hydrogen blended fuel ratios. Experimental studies were conducted using a fire-tube hot water boiler system, while numerical simulations were performed using Fluent codes with methane (CH_4) representing natural gas. Three combustion models were the Eddy Dissipation Model (EDM), Non-Premixed Combustion (NPC), and the Partially Premixed Combustion (PPC) model, which were compared, and the PPC model was validated against experimentally measured values for 1500 kW heat input, natural gas fueled, and 0.85 equivalence ratio. PPC combustion model and experimental studies were performed to investigate the variations in temperature, velocity, emissions, pollutants, temperature, flame formation, and stability for hydrogen ratios from 0 to 40% with equivalence ratios ranging from 0.7 to 0.85 at a heat input of 1500 kW. The results showed that blending hydrogen into natural gas fuel reduced CO_2 emissions by approximately 16.43% at 40% hydrogen.O_2 emissions remained constant, and NOx pollutants reduced below 38 ppm at 3% O_2 emissions. Combustion efficiency was maximized under low NOx operation conditions. Hydrogen also improved flame stability and increased flame temperature, velocity, and pressure, though density decreased. NO formation rose with increased hydrogen blending, necessitating higher air excess to control NO pollutant and flue gas temperatures. The study concludes that low NOx gas burners with nozzle-mix combustion flame characteristics can safely operate with up to 40% hydrogen blending in natural gas for fire-tube hot water boilers, following safety guidelines, offering a potential pathway for industrial decarbonization.

Keywords: NOx Reduction, Combustion Efficiency, Hydrogen, Decarbonization, Nozzle-mix burner

ASSESSMENT OF THE EFFECTS OF DAPAGLIFLOZIN ON RENAL FUNCTION, GLYCEMIC CONTROL, AND CARDIOVASCULAR RISK FACTORS IN PATIENTS WITH TYPE 2 DIABETES IN THE EAST ALGIERS REGION

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ABSTRACT

Background-Aim: Type 2 diabetes represents a major health concern due to its rising prevalence and impact on cardiovascular and renal health. While long-acting insulin traditionally targeted glycemic control, T2D management has evolved to include cardio-renal protection. Sodium-glucose cotransporter 2 (SGLT2) inhibitors have emerged as a novel therapeutic class. However, clinical practice data from Algeria remain limited. This study aimed to evaluate dapagliflozin's effects on metabolic, renal, and clinical parameters in T2D patients. **Methods:** This retrospective study was conducted at the diabetes unit of the Reghaïa Public Health Centre in 2025. The study included Fourty-Five type 2 diabetes patients prescribed dapagliflozin with complete clinical and biological data available before treatment and at 3 and 6 months follow-up. Parameters analyzed included glycemic control (HbA1c, fasting blood glucose), renal function (GFR, creatinine), blood pressure, body weight, and lipid profile. **Results:** The mean age was 61.5 ± 8.9 years with mean diabetes duration of 13.4 ± 8.2 years. A significant reduction in HbA1c was observed at 3 and 6 months versus baseline ($p < 0.01$), with decreased fasting blood glucose ($p = 0.006$). Renal function showed improved GFR at 6 months ($p = 0.0007$) and decreased serum creatinine ($p = 0.001$). Significant initial weight loss was observed, followed by stabilization. Blood pressure showed no significant changes. For lipids, LDL cholesterol decreased significantly, with no changes in other parameters. **Conclusion:** Dapagliflozin is associated with improved glycemic control and renal function in type 2 diabetes patients. Favorable effects on weight and LDL cholesterol were observed, without significant blood pressure impact. These observational results support dapagliflozin use in type 2 diabetes management and highlight the need for local data to optimize clinical practice.

Keywords: DIABETES, HBA1C, SGLT2

NANOEMULSION FORMULATIONS OF B-THUJAPLICIN PREPARED BY HIGH-PRESSURE HOMOGENIZATION: PHYSICOCHEMICAL CHARACTERIZATION, STORAGE STABILITY AND IN VITRO ANTIMICROBIAL AND ANTIOXIDANT ACTIVITY

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ABSTRACT

Background: The growing burden of antimicrobial resistance poses one of the most serious challenges in current biomedical sciences, necessitating new approaches to improve the efficacy of bioactive compounds and optimize their delivery. β-Thujaplicin (hinokitiol) is a naturally occurring troponoid, isolated from Thuja plicata, characterized by the presence of seven-membered aromatic ring with conjugated carbonyl and hydroxyl groups. The compound exhibits antimicrobial properties mediated by inhibition of zinc metalloenzymes and inherent free-radical scavenging properties. Although the biological activity of β-thujaplicin is established, the preparation of nanoemulsion formulations and the influence of nanoformulation on the biological performance of β-thujaplicin remain limited in the literature. Therefore, the aim of this study was to prepare β-thujaplicin-loaded nanoemulsions using high-pressure homogenization and sonication methods and to evaluate the effect of nanoformulation on antimicrobial and antioxidant activities between β-thujaplicin and nanoemulsion formulations.
Methods: β-Thujaplicin-loaded nanoemulsions were prepared by two methods, high-pressure homogenization and sonication, and were characterized for mean droplet size, polydispersity index, zeta potential, and encapsulation efficiency by dynamic light scattering technique and UV-Vis spectrophotometry. Morphological assessment was performed by scanning electron microscopy. Stability studies were carried out at temperatures 4 °C and 25 °C during six months of storage. Antimicrobial activity was determined by broth microdilution in accordance with CLSI standards M07 and M27, reporting MIC, MBC, and MFC values against selected ATCC reference strains of Gram-positive, Gram-negative, and fungal species. Antioxidant activity was examined using the DPPH radical-scavenging assay.
Results: β-Thujaplicin-loaded nanoemulsions prepared by high-pressure homogenization resulted in stable formulations with low polydispersity and negative zeta potential, confirming successful nanoformulation. Free β-thujaplicin showed broad-spectrum antimicrobial activity, with Gram-positive strains showing greater susceptibility due to the outer membrane barrier of Gram-negative bacteria. Nanoemulsion formulations showed significant enhancement of both antimicrobial and antioxidant activities compared to those of the free compound. All tested formulations maintained acceptable physicochemical properties under refrigerated storage. **Conclusions**: The preparation of β-thujaplicin-loaded nanoemulsions by

high-pressure homogenization represents an effective strategy for improving biological efficacy and supports further development of β-thujaplicin based nanocarrier systems.

Keywords: β-thujaplicin, hinokitiol, nanoemulsions, high-pressure homogenization, antimicrobial activity, antioxidant activity, DPPH

INTEGRATIVE APPROACH IN METABOLIC ENDOCRINOLOGY: CONTRIBUTION OF PHYTOTHERAPY THROUGH A CLINICAL CASE OF TYPE 2 DIABETES MELLITUS ASSOCIATED WITH OBESITY

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ABSTRACT

Endocrine-related metabolic diseases, such as type 2 diabetes mellitus and obesity, are complex chronic conditions involving hormonal, inflammatory, and metabolic disorders, and their management remains a major challenge due to variability in therapeutic response and the limitations of long-term conventional treatments. In this context, integrative approaches, particularly phytotherapy, are gaining increasing attention as complementary strategies that are both effective and environmentally sustainable. This study aims to illustrate the contribution of an integrated phytotherapeutic approach in the endocrinological management of a patient with type 2 diabetes mellitus associated with obesity through a clinical case and to discuss its metabolic and environmental implications. This is a clinical case study involving an adult patient with poorly controlled type 2 diabetes mellitus and abdominal obesity, in whom an integrative management strategy was implemented in addition to conventional treatment and lifestyle recommendations, including the controlled introduction of medicinal plants with hypoglycemic and metabolic potential. Clinical, biological, and metabolic parameters were monitored over several months. This integrative approach was associated with a progressive improvement in glycemic control, a moderate reduction in body weight, and improvements in selected metabolic parameters, without the occurrence of significant adverse effects. These findings suggest a synergistic action of plant-derived bioactive compounds on insulin sensitivity, hormonal regulation, oxidative stress, and chronic inflammation. This clinical case highlights the potential value of phytotherapy as a complementary approach in the endocrinological management of metabolic diseases. In conclusion, the rational and scientifically supervised integration of phytotherapeutic solutions may contribute to a more personalized, sustainable, and environmentally responsible form of medicine, although larger-scale clinical studies are required to confirm these observations and to establish standardized protocols.

Keywords: Obesity, Phytotherapy, Integrative medicine, Endocrinology

BRIDGING GAPS IN PICC LINE TRACEABILITY: DEVELOPMENT OF A STANDARDIZED MONITORING TOOL

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ABSTRACT

Introduction: Peripherally inserted central catheters (PICCs) are Class III long-term central venous access devices that require mandatory healthcare traceability throughout their lifecycle, due to their prolonged use and the risk of serious complications they pose: they are devices with a potentially critical risk. Accurate documentation of their insertion, maintenance, monitoring and removal is essential to ensure patient safety, promote multidisciplinary communication, facilitate the management of complications and comply with quality and risk management standards. Nevertheless, traceability practices remain insufficiently standardised in many healthcare settings. **Objective:** To assess nursing practices relating to traceability in the management of PICC lines, identify gaps in training, and develop a standardised traceability tool based on the identified needs and in line with international recommendations. **Methods:** A descriptive cross-sectional study was conducted between March and June 2025 amongst nurses working in departments using peripherally inserted central catheters (PICCs) at Bab El Oued University Hospital (Algiers, Algeria). Thirty-five nurses completed a structured questionnaire assessing their knowledge and current practices, with a particular focus on staff training and traceability throughout the PICC catheter's life cycle, including insertion, maintenance, monitoring, management of complications and catheter removal. A descriptive analysis was carried out to identify gaps requiring quality improvement interventions. **Results:** The survey revealed considerable variability in traceability practices. Although certain key pieces of information, such as the dates on which catheters were inserted, were frequently recorded (37.9 per cent only), maintenance procedures (dressing changes, flushing or valve replacement) were not systematically recorded. Furthermore, only a minority (11.1 per cent) of participants reported systematically documenting any complications that arose, whilst 37.1 per cent stated that no procedure was in place, and more than half of the respondents (54.3 per cent) were unaware whether such a procedure existed. These results demonstrated that current documentation practices were insufficient to ensure optimal monitoring of the device throughout its lifespan. Based on the identified gaps and international recommendations, a standardised PICC catheter traceability form was developed to document the insertion, maintenance, monitoring, complications and removal of the catheter using a structured and harmonised approach. **Conclusion:** These findings highlight the need to strengthen traceability practices in the management of PICC catheters. The tool developed is a traceability form, intended to be incorporated into the patient's medical record. Designed in accordance with SF2H recommendations, it consists of two appendices set out on two separate pages; Appendix 1: Traceability form for insertion/removal and Appendix 2: Daily monitoring form

Keywords: PICC line, Nursing care, Traceability, Patient safety, Quality improvement

OXIDATIVE STRESS-ENDOPLASMIC RETICULUM STRESS CROSSTALK IN GLIOMA: MOLECULAR MECHANISMS AND THERAPEUTIC POTENTIAL OF CURCUMIN

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ABSTRACT

Aim: Glioma is an aggressive primary brain tumor characterized by poor prognosis, therapeutic resistance, and high recurrence rates. Increasing evidence indicates that oxidative stress and endoplasmic reticulum (ER) stress are closely interconnected processes that contribute to glioma progression by regulating cellular survival, apoptosis, metabolic adaptation, and resistance to therapy. This review aims to summarize current evidence regarding the bidirectional crosstalk between oxidative stress and ER stress in glioma and to discuss the therapeutic potential of curcumin as a multi-target natural compound capable of modulating these interconnected signaling pathways. **Methods:** A narrative literature review was conducted using studies retrieved from PubMed, Scopus, Web of Science, and Google Scholar. Experimental and clinical studies published in English focusing on glioma, oxidative stress, ER stress, unfolded protein response (UPR), PERK, IRE1, ATF6 signaling pathways, apoptosis, and curcumin were evaluated. The available evidence was qualitatively synthesized according to major molecular mechanisms and therapeutic implications. **Results:** Current evidence demonstrates that oxidative stress and ER stress establish a reciprocal relationship in glioma cells. Excessive reactive oxygen species promote activation of unfolded protein response pathways, including PERK, IRE1, and ATF6, while persistent ER stress further enhances mitochondrial dysfunction and reactive oxygen species production, creating a self-amplifying pathogenic cycle. Activation of these pathways regulates glioma cell proliferation, apoptosis, autophagy, metabolic adaptation, and resistance to chemotherapy. Emerging evidence indicates that curcumin modulates oxidative stress-ER stress crosstalk by regulating PERK and IRE1 signaling, restoring redox homeostasis, suppressing adaptive survival responses, and promoting ER stress-mediated apoptosis in glioma cells. These findings suggest that simultaneous targeting of oxidative stress and ER stress may represent a promising therapeutic strategy for glioma management. **Conclusion:** The bidirectional interaction between oxidative stress and ER stress represents a central molecular mechanism underlying glioma progression and therapeutic resistance. Curcumin appears to exert anti-glioma activity through coordinated modulation of both pathways, highlighting its potential as a complementary multi-target therapeutic agent. Further experimental and clinical studies are required to translate these molecular findings into effective therapeutic applications.

Keywords: Glioma, oxidative stress, endoplasmic reticulum stress, curcumin, unfolded protein response, PERK, IRE1.

IODINE STATUS AND ENDEMIC GOITER IN ALGERIA: ASSESSMENT AND OUTLOOK FOR SALT QUALITY CONTROL

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ABSTRACT

The addition of iodine to salt is an essential public health measure. It involves enriching table salt with iodine or potassium iodate. This process helps prevent iodine deficiencies, which can lead to serious thyroid problems such as goiter. Algeria, like other countries, has joined the World Health Organization's (WHO) universal iodization program for table salt, aimed at reducing the risk of iodine deficiency disorders, including goiter, a disease that is unfortunately endemic in Algeria. Therefore, National Executive Decree No. 90-40 of January 30, 1990, mandated the sale of iodized salt for food use throughout Algeria. However, the current domestic market exhibits serious regulatory shortcomings that expose the Algerian population and consumers to a resurgence of endemic goiter. Algeria faces an alarming level of non-compliance in table salt sold by the private sector, with violation rates sometimes exceeding 75% of the samples analyzed. In this study, 105 samples of commercially available table salt were analyzed. Iodometric titration results revealed a very high violation rate: only 12 samples (50.76–94.60 mg of iodate per kg of salt) complied with the Algerian standard of 50 to 84 mg/kg of potassium iodate (KIO_3) in table salt, while the remaining samples (18.5–52.78 mg of iodate per kg of salt) were found to be non-compliant. This lack of rigorous iodine content control directly threatens the national public health policy. Consequently, severe pockets of endemic goiter persist. To address this, stricter controls by the Directorate of Commerce are recommended, along with a complete ban on bulk salt sales and regular monitoring of urinary iodine levels in the population.

Keywords: salt, iodine, standard, endemic goiter, control

EPILOBIUM PARVIFLORUM: POTENTIAL BENEFITS FOR PROSTATE HEALTH VERSUS IATROGENIC RISKS. A CLINICAL OBSERVATION AND IN SILICO PREDICTIONS

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ABSTRACT

Background: Epilobium parviflorum is a perennial plant that grows in wetlands in Europe, Asia, and North Africa; traditionally used for urinary and prostate disorders, but its side effects and safety in patients receiving anticoagulant therapy remain poorly documented. **Case presentation:** We report the case of a 69-year-old man treated with acenocoumarol for dilated cardiomyopathy who presented with an excessive international normalized ratio (INR) of 5.6 after daily consumption of Epilobium parviflorum herbal tea. The patient also had also elevated creatinine levels. The patient's anticoagulant therapy was modified, and pharmacological and therapeutic monitoring was initiated, his kidney function was closely checked until it stabilized. **Methods:** A follow-up of clinical and biological parameters was performed, and in silico analyses were carried out on the major phytoconstituents of E. parviflorum to explore possible mechanisms of interaction. **Results:** Serum creatinine showed a gradual decrease after withdrawal of the infusion. In silico predictions suggested potential inhibition of CYP2C9 and CYP3A4 by myricetin and quercetin, which may explain the observed increase in anticoagulant effect. **Conclusion:** This case highlights the risk of clinically significant herb-drug interactions and emphasizes the importance of systematically asking patients about herbal medicine use during anticoagulant treatment.

Keywords: Epilobium parviflorum, acenocoumarol, herb-drug interaction, in silico, CYP2C9, CYP3A4, case report

MOLECULAR CHARACTERISATION OF ESBL AND AMPC BETA-LACTAMASE ENCODING GENES IN E.COLI ISOLATED FROM DIABETIC FOOT INFECTIONS

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ABSTRACT

Background: Diabetic foot infections (DFIs) are a major complication of diabetes and are frequently associated with antimicrobial-resistant pathogens, complicating their management. *Escherichia coli* is among predominant Gram-negative bacteria involved in these infections. Despite the clinical importance of DFIs, limited molecular epidemiological data are available from Ouargla region (Southeast Algeria). Therefore, this study aimed to characterise Extended-spectrum β-lactamase (ESBL) and inducible chromosomal cephalosporinsases (AmpC) associated beta-lactamase genes in *E.coli* strains recovered from DFIs. **Materials/Methods:** Bacterial strains were isolated from DFIs in both "Maison du diabète" clinic, and Mohamed Boudiaf Hospital in Ouargla. Phenotypic screening for ESBL and inducible AmpC production was performed using standard microbiological methods . *E.coli* isolates were screened by PCR for the following β-lactamase-encoding genes: *bla*CTX-M phylogenetic lineage groups 1, 2 and 9, *bla*TEM, *bla*SHV, *bla*OXA-1, *bla*PER, *bla*VEB. E.coli resistance to cefoxitin antibiotic were further tested by using primers specific for plasmid-mediated AmpC β-lactamases encoding genes. **Results:** The antibiotic-resistance profile of sixteen *E. coli* strains exhibited high resistance rates to multiple antibiotics. Phenotypic analysis identified two ESBL-producing isolates , and one isolate inducible AmpC producer. PCR analysis revealed distinct beta-lactamase gene profiles among the resistant strains; one isolate coharboured *bla*CTX-M-1,*bla*CTX-M-2, and *bla*TEM , whereas the second carried *bla*CTX-M-2 and *bla*CIT . the inducible AmpC-producing isolate carried *bla*TEM and *bla*DHA , highlighting the genetic diversity of beta-lactam resistance mechanisms. **Conclusion:** This is the first study in Ouargla investigating DFIs and their antibiotic resistance profiles. It brings attention to the occurrence of multidrug-resistant strains. These findings highlight the diversity of beta-lactamase genes among *E.coli* isolates from DFIs and emphasise the importance of molecular characterisation for the accurate detection of resistance mechanisms.

Keywords: Diabetic foot infection, E.coli, antibiotic resistance, BLSE, AmpC, Ouargla.

PATTERNS OF STAPHYLOCOCCUS AUREUS INFECTIONS AND ANTIMICROBIAL RESISTANCE IN YOUTH POPULATIONS

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ABSTRACT

Staphylococcus aureus remains a major pathogen in pediatric populations, contributing to respiratory, skin, and soft tissue infections with significant public health implications. Understanding age-specific distribution and resistance trends is essential for guiding clinical management and stewardship strategies. This study analyzed 529 S. aureus isolates collected from children and adolescents, stratified by age group (≤6 years, 6–14 years, and 14–18 years) and sex. Sites of isolation included respiratory tract, skin/soft tissue, urine, and sterile fluids. Antimicrobial susceptibility testing was performed against commonly used agents, including penicillins, macrolides, aminoglycosides, and topical agents. The majority of infections occurred in school-aged children (56.7%), followed by preschoolers (38.6%) and adolescents (4.7%). Male patients accounted for 61.3% of cases. Respiratory tract isolates predominated (93.8%), while skin/soft tissue and sterile fluid infections were less frequent (3.0% each). Bloodstream infections were not detected. Antibiotic susceptibility patterns revealed high resistance to penicillin G (86.8%), ampicillin (82.4%), and amoxicillin (82.4%). In contrast, macrolides such as erythromycin, azithromycin, and clarithromycin demonstrated >91% sensitivity, while clindamycin (93.9%) and gentamicin (90.9%) remained highly effective. Notably, mupirocin and chloramphenicol exhibited complete activity (100% sensitivity), underscoring their potential utility in targeted therapy. The findings highlight distinct epidemiological patterns of S. aureus infections in youth, with respiratory tract infections dominating across age groups. The persistence of high resistance to β-lactam antibiotics emphasizes the need for rational prescribing and surveillance. The preserved efficacy of macrolides, clindamycin, and topical agents offers valuable therapeutic options, yet continuous monitoring is essential to prevent emerging resistance. These results reinforce the importance of age-specific epidemiological insights and antimicrobial stewardship in mitigating the burden of pediatric S. aureus infections.

Keywords: Staphylococcus aureus, Pediatric infections, Antimicrobial resistance, Youth populations, Respiratory tract infections, Antibiotic susceptibility, Epidemiology

MANAGEMENT OF PICC LINE COMPLICATIONS: AN ASSESSMENT OF CURRENT PRACTICES AND A NEW MONITORING TOOL

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ABSTRACT

Introduction: Peripherally inserted central catheters (PICCs) are a reliable alternative for medium- and long-term intravenous treatments, including chemotherapy, parenteral nutrition and prolonged antibiotic therapy. Despite their many advantages, their use carries a risk of infectious, thrombotic and mechanical complications that may compromise patient safety, interrupt treatment and lead to premature removal of the device. Preventing these events relies on rigorous nursing monitoring, early recognition of warning signs, appropriate management and systematic recording of incidents. However, the lack of standardised protocols and practical guidance materials can lead to variability in professional practice and compromise the quality of care. **Objective:** To assess nurses' knowledge and practices regarding the management and documentation of the main complications associated with PICC lines, and then to develop a practical tool designed to standardise procedures, improve the documentation of complications and enhance patient safety. **Methods:** As part of a final dissertation for a residency in hospital pharmacy, a descriptive cross-sectional study was conducted between March and June 2025 in departments using PICC lines at the Mohamed Lamine Debaghine University Hospital (Bab El Oued), Algiers. Thirty-five nurses completed a structured questionnaire assessing their knowledge and practices regarding the recognition, management and traceability of PICC complications. The data were subjected to a descriptive analysis to identify any shortcomings likely to compromise the quality and safety of care. **Results:** The results highlight significant heterogeneity in practice. In the event of a PICC blockage, 62.9% of respondents reported that their first-line approach was to flush the catheter with saline solution to restore patency, whilst 37.1% requested a medical prescription for a fibrinolytic agent if the blockage persisted. Only 17.1% mention repositioning the patient as a recommended additional measure. Regarding catheter displacement, 57.1% of participants reported removing the PICC with the assistance of a doctor. By contrast, only 25.7% indicated that they leave the device in place when the protrusion is less than 2 cm, in accordance with recommendations, with or without medical advice. The traceability of complications appears to be particularly inadequate. Only 11.1% of the healthcare professionals surveyed reported the existence of a specific procedure for documenting complications (infection, obstruction or displacement). These results reflect a lack of standardisation that is likely to limit continuity of care, communication between healthcare professionals, responsiveness to adverse events and medical device vigilance. To address the shortcomings identified, a technical information sheet for healthcare teams has been drawn up in accordance with international recommendations. This thirteen-page practical guide sets out the main care procedures relating to PICC lines, monitoring protocols, the most common complications (occlusion, phlebitis, infection, migration, rupture and air embolism), their clinical warning signs, and the recommended courses of action. It also reiterates the obligation to report any complications immediately to the responsible doctor and the lead nurse, to ensure systematic traceability of events, and to report serious incidents as part of medical device

vigilance. **Conclusion:** This study highlights gaps in knowledge, practice and the traceability of complications associated with PICC lines. The technical guide developed provides a practical decision-making aid and reference tool for nursing teams.

Keywords: PICC line , Nursing practice, Catheter-related complications, Traceability

FACIAL PLASTIC SURGERY AND PROFILOPLASTY: NUTRITIONAL STATUS AS A PREDICTOR OF HEALING AND PATIENT SAFETY

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ABSTRACT

Background: Facial plastic surgery, particularly profiloplasty, encompasses a range of aesthetic procedures designed to improve facial balance and harmony through interventions such as rhinoplasty, mentoplasty, and complementary contouring techniques. These procedures involve precise manipulation of soft tissue, cartilage, and bone, making optimal postoperative healing essential for both functional and aesthetic outcomes. Successful recovery depends on multiple patient-related factors, among which nutritional status plays an important yet often underrecognized role in supporting tissue repair, immune function, and perioperative safety. **Objective:** This study aims to highlight contemporary considerations in facial plastic surgery and profiloplasty by examining factors that influence successful surgical outcomes. Particular attention is given to the role of preoperative nutritional status as a modifiable determinant of wound healing, tissue regeneration, and patient safety following elective facial aesthetic procedures. **Methods:** A narrative review of the current literature was conducted to examine evidence on factors influencing postoperative outcomes in facial plastic surgery, with emphasis on the contribution of nutritional status. Clinical studies evaluating nutritional biomarkers—including serum albumin, prealbumin, Prognostic Nutritional Index (PNI), and Body Mass Index (BMI)—were reviewed in relation to wound healing, tissue viability, postoperative complications, and patient safety. **Results:** The literature demonstrates that successful healing after profiloplasty depends on coordinated inflammatory, proliferative, and remodeling phases, all of which require adequate nutritional support. Protein-energy malnutrition, reflected by hypoalbuminemia and reduced prealbumin levels, is associated with delayed wound healing, wound dehiscence, seroma formation, and increased postoperative morbidity. A low Prognostic Nutritional Index, indicating compromised nutritional and immunological status, has been linked to impaired vascularization, delayed tissue regeneration, and a greater risk of flap-related complications. In addition, extremes of Body Mass Index negatively influence surgical outcomes: underweight patients often exhibit reduced tissue repair capacity due to inadequate nutritional reserves, whereas obesity is associated with prolonged operative time, impaired tissue perfusion, fat necrosis, and higher rates of wound complications. Adequate perioperative intake of high-quality protein and essential micronutrients, including vitamins A and C, zinc, and iron, supports collagen synthesis, angiogenesis, immune function, and overall recovery. **Conclusions:** Contemporary facial plastic surgery and profiloplasty require a comprehensive preoperative assessment that extends beyond surgical planning to include evaluation of nutritional status. Incorporating simple, evidence-based nutritional biomarkers into routine clinical practice may improve patient selection, reduce postoperative complications, enhance wound healing, and strengthen patient safety. Integrating nutritional assessment into

multidisciplinary perioperative care represents a practical strategy for optimizing both aesthetic and clinical outcomes in facial plastic surgery.

Keywords: Facial plastic surgery, Profiloplasty, Nutritional status, Wound healing, Patient safety, Prognostic Nutritional Index (PNI).

DENTAL AND SKELETAL MALOCCLUSIONS AND THEIR FUNCTIONAL RELATIONSHIP WITH MASTICATION AND NUTRITION

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ABSTRACT

Introduction: Malocclusion represents one of the most common developmental disorders affecting the craniofacial complex and is traditionally evaluated according to dental alignment, skeletal relationships, and orthodontic treatment needs. However, increasing evidence indicates that malocclusions may also have functional consequences, particularly regarding masticatory performance and oral function. Alterations in occlusal relationships may influence chewing efficiency, mandibular movements, and the ability to process different food consistencies. **Objective:** The aim of this narrative review was to evaluate the relationship between dental and skeletal malocclusions, masticatory function, and nutrition, emphasizing the potential functional implications of occlusal disturbances.
Methods: A narrative review of the literature was conducted using publications retrieved from PubMed, Scopus, and Web of Science. Studies addressing dental and skeletal malocclusions, masticatory efficiency, chewing performance, dietary habits, food selection, and nutritional implications were analyzed. Systematic reviews, clinical studies, and standard orthodontic textbooks were included to provide an integrated overview of the current evidence. **Results:** The reviewed literature suggests that severe dental malocclusions, including crossbite, open bite, and marked tooth irregularities, may interfere with normal occlusal contacts and reduce masticatory efficiency. Skeletal malocclusions, particularly Class II and Class III discrepancies, may further influence mandibular dynamics, muscle coordination, and chewing patterns. Reduced masticatory capacity has been associated with changes in dietary habits and food selection, including preference for softer foods and avoidance of hard or fibrous foods. However, the relationship between malocclusion and nutritional outcomes remains multifactorial and is influenced by age, general oral health, socioeconomic factors, and individual adaptation mechanisms. **Conclusion:** Dental and skeletal malocclusions should be considered not only structural abnormalities but also functional conditions that may affect mastication and dietary behavior. Comprehensive orthodontic evaluation should integrate morphological and functional assessment to improve diagnosis and treatment planning. Further research using standardized functional and nutritional assessment methods is needed to clarify the long-term implications of malocclusion on overall health.

Keywords: Dental malocclusion, skeletal malocclusion, orthodontics, mastication, masticatory efficiency, dietary habits, food selection, nutrition.

BIOMECHANICAL FORCES GENERATED BY ORTHODONTIC APPLIANCES IN THE TREATMENT OF DENTAL AND SKELETAL MALOCCLUSIONS: A NARRATIVE REVIEW

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ABSTRACT

Background: Orthodontic treatment is based on the controlled application of mechanical forces to produce predictable changes in tooth position and to correct dental and skeletal malocclusions. The clinical effect of an orthodontic appliance depends on the magnitude, direction, duration, and point of application of the generated forces, as well as on the associated moment-to-force relationship, anchorage conditions, and biological response of the periodontal and alveolar tissues. Understanding these interactions is essential for effective biomechanical treatment planning. **Aim:** This narrative review aims to examine the biomechanical forces generated by commonly used orthodontic appliances and their relationship with the biological response and clinical management of dental and skeletal malocclusions. **Methods:** A narrative review of scientific literature was conducted to examine orthodontic biomechanics, force–moment relationships, biological mechanisms of orthodontic tooth movement, anchorage, and forces generated by commonly used orthodontic appliances. Relevant literature concerning fixed orthodontic appliances, elastics and springs, temporary skeletal anchorage devices, and clear aligner systems was considered. The literature was synthesized according to fundamental biomechanical principles, biological response, appliance-related force systems, and their clinical application in the treatment of sagittal, vertical, transverse, and space-related malocclusions. **Results and Discussion:** Orthodontic appliances generate mechanical force systems whose clinical effects depend on their magnitude, direction, duration, point of application, and relationship to the center of resistance. The resulting force–moment system influences the type and degree of tooth movement, including tipping, translation, rotation, intrusion, extrusion, and root movement. These mechanical effects interact with biological processes involving the periodontal ligament and alveolar bone, including cellular activity, inflammatory signaling, bone resorption, and bone formation. Fixed appliances provide versatile control through bracket–archwire interactions, whereas elastics and springs provide additional directional force systems. Temporary skeletal anchorage devices can modify anchorage conditions, while clear aligners generate forces and moments through appliance deformation and tooth–aligner interaction. The biomechanical requirements differ according to the characteristics of sagittal, vertical, transverse, and crowding-related malocclusions. **Conclusion:** Orthodontic treatment outcomes depend on the interaction between appliance-generated force systems and biological tissue response. A biomechanically informed approach that relates the characteristics of the malocclusion to the desired tooth movement, force–moment system, anchorage requirements, and appliance selection may facilitate more controlled and rational orthodontic treatment. Further clinical research is required to determine the comparative predictability and biological effects of emerging biomechanical and digital treatment approaches.

Keywords: Orthodontic biomechanics, Orthodontic forces, Orthodontic appliances, Malocclusion, Tooth movement, Anchorage, Clear aligners.

FROM FEAR TO AWARENESS: THE DUALITY OF SKIN MICROBIOME REALITY AND MEDIA REPRESENTATION THROUGH CASE STUDY ANALYSIS

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ABSTRACT

Human skin is a complex ecosystem that is home to millions of microorganisms known as the skin microbiome. These microorganisms play a vital role in regulating the immune system and protecting against pathogens. However, the media represents a significant discrepancy between scientific reality and how the skin is portrayed. Digital and traditional platforms consistently promote biologically unrealistic, sterile beauty standards that misrepresent normal microbial variation and trigger severe social stigmatization. Using a qualitative, multi-case study methodology, this paper examines the discrepancy between biological facts and media-driven aesthetic myths. We examined three distinct narratives: a ten-year autoethnographic experience of *Acne vulgaris*; the systemic aesthetic bullying of participant Stelina Kurila on Big Brother VIP Albania 5; and the digital activism of skin-positivity advocate Maia. Our findings reveal that media channels systematically moralize and misidentify biological dysbiosis as a failure of personal hygiene. They utilize a divisive normalization mechanism that marginalizes affected individuals. In contrast, skin-positivity movements successfully challenge these unscientific standards of perfection. This study concludes that aligning cultural narratives with genomic reality by shifting public communication from media-induced fear to evidence-based scientific awareness is a critical psychosocial and public health intervention, necessary for the mental well-being and social integration of individuals living with visible dermatological conditions.

Keywords: Skin microbiome, Acne vulgaris, Mass media, Aesthetic bullying, Stigmatization

PROLACTIN LEVEL IN POLYCYSTIC OVARY SYNDROME (PCOS): NOT ALWAYS TRUE HYPERPROLACTINEMIA!

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ABSTRACT

Polycystic Ovary Syndrome (PCOS) is the most common endocrinopathy among women of reproductive age and the leading cause of female infertility. The coexistence of hyperprolactinemia and PCOS is relatively common. Approximately 10–15% of patients with PCOS present with moderate hyperprolactinemia. **Observation:** We report a case of a 24-year-old woman presenting with persistent hyperprolactinemia associated with Polycystic Ovary Syndrome (PCOS), clinical hyperandrogenism (hirsutism and moderate acne), and menstrual irregularities. The hormonal assessment performed on day 3 of the cycle showed: Prolactin: 56 ng/mL (4.79–23.3), Testosterone: 0.7 ng/mL (0.084–0.481), DHEA-S: 450 µg/dL (35–430), FSH: 6.05 mIU/mL (follicular phase: 3.5–12.5), LH: 6.31 mIU/mL (follicular phase: 2.4–12.6), LH/FSH ratio: 1.04 (follicular phase: <0.82), Estradiol: 33.4 pmol/L (follicular phase : <160), TSH: 1.52 µIU/mL (0.4–4.0), 8 a.m. plasma cortisol: 249.5 nmol/L (reference range: 171–536). In view of the persistent hyperprolactinemia, screening for macroprolactin (big-big prolactin) was performed. The polyethylene glycol (PEG) precipitation test showed; Recovery: 29.85%, Monomeric (biologically active) prolactin: 16.66 ng/mL. **Conclusion:** Polycystic ovary syndrome (PCOS) and hyperprolactinemia are the two most common causes of menstrual irregularities in women of reproductive age. While hyperprolactinemia is not uncommon in PCOS, there is no evidence of a pathophysiological link between the two. The discovery of hyperprolactinemia in a patient with PCOS necessitates a standard etiological investigation, specifically ruling out macroprolactinemia. Its detection would prevent the use of dopaminergic therapy and excessive investigations.

Keywords: Hyperprolactinemia, Polycystic ovary syndrome, Macroprolactin, Menstrual dysfunction

HEMOSTASIS IN PEDIATRICS: MAIN COAGULATION ABNORMALITIES ENCOUNTERED AT THE CHU NAFISSA HAMOUD EX PARNET; ALGIERS

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ABSTRACT

Introduction: Coagulation disorders or coagulopathies are a common reason for biological exploration in hospitals, particularly in pediatrics, where the immaturity of the haemostatic system complicates the interpretation of results. The objective of our work is to explore the abnormalities detected in routine coagulation tests (PT/ APTT), performed in hospitalized children, with the aim of defining the different etiologies, their prevalence and characteristics. **Material and method:** We conducted a descriptive prospective study that took place between February 06, 2025 and May 04, 2025 at the hemobinology unit of the central medical biology laboratory of the University Hospital Center Nafissa Hamoud Ex Parnet/ Algiers in collaboration with the service of pediatrics from the same hospital. Our study included 379 children hospitalized and followed up in the pediatric service, among whom 93 presented with disrupted routine clotting assessments. The dosage of the PT; APTT as well as the other additional parameters were done on the automateSTA Compact Max 3. The clinical and biological data were collected using laboratory records; the anamnesis, the information sheet and the hospitalization reports of each patient. **Results and discussion:** Our study showed that out of a total of 379 samples sent by the paediatric service for a standard coagulation check-up (PT-APTT) and analyzed at our level: 286 (75.5%) returned to normal with an average PT of 86.32% and an average APTT of 32.94 secs, while 93 check-ups, , or 24.5%, were disturbed with an average PT of 53.61% and an average APTT of 54.4 secs. Of these 93 assessments: a predominance of acquired coagulopathies is observed with 52.7%, while coagulopathies of constitutional origin represent only 2.2%, 35.6% are mainly related to anomalies in the pre-analytical phase while 8.6% of the results were not explored. For acquired coagulopathies; the main etiologies encountered were: thrombotic manifestations with 32.7% related to the presence of dialysis catheters in patients with CKD. The state of hypercoagulability with 22.4% observed in some children with cancers but also in patients with nephrotic syndrome. The CDI with 10.2% ; serious liver disorders with 10.2%; chronic kidney failure have the disturbance of the balance sheet was due to oral or parenteral anticoagulants intake. In our series, there were 03 deaths due to CIVD. **Conclusion:** The interpretation of the hemostasis assessment in children must take into account physiological characteristics, the reference values being specific to each age group but also any personal and/or family bleeding history using the anamnesis and clinical examination which are therefore essential for the interpretation of a clotting test. It will also have to take into account the possible pre-analytical interferences, in particular related to sampling difficulties, which may interfere with the results. Our study explored these coagulation abnormalities in children and highlighted the value of a rigorous and standardized analysis within the laboratory, to ensure the reliability of the biological results transmitted to the prescribing services.

Keywords: Coagulation, pediatric, biological exploration, coagulopathies

LIFESTYLE AND INSULIN RESISTANCE IN HEALTHY ADULTS IN ALGIERS

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ABSTRACT

Introduction: Insulin resistance (IR) is a central pathophysiological factor involved in the development of type 2 diabetes as well as in the emergence of various associated metabolic disorders. Early identification of lifestyle-related behaviors and factors that may influence IR, even in apparently healthy individuals, represents a major public health challenge. A better understanding of these determinants could contribute to the development of targeted and effective preventive strategies. In this context, the present study aimed to assess the impact of diet, sleep, and physical activity on IR in a non-diabetic adult population. **Methods:** A total of seventy-one participants were recruited according to predefined inclusion criteria. Lifestyle habits were collected using a standardized and validated questionnaire. Subjects were classified based on their HOMA-IR index, with a threshold of ≥2 indicating insulin resistance. In addition, anthropometric measurements (weight, height, body mass index) as well as biochemical parameters were collected and analyzed to further characterize the metabolic profile of the participants. **Results:** Statistical analyses revealed a significant association between insulin resistance and several lifestyle-related factors, including frequent fast-food consumption ($p < 0.001$), high fruit intake ($p = 0.03$), presence of insomnia ($p < 0.001$), and a sedentary lifestyle ($p < 0.001$). In contrast, no statistically significant correlation was found between IR and a diet rich in vegetables or excessive consumption of sweets in this population. **Conclusion:** These findings suggest that certain behaviors commonly considered beneficial for health, such as high fruit consumption, may, in specific contexts, be associated with increased insulin resistance. They also highlight the complexity of interactions between lifestyle factors and glucose metabolism. Thus, the determinants of IR are not always intuitive and require a nuanced and individualized approach. Early promotion of a balanced lifestyle, based on rigorous and up-to-date scientific evidence, appears essential for the effective prevention of metabolic disorders.

Keywords: HOMA Index, Insulin Resistance, Lifestyle Habits, Healthy Population

ECONOMIC BURDEN OF ACUTE INTOXICATIONS AT EMERGENCY DEPARTMENT OF UNIVERSITY HOSPITAL TLEMCEN, ALGERIA: A RETROSPECTIVE COST ANALYSIS

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ABSTRACT

Acute poisoning represents a critical global health challenge, yet detailed medical-economic evaluations remain severely limited in Algeria. This study aimed to evaluate direct medical costs associated with the management of acute intoxications at the University Hospital Centre (CHU) of Tlemcen. Methods: A retrospective, descriptive cost analysis was executed using data from hospital records of all adolescent and adult patients admitted between 1 January 2025 and 31 December 2025 at the emergency department of CHU Tlemcen using a micro-costing approach. Statistical analyses were performed using SPSS version 26, with significant cost determinants identified through a generalized linear model. Results: A total of 265 patients were included, with a mean age of 31.64 ±14.45 years; 52,1% were female. Suicidal poisoning accounted for 66.4% of cases, while accidental poisoning represented 29.8% while the 3,8% was attributes to unknown causes. Domestic products constituted the primary category of toxic exposure, accounting for 30.2% of cases. This was followed by drugs and alcohol, which comprised 18.5%. The total direct medical cost was estimated at USD 50,814.89 corresponding to a mean cost of USD 191.75±73.57 per patient. Hospital accommodation constituted the largest cost component (175.32±69.73USD). Length of hospital stay and diagnostic imaging were identified as significant independent cost drivers ($p < 0.0001$). Mortality remained low at 1.9%, while psychiatric referral was the most frequent outcome (44.2%). Conclusion: Acute intoxications impose a continuous, volume-driven financial strain on the public budget of CHU Tlemcen, particularly among young adults. Strengthening preventive strategies, optimizing diagnostic resource use, and improving access to psychiatric care may contribute to reducing both the clinical and economic impact of acute intoxications in Algeria.

Keywords: Acute intoxication, direct medical cost, health economy, emergency, Algeria

THE ROLE OF THE RED BLOOD CELL DISTRIBUTION INDEX IN THE DIFFERENTIAL DIAGNOSIS BETWEEN IRON DEFICIENCY ANEMIA AND ANEMIA OF CHRONIC DISEASES

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ABSTRACT

Introduction: Among the most frequently encountered anemias in clinical practice are iron deficiency anemia (IDA) and anemia of chronic disease (ACD). Distinguishing between these two conditions presents a significant diagnostic challenge and remains difficult despite their different pathophysiologies. The Red Cell Distribution Width or RDW is one of the erythrocyte indices derived from the hemogram; it reflects the variation in RBC size or anisocytosis. **Study objective:** Evaluate the contribution of the RDW in the differential diagnosis between IDA and ACD. **Materials and methods:** We conducted a prospective, descriptive and comparative study at the hemobiology unit of the central medical biology laboratory of the Nafissa University Hospital Center Hamoud Ex Parnet over a period of four months from 18-01-2026 to 18-05-2026 in collaboration with the various departments of the same hospital. Our study included 120 subjects of both sexes, aged from 24 days to 84 years, divided into three equal groups (n = 40): a group of healthy controls, a group of patients with IDA and a group of patients with ACD. The complete blood counts (CBCs) were performed on the ADVIA2120i hematology analyzer. Ferritin assay was performed on the COBAS Integra 400 plus biochemistry analyzer. Clinical and biological data were collected using laboratory records; the patient history, information sheet and hospitalization reports for each patient. **Results and discussion:** The results obtained showed that patients with IDA were predominantly young females, with a microcytic hypochromic profile (MCV = 69 fL / MCH= 22fL), while those with ACD were mostly older adults with normocytic anemia. normochrome (MCV = 87 fL / MCH= 28fL). Furthermore, a higher RDW was found in patients with IDA (16.95%) compared to patients with ACD (14.88%) and control subjects (13.25%), with statistically significant differences ($p < 0.001$). ROC curve analysis also showed an area under the curve (AUC) of 0.75, indicating acceptable discriminatory power of the RDW. **Conclusion:** The Red Cell Distribution Width or RDW is a simple and accessible parameter; combined with other hematological parameters, it is a sensitive and reliable marker in guiding the differential diagnosis between iron deficiency anemia (IDA) and anemia of chronic disease (ACD) , and its integration into routine diagnostic protocols could significantly improve the detection and management of these anemias in resource-limited settings. Its interpretation, combined with baseline erythrocyte indices, could contribute to earlier and more appropriate management.

Keywords: RDW, differential diagnosis, iron deficiency anemia, anemia of chronic diseases

INTENTIONAL SELF POISONING IN WESTERN ALGERIA: A TOXIXOVIGILANCE CHALLENGE AMONG YOUNG ADULTS

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ABSTRACT

Intentional self-poisoning represents an important public health and toxicological challenge, particularly among young adults. This study aimed to characterize suicidal poisoning cases admitted to the Emergency Department of Tlemcen University Hospital and to highlight the implications for toxicological and psychiatric care. **Methods:** A retrospective descriptive study was conducted among patients aged ≥16 years admitted for acute poisoning at Tlemcen University Hospital between January and December 2025. Demographic characteristics, circumstances and routes of exposure, toxic agents, diagnostic investigations, treatment and clinical outcomes were analyzed. **Results:** Among 265 acute poisoning admissions, 176 cases (66.4%) were classified as intentional self-poisoning. Females predominated (60.2%), and young adults aged 16–26 years accounted for 54% of suicidal poisoning cases. Domestic products were frequently implicated, representing 35.8% of suicidal exposures. Oral ingestion was overwhelmingly predominant (97.7%). Biochemical investigations were performed in 83.5% of cases, while toxicological screening was performed in 19.3%. Treatment was administered in 69.9% of suicidal poisoning cases. The mean hospital stay was 1.06 ± 0.55 days, and psychiatric referral was the most frequent recorded outcome (44.2%). Overall mortality among acute poisoning cases was 1.9%. **Conclusion:** Intentional self-poisoning represents the predominant pattern of acute poisoning at Tlemcen University Hospital and disproportionately affects young adults and females. The predominance of oral exposure and domestic products, together with the high need for psychiatric referral, emphasizes the importance of integrated toxicological and mental-health management. Strengthening toxicovigilance and targeted preventive interventions may contribute to reducing recurrent self-poisoning and its clinical burden in Algeria.

Keywords: suicidal poisoning, acute intoxication, toxixovigilance, Algeria

EFFECT OF THE EXTRACTION TECHNIQUE ON THE PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF MENTHA SPICATA ESSENTIAL OIL

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ABSTRACT

The present study is part of the valorization of spearmint (Mentha spicata) essential oil by comparing two extraction methods, namely hydrodistillation and steam distillation, through the analysis of the phytochemical profile and therapeutic properties of the extracted essential oils. These techniques were investigated in order to determine their influence on the phytochemical composition and the therapeutic potential of the obtained essential oils. Spearmint is widely recognized for its rich content of bioactive compounds and its numerous pharmacological properties, including antimicrobial, antioxidant, and analgesic activities. Therefore, identifying the most efficient extraction method is essential for optimizing the quality and biological activity of its essential oil. The phytochemical profile of Mentha spicata essential oil obtained by both techniques was established using Gas Chromatography–Mass Spectrometry (GC-MS). The results revealed that the major compound in both oils is Carvone with proportions of 62.32 and 47.09% for hydrodistillation and steam distillation respectively, indicating that Carvone represents the chemotype of Mentha spicata essential oil. The analgesic activity evaluated using the writhing test showed that Mentha spicata essential oil obtained by hydrodistillation at a concentration of 25% exhibited a higher analgesic effect compared to the oil obtained by steam distillation (25%) and aspirin (500 mg/kg) with protection rates of 75.78, 72.33 and 65.15% respectively. The antibacterial activity assessed by the agar diffusion method revealed that the Mentha spicata essential oil obtained by hydrodistillation produced inhibition zone diameters of 35, 30 and 24 mm against Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli, respectively. In contrast, the essential oil obtained by steam distillation generated inhibition zones of 16, 18, and 9 mm against the same bacterial strains. These results suggest that hydrodistillation is the most effective extraction technique for Mentha spicata essential oil providing optimal therapeutic potential.

Keywords: Mentha spicata, Essential oil, Hydrodistillation, Steam distillation

ANTI-INFLAMMATORY EFFECTS OF OLIVE LEAF TRITERPENOIDS ON HEPATIC AND SYSTEMIC INFLAMMATION IN HIGH-FAT DIET-INDUCED OBESE MICE

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ABSTRACT

Background: Obesity induced by high-fat diet (HFD) is associated with chronic low-grade inflammation characterized by elevated pro-inflammatory cytokines in plasma and tissues. Olive leaf triterpenoids, including oleanolic acid and maslinic acid, have demonstrated anti-inflammatory and anti-obesity properties in preclinical models. **Objective:** This study aimed to evaluate the anti-inflammatory effects of olive leaf (Olea europaea L.) triterpenoids in a mouse model of HFD-induced obesity, focusing on systemic and hepatic inflammatory markers. **Methods:** Male C57BL/6 mice were randomly divided into four experimental groups: (1) normal diet control (ND), (2) normal diet supplemented with olive leaf triterpenoids (ND + OLT), (3) high-fat diet control (HFD), and (4) high-fat diet supplemented with olive leaf triterpenoids (HFD + OLT). Body weight was monitored weekly throughout the experimental period. At the end of the study, plasma levels of pro-inflammatory cytokines (TNF-α$^{\alpha}$, IL-1β $^{\beta}$, IL-6) were quantified by enzyme-linked immunosorbent assay (ELISA). Hepatic mRNA expression of pro-inflammatory cytokine genes was assessed by reverse transcription quantitative polymerase chain reaction (RT-qPCR). **Results:** Olive leaf triterpenoid supplementation did not significantly reduce body weight in either the HFD + OLT or ND + OLT groups compared to their respective controls. However, triterpenoid treatment exerted a significant modulatory effect on hepatic inflammation in HFD-fed mice, as evidenced by reduced mRNA expression of pro-inflammatory cytokines (TNF-α$^{\alpha}$, IL-1β$^{\beta}$, IL-6) in liver tissue. Concurrently, ELISA analysis revealed decreased circulating pro-inflammatory cytokine levels in plasma of the HFD + OLT group compared to HFD controls. **Conclusion:** Olive leaf triterpenoids exert a pronounced therapeutic anti-inflammatory effect in HFD-induced obese mice by significantly reducing hepatic pro-inflammatory cytokine expression and circulating cytokine levels, this highlights their potential as effective adjunctive therapeutics for obesity-related chronic inflammation.

Keywords: olive leaf, triterpenoids, high-fat diet, obesity, inflammation, cytokines, RT-qPCR, ELISA.

EVALUATING PUBLIC AWARENESS AND HEALTH IMPLICATIONS OF ENDOCRINE DISRUPTORS IN COSMETIC

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ABSTRACT

Background And Objective: Cosmetic products occupy a prominent place in our daily lives, contributing to overall well-being and playing an essential role in personal care routines. However, these products may sometimes contain harmful substances, particularly endocrine disruptors, which have emerged as a major public health concern. The primary objective of this study is to assess individuals' knowledge, attitudes, and behaviors regarding endocrine disruptors (EDs) present in cosmetic products. More specifically, the study aims to: 1. Evaluate the level of individuals' knowledge concerning EDs and their associated potential health risks. 2. Analyze individuals' attitudes, perceptions, and concerns regarding the use of cosmetic products containing endocrine disruptors. 3. Examine individuals' behaviors through the assessment of cosmetic purchasing habits, the knowledge and attitudes influencing these behaviors, and the actions undertaken to avoid such products. **Mareials And Method:** This cross-sectional observational study was conducted using a survey-based methodology. Data were collected through a structured questionnaire consisting of 24 closed-ended questions distributed via social media. The survey evaluated participants' cosmetic purchasing habits, concerns about product ingredients, and knowledge of health risks related to endocrine disruptors. The questionnaire was created using Google Forms, and data were analyzed with Microsoft Excel (2013). A total of 186 participants from the general population were surveyed between February 18 and March 18, 2024. **Results:** The results revealed that while a certain level of awareness regarding the effects of EDs exists within the population, significant knowledge gaps remain. These findings underscore the critical need for enhanced education on the potential health risks associated with these substances. **Conclusion:** This study highlights endocrine disruptors in cosmetic products as a significant public health concern, emphasizing the need for stricter regulatory standards and greater transparency in product labeling.It recommends clearer certifications for endocrine disruptor–free products and strengthened consumer education through awareness campaigns. Consumers should be encouraged to read labels carefully and prioritize safer, natural, or organic alternatives. The study also stresses the role of healthcare professionals, cosmetic industries, and ongoing scientific risk assessment in ensuring safer products and updated regulations.

Keywords: cosmetic products, endocrine diruptors, public health

FORMULATION OF A COSMETIC CREAM WITH HEALING EFFECT BASED ON A MEDICINAL PLANT

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ABSTRACT

Carthamus caeruleus is a medicinal plant recognized for its richness in polyphenols and other bioactive compounds. These substances are attracting increasing interest due to their anti-inflammatory, antimicrobial, and regenerative properties, thereby meeting the current need to develop therapeutic solutions that are both effective and safe for the body.In response to the challenge of post-burn scars, which are difficult to treat and a source of functional and aesthetic sequelae, this study aims to develop an innovative healing cream from an aqueous extract of an Algerian medicinal plant. The extraction, carried out by heating under reflux, gave a yield of 2.5%. Phytochemical analysis revealed a notable richness in bioactive compounds, with high levels of total polyphenols (74.73 mg GAE/g) and flavonoids (14.79 mg QE/g). Pharmacological evaluation, performed through in vitro tests, demonstrated significant anti-inflammatory activity (86% inhibition of albumin denaturation) and strong antioxidant activity (90% against DPPH and 72% against ABTS). Furthermore, the extract showed broad-spectrum antibacterial activity, with a minimum inhibitory concentration (MIC) of 6.5 mg/mL against Enterococcus faecalis and 12.5 mg/mL against strains such as Staphylococcus aureus and Escherichia coli. Twenty cream formulations, assessed for their skin-compatible pH (4.78–5.50) and complete microbiological safety, were optimized using JMP software. The final selected formula exhibited a physiological pH of 5.12, a density of 1.28 g/cm³, a stable and smooth texture (viscosity 35.41 Pa·s), and pleasant organoleptic properties. This study successfully transformed a bioactive botanical resource into a stable and safe parapharmaceutical product, offering a promising natural alternative for the management of post-burn skin lesions.

Keywords: Plant extract, Burn, Antioxidant activity, Anti-inflammatory activity, Antibacterial activity, Healing cream, Optimization.

FROM LIPOSOMES AND NANOEMULSIONS TO HYBRIDOSOMES: AN EVOLVING NANOCARRIER LANDSCAPE FOR THE DELIVERY OF PLANT-DERIVED BIOACTIVE COMPOUNDS

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ABSTRACT

Naturally occurring bioactive compounds of plant origin have been of considerable scientific interest due to their well-documented biological activities such as antimicrobial , antioxidative potential, anti-inflammatory effect, and cytoprotection. Although their biological activities have been recognized, the application of such compounds has been hindered by several problems, including poor aqueous solubility, chemical instability, and reduced bioavailability. Liposome-based nanocarrier systems as well as nanoemulsions have gained widespread attention in recent years as delivery systems with the potential to address the aforementioned drawbacks, demonstrating the ability to improve stability, efficacy, and biological performance of plant-derived bioactive compounds. However, classical lipid-based nanocarriers also suffer from several limitations such as drug leakage, gastrointestinal instability, and poor scalability, which restrict their translational value. Recently, milk-derived extracellular vesicles (MEVs) have emerged as a promising natural nanocarrier platform with distinct properties compared to synthetic lipid-based nanocarriers. MEVs are natural nanocarriers that show high stability, biocompatibility, and low immunogenicity and carry various molecules such as proteins, nucleic acids, and lipids within their lipid bilayer structure. Moreover, MEVs maintain integrity under harsh conditions of the gastrointestinal tract, enabling cargo protection and preserving its physiological activity. Furthermore, MEVs are biocompatible nanocarriers that can be internalized by intestinal epithelial cells, macrophages, vascular endothelial cells, and are capable of crossing the blood-brain barrier. This work provides an overview of the current state of knowledge on nanocarrier development for delivering plant-derived bioactive compounds. Particular attention is paid to the comparison of physicochemical properties, biological performance, preparation methods, and limitations of conventional systems such as liposomes and nanoemulsions, alongside MEVs. Current evidence indicates that MEVs demonstrate superior gastrointestinal stability and enhanced cargo protection compared to conventional lipid-based nanocarriers, positioning them as particularly promising platforms for delivery of bioactive compounds.

Keywords: hybridosomes, liposomes, nanoemulsions, plant bioactive compounds, antimicrobial activity, antioxidant activity, nanocarrier systems, drug delivery

ANTIPLASMODIAL HERBAL MEDICINE

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ABSTRACT

Malaria remains one of the most serious parasitic diseases worldwide, particularly in tropical and subtropical regions where millions of people remain at risk and where drug-resistant strains of Plasmodium falciparum continue to emerge. Despite significant advances in chemotherapy and vector control strategies, the rapid spread of resistance to conventional antimalarial drugs represents a major challenge for global public health. In this context, herbal medicine continues to play a crucial role in the discovery and development of novel antimalarial agents, providing structurally diverse bioactive compounds with multiple pharmacological targets and mechanisms of action. Natural products isolated from medicinal plants, including quinine, chloroquine-derived compounds, and artemisinin analogues, have demonstrated remarkable antiplasmodial activity through inhibition of parasite growth, disruption of heme detoxification pathways, induction of oxidative stress, and modulation of host immune responses. Historically, the discovery of quinine from Cinchona species and artemisinin from Artemisia annua revolutionized malaria treatment and highlighted the immense therapeutic potential of plant secondary metabolites. These discoveries also emphasized the importance of ethnopharmacological knowledge as a valuable source of innovative drug leads.The integration of traditional medicinal practices with modern phytochemical, pharmacological, and computational approaches has become essential for the identification of safer and more effective antimalarial therapies. In this regard, our recent phytochemical and pharmacological investigations, supported by molecular docking studies, revealed several promising antimalarial compounds isolated from Algerian Achillea species. The identified secondary metabolites mainly belong to sesquiterpene lactones with a guaianolide skeleton, characterized by highly reactive structural features that may contribute to their strong interactions with key parasitic targets. These findings support the potential of Algerian medicinal flora as an important reservoir of novel antimalarial drug candidates.

Keywords: Malaria, Quinine, Artemisinin, Plasmodium, medicinal plant, Achillea

ANTIOXIDANT COMPOUNDS ISOLATED FROM STACHYS GUYONIANA DE NOÉ EX. BATT. WITH A QSAR STUDY

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ABSTRACT

Five known polyphenolic compounds, namely isoscutellarein-7-O-(6'''-O-acetyl)-β-D-allosyl-(1→2)-β-D-glucoside (**1**), acteoside (**2**), luteolin 7-O-β-D-glucoside (**3**), 4'-methylisoscutellarein-7-O-2″-O-(6'''-O-acetyl-β-D-allosyl)-β-D-glucoside (**4**) and rosmarinic acid (**5**),), were successfully isolated and characterized from the n-butanol fraction (BFSG) obtained from the aerial parts of Stachys guyoniana de Noé. Structural elucidation of these metabolites was achieved through extensive chromatographic separation combined with spectroscopic analyses, including UV, MS, and NMR techniques, confirming the remarkable richness of this endemic Algerian species in bioactive phenolic constituents. Compounds (1) and (4), recognized as characteristic chemotaxonomic markers of the genus Stachys, were identified as the predominant metabolites and remained persistent throughout all fractions and chromatographic sub-fractions, indicating their abundance and strong association with other phenolic compounds within the extract matrix. The BFSG fraction exhibited remarkable antioxidant activity in several complementary in vitro assays, including DPPH radical scavenging, ABTS cation decolorization, and ferric reducing antioxidant power (FRAP) tests. Likewise, all isolated compounds demonstrated significant antioxidant potential, highlighting the important contribution of flavonoid glycosides and phenolic acids to the overall biological activity of the extract. Among the tested metabolites, acteoside displayed the highest antioxidant capacity, probably due to its highly hydroxylated structure and conjugated phenolic system, which favor electron donation and free radical stabilization. In addition, QSAR analysis confirmed the experimental data and established the same ranking order of antioxidant activity across all assays, with acteoside consistently occupying the first position. Overall, these findings emphasize the phytochemical importance of Stachys guyoniana and support its potential as a valuable natural source of antioxidant agents for pharmaceutical, nutraceutical, and therapeutic applications.

Keywords: Stachys guyoniana de Noé, flavonoids, antioxidant activity, QSAR

PHYTOCHEMICAL PROFILE AND ANTICHOLINESTRASE ACTIVITY OF FRUIT AND SEEDS FROM THE ALGERIAN PHOENIX DACTYLIFERA VARIETY DEGLET NOUR

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ABSTRACT

The phytochemical composition and anticholinesterase potential of hydroethanolic fractions obtained from the fruits (DNF) and seeds (DNS) of Phoenix dactylifera were investigated using LC–MS/MS analysis and in vitro enzyme inhibition assays. The chemical profiling revealed that both extracts were particularly rich in phenolic compounds, including protocatechuic acid (28.33, 28.33), epicatechin (535.682, 137.575), cyranoside (2.196, 4.491), and isoquercetin (5.015, 13.659) mg analytes/g extract, respectively, whereas DNS was richer in ferulic acid (11.628 mg/g extract) and hesperidin (17.691 mg/g extract), suggesting significant differences in the distribution of bioactive metabolites between fruits and seeds. These phenolic constituents are well recognized for their antioxidant, anti-inflammatory, and neuroprotective activities, which may contribute to the observed biological effects. The biological evaluation highlighted a remarkable anticholinesterase activity, especially for the seed extract. DNS displayed potent inhibitory effects against acetylcholinesterase (AChE) with an IC_{50} value of 3.17 ± 0.11 µg/mL, surpassing the activity of the reference drug galantamine (IC_{50}: 5.01 ± 0.11 µg/mL). In addition, DNS showed moderate butyrylcholinesterase (BChE) inhibition with an IC_{50} value of 52.55 ± 0.72 µg/mL, comparable to that of galantamine (53.90 ± 0.56 µg/mL). The strong inhibitory activity may result from the synergistic interaction of flavonoids and phenolic acids capable of modulating cholinergic transmission and reducing oxidative stress associated with neurodegeneration. Moreover, the richness of the seed extract in bioactive secondary metabolites emphasizes the importance of date-processing by-products as valuable natural resources. Overall, these findings support the potential use of Deglet Nour date seeds as promising candidates for nutraceutical, functional food, and pharmaceutical applications aimed at the prevention and management of neurodegenerative disorders, particularly Alzheimer's disease.

Keywords: Phoenix dactylifera, Anticholinesterase, LC-ESI/MS, Polyphenols

PHYTOCHEMICAL PROFILE AND EVALUATION OF THE ANTIOXIDANT AND ANTIDIABETIC ACTIVITIES OF THE N-BUTANOL FRACTION FROM THE ALGERIAN SPECIES LINUM TENUE

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ABSTRACT

Species belonging to the genus Linum represent an important source of biologically active secondary metabolites with considerable pharmacological and industrial potential. Among them, Linum usitatissimum has attracted significant scientific interest because of its rich phytochemical composition and wide spectrum of biological activities. Linum species are known to contain lignans, flavonoids, phenolic acids, terpenoids, tannins, alkaloids, and fatty acids, all of which contribute to their medicinal properties. In particular, L. usitatissimum is rich in secoisolariciresinol diglucoside, omega-3 fatty acids, and diverse phenolic constituents that exhibit antioxidant, anti-inflammatory, antimicrobial, anticancer, antidiabetic, and cardioprotective activities. In traditional medicine, several Linum species have also been used for the treatment of digestive disorders, inflammation, skin diseases, and metabolic dysfunctions. Furthermore, previous phytochemical investigations demonstrated that the biological properties of Linum species are closely associated with their high content of polyphenols and lignans capable of modulating oxidative stress and cellular signaling pathways. In the present study, we investigated the phytochemical profile as well as the antioxidant and antidiabetic activities of the n-butanol fraction obtained from the Algerian species Linum tenue. Phytochemical analysis revealed the presence of several phenolic compounds, including chlorogenic acid, vicenin-2, p-coumaric acid, and other bioactive polyphenols known for their strong radical-scavenging and enzyme inhibitory activities. Biological assays demonstrated a remarkable antioxidant capacity together with significant inhibition of carbohydrate-hydrolyzing enzymes involved in glucose metabolism. The observed activities may result from the synergistic interaction between the identified phenolic constituents. These findings highlight the therapeutic potential of L. tenue as a promising natural source of antioxidant and antidiabetic agents and support the valorization of Algerian medicinal flora for nutraceutical and pharmaceutical applications.

Keywords: Linum, antioxidant, alpha-amylase inhibition, polyphenols

IN VIVO AND IN SILICO INVESTIGATION OF THE GASTROPROTECTIVE ACTIVITY OF ALEPPO PINE (PINUS HALEPENSIS MILL.) EXTRACT

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ABSTRACT

The present study aimed to evaluate the gastroprotective activity of hydromethanolic bark extract of Pinus halepensis (PHE) using both in vivo and in silico approaches. Gastric ulcers were induced in albino Wistar rats using an HCl/Ethanol model. PHE was administered at 250, 500, and 1000 mg/kg, with omeprazole (20 mg/kg) as the reference drug. Molecular docking of twelve LC-MS/MS-identified compounds was conducted against the gastric proton pump (H^+/K^+-ATPase). 3D structures of the ligands were sourced from PubChem, and the crystallographic structure of the gastric proton pump was obtained from the Protein Data Bank (PDB ID: 5YLU). Docking simulations were conducted using FlexX software. A clear dose-dependent effect was observed, with inhibition rates reaching 33.91 ± 1.02%, 51.08 ± 4.73%, and 62.04 ± 2.73% for the 250, 500, and 1000 mg/kg doses, respectively. The UI decreased from 70.37 ± 4.2 in the control group to 46.46 ± 0.72 (250 mg/kg), 34.55 ± 3.33 (500 mg/kg), and 26.73 ± 1.92 (1000 mg/kg). At the highest dose (1000 mg/kg). Macroscopic examination of the gastric mucosa demonstrated that pretreatment with PHE at the highest dose (1000 mg/kg) resulted in near-complete restoration of mucosal integrity compared to the untreated control group. Docking simulations of identified compounds against H^+/K^+-ATPase highlighted quercetin (−26.74 KJ/mol) and catechin (−25.95 KJ/mol) as the most promising candidates, both surpassing omeprazole (−18.49 KJ/mol) in binding affinity. Molecular interaction analysis revealed that the best compounds established multiple stabilizing contacts within the active site of H^+/K^+-ATPase. These findings suggest that Pinus halepensis bark extract possesses potent gastroprotective properties, likely mediated by the antisecretory activity of its flavonoid constituents, highlighting PHE as a promising candidate for future anti-ulcer therapeutic development.

Keywords: Pinus halepensis, gastroprotective effect, ulcer index, molecular docking, gastric proton pump.

VALORIZATION OF ALGERIAN DATE SEEDS (PHOENIX DACTYLIFERA L.): EVALUATION OF ACUTE ORAL TOXICITY IN WISTAR RATS - TOWARD AN INNOVATIVE PHARMACOLOGICAL APPROCH

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ABSTRACT

Agrifood sector residues are often discarded despite their significant potential. Date seeds (Phoenix dactylifera L.), major by-products of the date industry, represent a valuable natural resource due to their richness in bioactive compounds and associated health benefits. Natural products are increasingly investigated as alternatives to synthetic drugs because of their accessibility and lower risk of adverse effects. The present study aimed to evaluate the acute oral toxicity of Algerian date seed aqueous extracts and to characterize their phytochemical composition. Qualitative phytochemical screening was performed using standard methods, where color changes or precipitate formation indicated the presence of specific compounds. Wistar rats were randomly divided into groups, including a control group and treatment groups receiving single oral doses of 300, 1000, and 2000 mg/kg body weight via gavage. The animals were observed over a period of 14 days, after which organ weights and biochemical parameters were assessed. The results revealed the presence of primary metabolites, such as reducing compounds and proteins, as well as secondary metabolites including phenols, flavonoids, tannins, alkaloids, steroids, and saponins. No mortality or clinical signs of toxicity were observed at any tested dose. Furthermore, no significant changes in organ weights or biochemical parameters were detected. The median lethal dose (LD_{50}) was estimated to be greater than 2000 mg/kg, indicating low toxicity. According to the Globally Harmonized System, the extract falls into category 5 for acute oral toxicity. In conclusion, Algerian date

seed extracts exhibit antioxidant potential and are safe at the tested doses, suggesting applications as antioxidants in pharmaceutical and nutraceutical fields.
Keywords: Date seeds (Phoenix dactylifera L.) , Acute toxicity, Wistar rats, Phytochemical screening

FORMULATION OF A COSMETIC CREAM WITH HEALING EFFECT BASED ON A MEDICINAL PLANT

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ABSTRACT

Carthamus caeruleus is a medicinal plant recognized for its richness in polyphenols and other bioactive compounds. These substances are attracting increasing interest due to their anti-inflammatory, antimicrobial, and regenerative properties, thereby meeting the current need to develop therapeutic solutions that are both effective and safe for the body. In response to the challenge of post-burn scars, which are difficult to treat and a source of functional and aesthetic sequelae, this study aims to develop an innovative healing cream from an aqueous extract of an Algerian medicinal plant. The extraction, carried out by heating under reflux, gave a yield of 2.5%. Phytochemical analysis revealed a notable richness in bioactive compounds, with high levels of total polyphenols (74.73 mg GAE/g) and flavonoids (14.79 mg QE/g). Pharmacological evaluation, performed through in vitro tests, demonstrated significant anti-inflammatory activity (86% inhibition of albumin denaturation) and strong antioxidant activity (90% against DPPH and 72% against ABTS). Furthermore, the extract showed broad-spectrum antibacterial activity, with a minimum inhibitory concentration (MIC) of 6.5 mg/mL against Enterococcus faecalis and 12.5 mg/mL against strains such as Staphylococcus aureus and Escherichia coli. Twenty cream formulations, assessed for their skin-compatible pH (4.78–5.50) and complete microbiological safety, were optimized using JMP software. The final selected formula exhibited a physiological pH of 5.12, a density of 1.28 g/cm³, a stable and smooth texture (viscosity 35.41 Pa·s), and pleasant organoleptic properties. This study successfully transformed a bioactive botanical resource into a stable and safe parapharmaceutical product, offering a promising natural alternative for the management of post-burn skin lesions.

Keywords: Plant extract, Burn, Antioxidant activity, Anti-inflammatory activity, Antibacterial activity, Healing cream, Optimization.

ANTI-INFLAMMATORY AND ANALGESIC ACTIVITIES OF THE ETHANOLIC EXTRACT OF GLOBULARIA ALYPUM L.

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ABSTRACT

Globularia alypum L. is a medicinal plant widely distributed throughout the Mediterranean region and traditionally used for the treatment of various ailments, including gastrointestinal disorders, hyperglycemia, and certain renal diseases. In this context, the present study aimed to evaluate the pharmacological properties of the hydroethanolic extract obtained from the aerial parts of this species. The investigations focused on its safety profile as well as its anti-inflammatory and analgesic activities using in vivo experimental models in NMRI mice. The acute toxicity study revealed no clinical signs of toxicity at the tested doses, indicating good tolerance of the extract. Anti-inflammatory activity was assessed using the carrageenan-induced paw edema model. The results demonstrated a significant and dose-dependent inhibition of the inflammatory response, reaching 80.47% and 83.72% at doses of 500 and 1000 mg/kg body weight, respectively, after 5 hours of treatment ($p < 0.0001$). These findings were further supported by histological analysis, which revealed a less intense inflammatory infiltrate in treated groups compared with the control group, where a pronounced inflammatory reaction was observed, confirming that carrageenan successfully induced a strong inflammatory response. Analgesic activity was evaluated using the acetic acid-induced writhing test. The extract produced a marked reduction in the number of writhes, with inhibition rates of 78.99% and 89.54% at doses of 500 and 1000 mg/kg, respectively. These values were higher than that obtained with the reference drug Livospasme (65.89%). Overall, these findings highlight the pharmacological potential of Globularia alypum and support its use as a natural source of bioactive compounds with anti-inflammatory and analgesic properties. However, further studies are required to identify the compounds responsible for these activities and to elucidate their underlying mechanisms of action.

Keywords: Globularia alypum L., ethanolic extract, acute toxicity, anti-inflammatory activity, analgesic activity, mice.

ANTIBACTERIAL ACTIVITY OF ZERAVSCHANIA KHORASANICA AGAINST STAPHYLOCOCCUS AUREUS AND ESCHERICHIA COLI

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ABSTRACT

The present study investigated the antibacterial effects of hydroalcoholic extract and essential oil of *Zeravschania khorasanica*, against resistant *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (MRSA, ATCC 33591). the hydroalcoholic extract and essential oil of *Zeravschania khorasanica* contain bioactive secondary metabolites (like flavonoids and phenolic compounds) that exhibit promising antimicrobial effects/ For this purpose, the hydroalcoholic extract and essential oil were prepared from aerial parts of the plant. Antibacterial activity was measured using the Kirby-Bauer disk diffusion method, and minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined by the broth microdilution. The essential oil produced inhibition zones of 7.2 ± 0.2 mm for *S. aureus* and 7.0 ± 0.2 mm for *E. coli*, whereas the extract showed weaker inhibitory effects of 6.2±0.1 mm for both species. However, amikacin and cefoxitin antibiotics produced larger inhibition zones of 13± 0.1 for *E. coli* and 15± 0.1 for *S. aureus*. MIC and sub-MIC values indicated stronger antibacterial activity of the essential oil, particularly against *S. aureus*, with inhibitory concentration of 10-4 and 10-5 mg/mL. These findings suggest that the extract and essential oil of *Z. khorasanica* possess weak antibacterial activity on resistant mentioned bacteria. Since the antibacterial activity of this plant species has been evaluated for the first time, further studies are required to explore its potential pharmaceutical applications.

Keywords: Antibacterial activity, essential oil, hydroalcoholic extract, *Escherichia coli*, *Staphylococcus aureus, Zeravschania khorasanica*

POTENTIAL ANTIOXIDANT PROPERTIES OF WASTEWATER EXTRACT REMAINING AFTER THE ESSENTIAL OIL PROCESS OF THYMBRA SPICATA L. COLLECTED AT DIFFERENT PERIODS

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ABSTRACT

Oxidative stress, triggered by an increase in reactive oxygen species, leads to macromolecular damage, triggering chronic disorders such as cancer, diabetes, and neurodegenerative diseases. In preventing this damage, plant-derived phenolic compounds and flavonoids stand out as powerful natural antioxidants due to their low toxicity, ability to neutralize free radicals, and metal chelation capabilities. *Thymbra spicata* L., known in Türkiye by names such as "zahter" and "karabaş kekik," is a perennial plant belonging to the Lamiaceae family that grows naturally in the Eastern Mediterranean basin and is known for its aromatic and medicinal properties. Used in traditional medicine to treat digestive disorders, infections, and inflammatory diseases, this species is notable for its rich content of secondary metabolites such as essential oils, phenolic acids, flavonoids, diterpenoids, and tannins. These components support the plant's antioxidant, anti-inflammatory, anticancer, antimicrobial, and neuroprotective effects, making it biologically valuable. The phenolic composition of the species varies significantly depending on the geographical conditions in which it grows (Yıldırım Baştemur G., 2025). This study aims to comparatively examine the antioxidant capacities of wastewater extracts remaining after hydrodistillation of essential oil from *T. spicata* L. harvested at different times from the same region. The antioxidant capacities of the wastewater extracts remaining after the essential oil extraction from the aerial parts of *T. spicata* L. samples collected from the Dülük region of Gaziantep (985 m altitude) on different dates (02.06.2025-N1 and 09.06.2025-N2) by hydrodistillation using a Clevenger apparatus were measured using DPPH• and ABTS+ methods, and their phenolic content was analyzed using an LC-MS/MS system. Resultantly, sample N2 showed stronger antioxidant activity with lower IC50 values as ABTS+: 0.1492 ± 0.0184 and DPPH•: 0.1784 ± 0.0142 mg/mL compared to N1 in ABTS+: 0.1232 ± 0.0108 mg/mL and DPPH•: 0.1312 ± 0.0224 mg/mL methods. LC-MS/MS data confirm the relationship between the increased activity and phenolic content: the dominant component, rosmarinic acid, increased from 3959.333 µg/g in N1 to 4189.392 µg/g in N2; protocatechuic acid increased from 40.704 µg/g to 137.632 µg/g; and quercetin increased from 41.919 µg/g to 72.278 µg/g. This indicates that a one-week harvest difference significantly altered the phytochemical profile. The antioxidant capacity of wastewater has also increased in favor of N2, in parallel with this phenolic enrichment. Consequently, the antioxidant potential of the wastewater, which has been neglected as byproduct in the literature, has been confirmed; and it is recommended that wastewater extracts be recovered as natural preservatives or therapeutic agents in industrial formulations.

Keywords: ABTS+, DPPH•, Lamiaceae, Wastewater extract, Clevenger apparatus

THE POTENTIAL ANTIOXIDANT ACTIVITY OF THE SCUTELLARIA ORIENTALIS SUBSP. MACROSTEGIA WASTEWATER REMAINING FROM ESSENTIAL OIL PRODUCTION

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ABSTRACT

Scutellaria orientalis subsp. *macrostegia* is one of the endemic plants in the flora of Türkiye belonging to the Lamiaceae family. Traditionally, *Scutellaria* species are widely used around the world for their anti-inflammatory, antiviral, sedative, and antioxidant effects, while in Türkiye, they are used to promote wound healing, for their astringent properties, and in the treatment of hemorrhoids. Flavonoids constitute the dominant group of phytochemicals in *Scutellaria* species, which are rich in polyphenols. The flavonoids found in this plant offer significant pharmaceutical potential by contributing to various biological processes through their antioxidant properties. In this study, the wastewater generated as a result of the extraction of essential oil from the whole plant of *Scutellaria orientalis* subsp. *macrostegia* using the Clevenger apparatus was collected and evaluated for the first time in terms of its antioxidant activity. Antioxidant capacity was measured using the DPPH• and ABTS+ methods, with the Trolox compound as a reference, and the phytochemical composition was analyzed using LC-MS/MS. The antioxidant activity result of the wastewater exhibited significant activity in both radical scavenging systems with IC50 values such as ABTS+: 0.0931 ± 0,0081 and DPPH•: 0,2631 ± 0,0241 mg/mL. The LC-MS/MS data results showed that gallic acid, ellagic acid, and a small amount of naringin have been detected in the wastewater. Based on these data, it can be seen that the wastewater has a much richer phenolic content than previously thought. In this case, the plant's bound compounds have broken down, particularly due to heat, causing free flavonoids and gallic acid to pass into the water in high concentrations. Consequently, the wastewater demonstrated possesses great antioxidant potential, so it could serve as a valuable pharmaceutical candidate for further research.

Keywords: Scutellaria, Hydrodistilation, ABTS+, DPPH•, LC-MS/MS

EVALUATION OF THE ANTIDIABETIC AND ANTI-INFLAMMATORY POTENTIAL OF LAURUS NOBILIS EXTRACT BY INHIBITION OF A-AMYLASE, A-GLUCOSIDASE, AND LIPOXYGENASE ENZYMES

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ABSTRACT

Plant extracts represent a promising source of bioactive compounds of interest in the prevention and management of metabolic and inflammatory diseases. This study aims to evaluate the antidiabetic and anti-inflammatory potential of Laurus nobilis extract by investigating its inhibitory activity on α-amylase and α-glucosidase enzymes involved in the digestion of carbohydrates, as well as on lipoxygenase (LOX). Phytochemical screening of the phenolic compounds in the prepared extract revealed the presence of flavonoids, tannins, quinones, saponins, terpenoids, and alkaloids. However, coumarins and anthraquinones were not detected. The levels of polyphenols, flavonoids, and tannins determined in the L. nobilis extract are 57.47 µg equivalent gallic acid /mg Extract, 35.29 µg equivalent Catechin/mg Extract, and 45.45 µg equivalent Catechin/mg Extract, respectively. Incubation of the aqueous extract (0.3 mg/mL) with intestinal α-glucosidase (0.02 IU/mL) and its substrate (p-nitrophenyl α-D-glucopyranoside (pNPG) at 37°C for 30 min resulted in a 55.48% inhibition of this enzyme's activity. Regarding α-amylase, a 69.69% inhibition was observed at a concentration 4.17 mg/mL. Furthermore, evaluation of anti-inflammatory activity, based on lipoxygenase (LOX) inhibition, revealed a 50.74% inhibition at 0.33 mg/mL. These results highlight the potential of this plant extract to inhibit key enzymes involved in carbohydrate metabolism and the inflammatory response, thus suggesting its interest as a source of bioactive compounds for antidiabetic and anti-inflammatory purposes.

Keywords: Laurus nobilis, phenolic compounds, antidiabetic and anti-inflammatory potential.

IN VITRO EVALUATION OF THE ANTI-INFLAMMATORY POTENTIAL OF AN ESSENTIAL OIL-BASED RESPIRATORY BALM

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ABSTRACT

Inflammation is a physiological response involved in numerous pathological conditions and remains a major target for the development of safe and effective therapeutic agents. In recent years, increasing attention has been directed toward natural products, particularly essential oils, owing to their diverse biological activities and favorable safety profiles. The present study aimed to evaluate the in vitro anti-inflammatory potential of a respiratory balm formulated with selected essential oils. The balm was prepared using a lipid base composed of sweet almond oil, coconut oil, shea butter, and beeswax, and enriched with essential oils of Eucalyptus globulus, Mentha piperita, Rosmarinus officinalis, Lavandula angustifolia, and Thymus vulgaris. The anti-inflammatory activity was assessed using the inhibition of protein denaturation assay, a widely employed screening method for the evaluation of anti-inflammatory agents. Diclofenac sodium was used as the reference drug. All analyses were performed in triplicate and results were expressed as mean ± standard deviation. The formulated respiratory balm demonstrated a pronounced inhibitory effect against protein denaturation, with an inhibition percentage of 86.67 ± 1.53%, while diclofenac sodium exhibited an inhibition of 89.67 ± 1.53% under the same experimental conditions. The substantial inhibitory activity observed for the balm may be attributed to the synergistic action of the bioactive constituents present in the incorporated essential oils, including terpenes and oxygenated compounds known for their anti-inflammatory properties. The findings indicate that the developed respiratory balm possesses promising in vitro anti-inflammatory activity, showing efficacy comparable to that of the reference drug. These results support the potential application of essential oil-based topical formulations as natural alternatives for inflammation management. Further studies are warranted to investigate the underlying mechanisms of action and to confirm the efficacy and safety of the formulation through in vivo evaluations.

Keywords: Respiratory balm, Essential oils, Anti-inflammatory activity, Protein denaturation assay, Natural products.

LC–MS/MS PHENOLIC PROFILING, ANTIOXIDANT AND CHOLINESTERASE INHIBITORY ACTIVITIES OF ECHIUM CRETICUM L. FROM ALGERIA

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ABSTRACT

Echium creticum L. is a Mediterranean medicinal species that remains insufficiently explored from phytochemical and pharmacological perspectives. This study investigated the phenolic composition, antioxidant potential, and anti-Alzheimer-related activity of aerial-part extracts of E. creticum collected in Constantine, Algeria. Following hydro-methanolic extraction, *n*-butanol (BEEC), ethyl acetate (EAEEC), and chloroform (CEEC) fractions were obtained and analyzed by LC–MS/MS using authenticated phenolic standards. LC–MS/MS profiling revealed 24, 22, and 25 phenolic compounds in BEEC, EAEEC, and CEEC, respectively. Rosmarinic acid was the major constituent of BEEC (21.658 mg/g), whereas ferulic acid predominated in EAEEC (6.752 mg/g), and salicylic acid was the main compound in CEEC (7.814 mg/g). Protocatechuic acid, gentisic acid, *p*-coumaric acid, cosmosiin, cynaroside, nicotiflorin, and genistin were also identified. Notably, cosmosiin, nicotiflorin, and genistin are reported for the first time in the genus Echium. The extracts exhibited marked antioxidant capacity in DPPH, ABTS, FRAP, and Fe^{3+}-phenanthroline assays, with the ethyl acetate fraction showing the strongest overall antioxidant performance. The *n*-butanol fraction, characterized by its high phenolic content and rosmarinic acid abundance, demonstrated the most pronounced anticholinesterase activity, with an acetylcholinesterase inhibition IC_{50} value of 68.98 ± 1.33 µg/mL. These findings highlight E. creticum as a promising Algerian source of phenolic compounds with antioxidant and cholinesterase-inhibitory potential, supporting further investigation of this species for neuroprotective applications.

Keywords: Echium creticum, LC–MS/MS, phenolic compounds, antioxidant activity, acetylcholinesterase inhibition.

CHEMICAL COMPOSITION, ANTIOXIDANT AND ANTICHOLINESTERASE ACTIVITIES OF ESSENTIAL OILS FROM PISTACIA ATLANTICA DESF. LEAVES AND FLOWERS

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ABSTRACT

Pistacia atlantica Desf. is an aromatic Mediterranean species traditionally used in North Africa. The present study aimed to characterize the chemical composition and evaluate the antioxidant and anticholinesterase activities of essential oils obtained from leaves and flowers of Algerian P. atlantica. Fresh leaves and flowers collected from Berriane, Ghardaïa, Algeria, were hydrodistilled using a Clevenger-type apparatus. Essential oil yields were 1.5% for leaves and 1.7% for flowers. GC and GC–MS analyses identified 30 compounds in leaf oil and 22 compounds in flower oil, representing 97.8% and 96.9% of the total compositions, respectively. Both oils were rich in monoterpenes and oxygenated sesquiterpenes. The major constituents of leaf oil were α-pinene (18.4%), α-terpinene (17.3%), γ-gurjunene (10.0%), spathulenol (10.7%), α-phellandrene (8.9%), β-elemene (7.5%), germacrene B (6.2%), limonene (5.9%), and β-phellandrene (5.5%). Flower oil was characterized mainly by α-pinene (30.0%), β-phellandrene (13.4%), α-phellandrene (11.0%), limonene (8.9%), and α-terpinene (17.3%). Both essential oils showed significant antioxidant activity in β-carotene–linoleic acid, DPPH, and ABTS assays. Leaf oil was more active than flower oil, with IC_{50} values of 17.0 ± 0.3, 23.9 ± 0.3, and 4.7 ± 0.2 µg/mL, respectively. Leaf oil also showed stronger cholinesterase inhibition, with IC_{50} values of 18.5 ± 0.5 µg/mL against acetylcholinesterase and 79.7 ± 2.1 µg/mL against butyrylcholinesterase. The results demonstrate that P. atlantica essential oils, particularly leaf oil, are promising natural sources of antioxidant and cholinesterase-inhibitory terpenoids with potential relevance for neuroprotective applications.

Keywords: Pistacia atlantica, essential oil, GC–MS, antioxidant activity, anticholinesterase activity.

ROLE OF THE HOSPITAL PHARMACIST IN THE PREVENTION OF LOOK-ALIKE, SOUND-ALIKE (LASA) MEDICATION ERRORS

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ABSTRACT

Introduction: Look-Alike, Sound-Alike (LASA) medications are drugs with similar names or packaging, which may lead to serious errors during prescribing, dispensing, or administration. Such errors can have harmful consequences for patient safety. The aim of this study was to highlight the crucial role of the hospital pharmacist in minimizing medication errors associated with LASA drugs. **Materials and Methods:** A descriptive study was conducted in the central pharmacy of Bab El Oued University Hospital (CHU Bab El Oued). During the study period, several cases of LASA medications that could potentially lead to medication errors among healthcare professionals were identified and collected. **Results and Discussion:** A total of 10 cases of Look-Alike medications were identified, including Methotrexate 50 mg/2 mL and Mitomycin 10 mg, both manufactured by NAPROD Laboratories. In addition, 4 cases of Sound-Alike medications were identified, such as Endoxan[X] 500 mg and Holoxan[X] 1 g. To prevent medication errors resulting from confusion between these products, several recommendations were proposed to reduce the risks associated with LASA medications. These preventive measures are intended to improve patient safety by minimizing the occurrence of medication errors. **Conclusion:** Through effective identification, prevention, education, and communication strategies, the hospital pharmacist, as the medication expert, plays a key role in enhancing medication safety and protecting patients from the risks associated with Look-Alike, Sound-Alike medications. Close collaboration with the entire healthcare team is essential to reduce these errors and ensure the safe use of medicines.

Keywords: LASA medications, Hospital pharmacist, Medication errors, Patient safety.

GOOD PRACTICE IN THE USE OF ANTISEPTICS: INVESTIGATION AT BLIDA UNIVERSITY HOSPITAL CENTER

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ABSTRACT

Introduction : Proper use of antiseptics is a key factor in the prevention of healthcare-associated infections.The objective of this study is to assess the level of knowledge among healthcare professionals regarding antiseptics and their use in medical care. **Material And Methods:** This is a descriptive study., We used a surveytechnique with a questionnaire as our research tool. The survey was conducted through a questionnaire consisting of two sections: one covering the professional data of the study participants and the availability of an antiseptic usage protocol, and the other focusing on the participants ; knowledge level about antiseptics and their use (hand hygiene compliance, criteria for selecting an antiseptic, conditions for antiseptic storage, and adherence to antiseptic use principles). We surveyed 327 healthcare professionals (150 doctors, 166 nurses, and 11 biologists) working in various departments of the Blida University Hospital Center. **Results:** The study revealed that more than half of the participants (55.96%) reported the absence of an antiseptic usage protocol in their departments. In terms of hand hygiene before handling antiseptics, a large majority of participants adhered to this practice (93.27%). Aqueous Povidone-iodine was the most commonly used antiseptic (46.92%). Regarding the criteria for choosing antiseptics, availability was the top priority (50.42%). Antiseptic storage practices varied by department, with particular attention given to storing bottles away from light and heat. However, gaps remain, notably regarding the indication of the expiration date after opening on the bottles. **Conclusion:** This study highlighted that the situation regarding the use of antiseptics appears to be adequate.Nevertheless, drafting protocols remains necessary to ensure practices conform to recommendations and thus contribute to the prevention of healthcare-associated infections.

Keywords: Antiseptics, Hygiene, Infection, Prevention, Healthcare.

HYPOCHOLESTEROLEMIC EFFECT OF LEPIDIUM SATIVUM SEED POWDER: A PILOT AND IN SILICO STUDY IN CHOLESTEROL-FED RATS

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ABSTRACT

Lepidium sativum (Brassicaceae) exhibits a complex pharmacological profile, possessing documented antidiarrheal, hypoglycemic, and anti-osteoarthritic properties. Its therapeutic efficacy is driven by a diverse phytochemical matrix, including alkaloids, α-tocopherol, β-carotene, and β-sitosterol. To elucidate its hypocholesterolemic efficacy and structural mechanisms, this study employed an integrated approach combining a preliminary in vivo bioassay with in silico network pharmacology and molecular docking. A pilot in vivo trial was conducted using Wistar rats (n=5) maintained on a 1% hypercholesterolemic diet supplemented with L. sativum seed powder to monitor serum lipid profiles, alanine aminotransferase (ALT) activity, and hepatic histopathology. Parallel network pharmacology identified bioactive phytoconstituents and mapped compound–target–pathway topologies against cholesterol metabolism regulators, specifically 3-hydroxy-3-methylglutaryl-coenzyme A reductase (HMGCR) and low-density lipoprotein receptor (LDLR). Hub targets from protein–protein interaction (PPI) networks underwent rigid-receptor molecular docking simulations to quantify binding affinities and characterization of pocket-residue interactions.
Network pharmacology prioritized HMGCR as a principal hub node. Molecular docking revealed that major L. sativum lipophilic constituents, particularly β-sitosterol, demonstrated high-affinity binding within the catalytic domain of HMGCR. B-sitosterol achieved a free binding energy ΔG of -8.7 kcal/mol, stabilizing the complex via hydrophobic interactions with Leu562, Val683, and Ala856, alongside a critical hydrogen bond with Asp767 (distance = 2.8 Å). These computer models matched the animal results, which showed a clear reduction in high cholesterol. The treated rats showed a downward trend in total cholesterol, triglycerides, and LDL-C, as well as a lower heart disease risk ratio. The convergence of in silico and preliminary in vivo data suggests that the hypocholesterolemic activity of L. sativum operates via a multi-target mechanism anchored by the competitive inhibition of endogenous HMGCR, supplemented by the modulation of downstream lipid transport pathways. These findings explain how L. sativum works to lower cholesterol, supporting its development as a natural treatment. However, molecular dynamics simulations are still running to confirm these results.

Keywords: Lepidium sativum, hypocholesterolemic activity, network pharmacology, molecular docking

PHENOLICS AND ANTIMICROBIAL POTENTIAL OF PEGANUM HARMALA .L SEEDS

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ABSTRACT

Peganum harmala L., belonging to the Zygophylaceae family, it is a herbaceous, perennial, and glabrous plant**.** it is a plant widely used in traditional medicine in various countries, especially in Algeria and the Arab Maghreb. For many centuries, Peganum harmala L., was used to treat various human diseases such as lumbago, asthma, colic, and jaundice. It is a true panacea renowned for treating rheumatism, female genital ailments, mental and nervous illnesses, and insomnia in adults and children. Also, smoke from the burning seeds of Peganum harmala is traditionally used in Iran as an antiseptic and disinfectant. It is also used against other diseases such as diabetes, high blood pressure, poisoning, and other diseases.
This context includes several studies, including a phytochemical screening study using standard methods, colorimetric determination of total phenols using Folin-Ciocalteu, and evaluation of the antimicrobial activity of the methanol extract of Peganum harmala L. seeds. The latter was identified on four bacterial strains and one fungal strain in two different ways (the spread method on agar and the direct contact method), respectively, and the results showed that the methanolic extract has a moderate inhibitory effect on (staphyllococus aureus, Escherichia coli, Bacillus sp, and Fusarium oxysporum f). On the other hand, it was shown to be inactive against Pseudomonas aeruginosa.

Keywords: peganum harmala. L, phytochemical screening, phenolics content, antimicrobial activity, methanolic extract

PHYTOCHEMICAL STUDY AND BIOLOGICAL ACTIVITIES OF HIBISCUS SABDARIFFA. L EXTRACTS: A COMPARATIVE EVALUATION

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ABSTRACT

Medicinal plants represent a fundamental pillar of traditional medicine, and modern scientific studies are increasingly important to validate their efficacy and elucidate their mechanisms of action. This work falls within the framework of research into natural alternatives to chemical compounds, focusing on the study of Hibiscus sabdariffa L., a plant widely known for its multiple culinary and traditional therapeutic uses. The study aimed to evaluate the biological activities (antioxidant, antibacterial, antifungal, and anticoagulant) of Hibiscus sabdariffa flower extracts, and to compare the effectiveness of two extraction methods: maceration in hydro-methanolic solution and infusion in boiling water. The results showed that both extracts are rich in bioactive compounds, particularly flavonoids and phenolic compounds, with similar extraction yields (36% for infusion and 32.56% for maceration). Total polyphenol contents were also comparable, reaching 37.45 mg gallic acid equivalent/g for the hydro-methanolic extract and 34.65 mg GAE/g for the infused extract. Both extracts exhibited moderate antioxidant activity (IC50 values of 1.63 and 1.92 mg/ml, respectively), as well as moderate inhibitory effects against certain bacteria such as Staphylococcus aureus and Escherichia coli, while showing no activity against Bacillus subtilis. They also demonstrated moderate antifungal activity against Fusarium oxysporum. The most remarkable finding concerned the anticoagulant activity, as both extracts significantly prolonged coagulation time in a dose-dependent manner, particularly affecting the intrinsic pathway. This suggests their potential as promising natural sources for anticoagulant therapy. These findings confirm the therapeutic value of Hibiscus sabdariffa and support its traditional uses, while opening new perspectives for the development of its natural extracts in pharmaceutical and food industry applications.

Keywords: hibiscus sabdariffa.L, phytochemical screening, antioxidant activity, antibacterial activity, antifungal activity, anticoagulant activity

TRITERPENOIDS OF ETHYL ACETATE AND N-BUTANOL EXTRACTS OF ASTRAGALUS ARMATUS SUBSP. NUMIDICUS (MURB.) EMB. & MAIRE AND THEIR CHEMOTAXONOMIC SIGNIFICANCE

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ABSTRACT

Astragalus is one of the largest genuses of flowering plants in the Fabaceae family, is rich source of triterpenoid saponins and sapogenins, steroids, polysaccharides, alkaloids, phenylpropanoids and flavonoids. In the present work, we are interested with the triterpenoid saponins of Astragalus armatus subsp. numidicus (Murb.) Emb. & Maire.
Air-dried and powdered aerial parts (900 g) of Astragalus armatus subsp. numidicus (Murb.) were macerated in hydroalcoholic mixture (EtOH/H2O, 70:30v/v) at room temperature. The residue was filtred, concentrated then successively extracted with petroleum ether, chloroform, ethyl acetate and n-butanol. Three undescribed cycloartane saponin named Astragalarmoside A–C (1-3) together with eleven known compounds namely Astrasieversianin II (4), Astrasieversianine IV (5), Astrasieversianine VI (6), Astrasieversianine X (7), Astragaloside II (8), Astragaloside IV (9), Cyclomacroside D (10), Cycloaraloside E (11), Cyclomacroside C (12), Agroastragaloside IV (13), Soyasaponin I (14), were successfully isolated and characterized from the ethyl acetate and n-butanol extracts of the aerial parts of Astragalus armatus subsp. numidicus (Murb.) Emb. & Maire. Structural elucidation of these compounds was achieved through comprehensive chromatographic separation combined with spectroscopic analysis, including HR-ESIMS and NMR techniques. These findings expand our understanding of the genus chemical diversity and highlight the chemotaxonomic significance of these metabolites. Notably, because compounds 5, 8, and 9 have been previously reported in other Astragalus species, their presence here suggests a close chemotaxonomic relationship between A. armatus subsp. numidicus (Murb.) Emb. & Maire and the reste of the genus.

Keywords: A.armatus subsp. numidicus (Murb.) Emb. & Maire, triterpenoid saponins, chemotaxonomic

ANTIOXIDANT ACTIVITY AND PHYTOCHEMICAL COMPOSITION OF N-BUTANOL EXTRACT FROM THE AERIAL PARTS OF ATHAMANTA SPECIES

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ABSTRACT

The genus Athamanta it is kind of flowering plant of the Apiaceae family. consists of about nine species, it is an endemic plant of southeastern Europe and northern africa, we've been interested with the phytochemical study and antioxidant activity of the n-butanol extract of Athamanta species. Air-dried and powdered aerial parts (3000 g) of this species were macerated in a hydromethanol solution (70%) at room temperature. The extract was concentrated to dryness (under low pressure), the residue was dissolved in water and extracted with petroleum ether, chloroform, ethyl acetate and n-butanol, successively. The n-butanol extract (20.57g) was subjected to a vaccum liquid chromatography on RP18 (VLC), eluted with a gradient of H2O/MeOH (70:30 to 0:100) to obtained 7 fractions. The fraction F2, F3 and F4 was combined then purified to a column chromatography on polyamide gel eluted with a gradient of Toluene/MeOH (100:0 to 0:100). Five compounds 2 phenylpropanoids: 3-(7-méthoxy-1,3-benzodioxol-5yl)-1,2-propandiol (A1), 6-(2-propen-1-yl)-1,3-benzodioxol-4-O-β-D-glucopyranoside (A2), one phenol Thymol-3-O-β-D-glucoside (A3) and two flavonoids Lutéoline-7-O-β-D-glucopyranoside (A4), Apigénine-7-O-β-D-rutinoside (A5) were separated and characterized by the spectroscopic methods 1D, 2D experiments (1H,13C, COSY, HSQC and HMBC). The n-butanol extract was tested for its antioxidant activity using four methods (DPPH, ABTS, Reducing power and Phenanthroline). This extract showed a high activity in DPPH (IC50: 37.88±3.52; 49.57±1.40 µg/mL), assays ABTS (IC50: 8.97 ± 0.97; 15.83 ± 0.13 µg/mL), Reducing power (A0.5: 30.21±1.75; 41.72±0.63 µg/mL) and phenanthroline (A0.5: 6.60 ± 0.46; 9.60 ± 0.18 µg/mL) assays.

Keywords: Apiaceae, Athamanta species, antioxidant activity, phytochemical composition

DEVELOPMENT AND VALIDATION OF A NOVEL HPLC-UV METHOD FOR THE DETERMINATION OF VALTRATE, A NON-GLYCOSIDIC IRIDOID, IN COMMERCIAL VALERIANA OFFICINALIS PREPARATIONS

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ABSTRACT

Background: Valeriana officinalis L. is one of the most widely used herbal medicines for the management of insomnia, anxiety, and nervous disorders. Among its bioactive constituents valtrate, a characteristic non-glycosidic iridoid, has attracted considerable interest due to its pharmacological properties and potential use as a quality marker. However, validated analytical methods for the routine determination of valtrate in commercial valerian preparation are limited. **Objective:** This study aimed to develop and validated a simple, rapid, and reliable HPLC-UV method for the quantitative determination of valtrate in commercially available Valeriana officinalis L. preparations. **Methods:** Chromatographic analysis was performed using a reversed phase C18 column (250 x 4.6 mm, 5 µm). The mobile phase consisted of acetonitrile and 0.1% formic acid in water (75:25, v/v) under isocratic conditions. Valtrate was detected at 254 nm using a UV detector. Method validation was carried out according to ICH guidelines, including assessments of linearity, accuracy, precision, specificity, limit of detection (LOD), and limit of quantification (LOQ). The validated method was subsequently applied to the analysis of valerian containing preparations obtained from community pharmacies in Türkiye. **Results:** The developed method exhibited good chromatographic performance with satisfactory peak shape and resolution. Excellent linearity was observed within the concentration range of 5-30 ng/mL ($r^2>0.999$). The LOD and LOQ values were determined as 1.5 ng/mL and 5.0 ng/mL, respectively. Accuracy and precision results were found to be within acceptable limits. Application of the method revealed measurable differences in valtrate content among the analyzed commercial preparations. **Conclusion:** A novel, simple, and validated HPLC-UV method was successfully developed for the determination valtrate in Valeriana officanlis L. preparations. The proposed method offers a practical approach for routine quality control, standardization, and quantitative assessment of valerian containing products.

Keywords: Valtrate, Valeriana officinalis L., Method development, Validation

A BIBLIOMETRIC ANALYSIS OF RESEARCH PROGRESS ON SCUTELLARIA FLAVONOIDS

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ABSTRACT

Plants belonging to the genus Scutellaria (Lamiaceae) are widely recognized for their important medicinal value, particularly well-known species such as Scutellaria baicalensis, Scutellaria barbata, and Scutellaria lateriflora. Flavonoids, phenolics, and other bioactive secondary metabolites isolated from these plant species play an increasingly important role in modern pharmacology, especially in the treatment and therapeutic management of various medical conditions, including diverse types of cancers, gastrointestinal diseases, liver disorders, and complex neurological conditions. Although many qualitative narrative review articles have been published on this plant genus, comprehensive quantitative studies and systematic bibliometric analysis of the global scientific literature remain quite limited. Therefore, the main objective of this study is to effectively fill this existing gap by conducting a detailed, long-term bibliometric analysis of global research focused on Scutellaria species and their bioactive chemical constituents. In this study, key bibliometric parameters—including annual publication output, total citation numbers, top publishing academic journals, leading research institutions, geographic distribution by countries, and individual author contributions—were systematically analyzed. In addition, international author research collaborations, keyword co-occurrence patterns, and major emerging research trends were mapped, structured, and visually analyzed using VOSviewer software. To the best of the authors' knowledge, this study represents the first comprehensive bibliometric review specifically dedicated to Scutellaria research worldwide. The findings provide clear, data-driven insights into current scientific developments and offer valuable directions for future interdisciplinary studies in plant biology, phytochemistry, and pharmacology.

Keywords: Scutellaria, flavonoids, biologically active compounds, cancer

IN SILICO SCREENING OF SUNFLOWER (HELIANTHUS ANNUUS L.) BY-PRODUCT METABOLITES AGAINST HUMAN ACETYLCHOLINESTERASE AND BUTYRYLCHOLINESTERASE

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ABSTRACT

Sunflower (*Helianthus annuus* L.) is the principal oilseed crop of the Thrace region, and its leaves, stems and receptacles are discarded during oil extraction although they contain a range of phenolic and terpenoid metabolites. This study screened sunflower by-product metabolites for binding to human acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) and examined their physicochemical suitability for central nervous system exposure. Eighteen metabolites with documented occurrence in sunflower by-product tissues were selected from the published phytochemical literature: receptacle flavones (hispidulin, jaceosidin, cirsiliol, pectolinarigenin, scrophulein, isoquercitrin), leaf sesquiterpenoids (heliannuols A, C and D), diterpene acids (kaurenoic, grandifloric and trachylobanoic acids), caffeoylquinic acids (3,4- and 3,5-di-O-caffeoylquinic acids, cynarin), tambulin, β-amyrin and stigmasterol. Structures were retrieved by PubChem CID, verified by InChIKey and assigned ionisation states at pH 7.4. Five reference cholinesterase inhibitors were included as scale references. Docking was performed with AutoDock Vina 1.2.7 (exhaustiveness 32, three independent seeds) against AChE (PDB 4EY7, 2.35 Å) and BChE (4BDS, 2.10 Å). To keep the two search spaces comparable, the enzymes were superimposed (53.5% sequence identity; 1.01 Å RMSD over 493 Cα) and the crystallographic donepezil centroid of 4EY7 was transformed into the BChE coordinate frame; the transferred centre lay 5.6 Å from the crystallographic tacrine of 4BDS. Redocking reproduced the tacrine pose in BChE as the top-ranked solution (0.50 Å RMSD); for donepezil in AChE the near-native pose was sampled but ranked third (1.55 Å). Predicted binding energies for the sunflower metabolites ranged from −6.59 to −11.68 kcal/mol at AChE and from −6.12 to −10.76 kcal/mol at BChE, with seed-to-seed variation not exceeding 0.32 kcal/mol. The strongest predicted binding at AChE was obtained for 3,5-di-O-caffeoylquinic acid (−11.68), cynarin (−10.88) and pectolinarigenin (−10.75); the reference drug donepezil scored −11.85. Physicochemical assessment using criteria for central nervous system exposure, under which four of the five reference drugs qualified, admitted five of the eighteen metabolites: pectolinarigenin, scrophulein and heliannuols A, C and D. The anionic diterpene and caffeoylquinic acids, the glycosylated flavonol isoquercitrin, and the triterpene and phytosterol fractions fell outside these criteria, as did the more hydroxylated receptacle flavones. The five qualifying metabolites occupied positions 3, 8, 16, 17 and 18 of eighteen in the affinity ranking, pectolinarigenin combining the third strongest predicted binding with a profile within the applied limits. Differences between AChE and BChE scores were negative for sixteen of eighteen metabolites and showed no dependence on molecular weight ($r^2 = 0.027$). Within these limits, predicted binding strength and physicochemical suitability were distributed differently across the compound classes examined, and the methylated receptacle flavones, pectolinarigenin in particular, merit further evaluation.

Keywords: Helianthus annuus L., sunflower by-products, molecular docking, cholinesterases, pectolinarigenin

QUANTIFICATION OF PHENOLIC COMPOSITION, ANTIOXIDANT AND ANTIPROLIFERATIVE ACTIVITIES OF EXTRACTS FROM AN ENDEMIC NORTH AFRICAN GENISTA SPECIES (FABACEAE)

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ABSTRACT

The purpose of the natural product chemistry research conducted at our laboratory is to maintain and improve the richness and diversity of Algerian flora. In considering this, we have concentrated on the chemical analysis of a plant belonging to the Fabaceae family, specifically species from Genista genus. The studied species is an endemic plant of North Africa which is found in eastern Algeria. Conventional medicine uses the aerial parts of this plant as a wound-healing agent. A literature review revealed that very few phytochemical studies have been conducted on this species, which motivated us to undertake this work. In this study, three extracts namely CHCl3, AcOEt and n-Butanol were obtained after hydroalcoholic extraction of the aerial parts (leaves), concentration, and successive treatment with increasing polarity solvants. Quantitative estimation of total polyphenols and total flavonoids contents (TPC and TFC) by colorimetric methods revealed that EtOAc extract was the richest in phenolic compounds followed by the chloroform than the n-butanol. The antioxidant activity results, using DPPH assay, show that the three extracts have a powerful inhibitory effect. The ethyl acetate extract showed the best activity with an inhibition percentage of 93.90% when compared with ascorbic acid used as standard (96.92%). Furthermore, all extracts were tested against HeLa cell lines. The results showed that both extracts, chloroform and ethyl acetate exhibited anti-proliferative activity at various concentrations, while the n-butanol extract was completely inactive at all tested concentrations.

Keywords: Fabaceae, Genista, Phenolic content, Flavonoid content, antioxidant, antiproliferative

ESSENTIAL OIL COMPOSITION OF ASTERISCUS SPECIES (ASTERACEAE) FROM TEBESSA REGION AND ITS ANTIBACTERIAL ACTIVITY

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ABSTRACT

The use of plants, in traditional medicine, is based on empirical knowledge that has been transmitted orally across generations. This knowledge is particularly valuable in rural and remote regions, where access to modern healthcare infrastructure is often limited. The aim of this study was to determine for the first time the chemical composition and antibacterial activity of the essential oil obtained from the fresh flowers of Asteriscus hieichunticus (Michon) Wiklund. Essential oil was extract from fresh flowers by hydrodistillation using Clevenger apparatus. The oil was analyzed using gas chromatography techniques (GC-FID and GC/MS). A total of 21 volatile substances were identified, accounting for about 78.67% of essential oils. The profile is dominated by oxygenated sesquiterpenes (75.25%), from which the 6R,7R-bisabolone was the main constituent (44.84 %), followed by sesquicineole (13.16 %), the hinesol (5.34 %). Furthermore, antibacterial activity against various gram-positive and gram-negative bacteria was determined by disk diffusion method. The essential oils exhibited appreciable antibacterial activity, with inhibition zones ranging from 9.2 to 18.4 mm and Minimum Inhibitory Concentration (MIC) values between 0.625 and 5 mg/mL. Overall, the essential oil showed significantly greater activity against Gram-positive bacteria, especially Staphylococcus aureus (18.4±0.6 mm). Asteriscus essential oil has good antimicrobial activity against tested pathogenic bacteria and may be used as a natural antimicrobial agent.

Keywords: Asteraceae, Asteriscus, Essential oil, antibacterial activity, Bisabolone, GC/MS analysis, Tebessa region.

BEYOND A CULINARY SPICE: EXPLORING THE ANTIOXIDANT, ANTIMICROBIAL AND ANTIBIOTIC-SYNERGISTIC POTENTIAL OF ALGERIAN NIGELLA SATIVA L. FIXED OIL

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ABSTRACT

Nigella sativa L. is a medicinal plant widely recognised for its use as an aromatic herb and a culinary spice of significant ethnobotanical importance. The present study aimed to evaluate the antioxidant and antimicrobial properties of the fixed oil extracted from Algerian Nigella sativa seeds. Phytochemical screening revealed the presence of primary metabolites, including reducing sugars and proteins, as well as secondary metabolites, notably phytosterols and saponins. Antioxidant activity was assessed using the DPPH free radical scavenging assay and the β-carotene/linoleic acid bleaching method. The DPPH assay revealed a moderate radical-scavenging activity, with an IC_{50} value of approximately 3.94 mg/mL. In contrast, the fixed oil exhibited negligible inhibition of β-carotene/linoleic acid oxidation, with an inhibition percentage of only 2.72%. Furthermore, antimicrobial activity was evaluated against eleven pathogenic bacterial strains, revealing variable inhibitory effects depending on the bacterial species, with pronounced activity against Gram-positive bacteria. Minimum inhibitory concentration (MIC) values were determined at 3.125 µL/mL and 6.25 µL/mL for Acinetobacter baumannii and Escherichia coli ATCC 25922, respectively. Assessment of the synergistic interactions between the fixed oil and selected antibiotics demonstrated a significant potentiating effect with erythromycin and vancomycin against methicillin-resistant Staphylococcus aureus (MRSA), as well as an inhibitory interaction with trimethoprim and amoxicillin against ESBL-producing Escherichia coli (BLSE+). Overall, the findings highlight the biological potential of Algerian Nigella sativa fixed oil, particularly its antimicrobial activity and its ability to enhance the efficacy of certain antibiotics. Despite its limited activity in the β-carotene/linoleic acid assay, the observed antioxidant activity in the DPPH assay and its antibiotic-synergistic effects support its potential as a natural bioactive agent and warrant further investigation of its chemical composition and mechanisms of action.

Keywords: Nigella sativa seeds, fixed oil, antibacterial activity, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), synergistic effects.

COMPARATIVE EVALUATION OF PHYTOCHEMICAL CONTENTS AND ANTIOXIDANT ACTIVITIES OF OLEA EUROPAEA L., CISTUS CRETICUS L. AND VIBURNUM OPULUS L. FROM TÜRKIYE

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ABSTRACT

Olea europaea L., Cistus creticus and Viburnum opulus L. grow in the Mediterranean Region of Türkiye and they are crucial medicinal plants related to their high secondary metabolites, antioxidant molecules. Also, these plants use in not only traditional and complementary medicine but also in the food and culinary industries. Based on these valuable properties, this study aimed to evaluate antioxidant potentials of these plant species by determining their antioxidant analysis which are Total Phenolic Content (TPC), Total Flavonoid Content (FC) and 2,2- diphenyl-1-picrylhydrazyl- Radical Scavenging Activity (DPPH-RSA).Firstly, plant materials collected from their habitats and dried appropriately. The dried plant materials were extracted with ethanol and the solvent was evaporated. Whole extracts were transported from Türkiye to Spain under suitable storage conditions in accordance with an approved MTA (material transfer agreement). Gallic acid and Quercetin were utilized as reference standard for TPC and TFC analysis, respectively. And also, these both standards were employed to evaluate DPPH- RSA. The statistical results showed that differences among the plants species for whole analysis ($p< 0.05$). For TPC, Viburnum opulus L. (65.35 ± 2.81 mg GAE g^{-1} DW plant) was the highest, whereas Cistus creticus L. (256.47 ± 30.83 mg QE g^{-1} DW plant) for TFC. In addition, Viburnum opulus L. demonstrated the highest DPPH radical scavenging activity (28.42 ± 0.05 mg GAE g^{-1} DW plant and 44.23 ± 0.08 mg QE g^{-1} DW plant). In addition, Viburnum opulus L. exhibited the lowest IC50 value (5.36 mg/mL) based on QE and *Cistus creticus* L. showed the lowest IC50 value (8.76 mg/mL) based on GA, indicating DPPH radical scavenging activity among the evaluated plant species. This study is committed to shed light on phytochemical potential of these plant species, particularly Viburnum opulus. Furthermore, these results support the potential use of these plant species such as natural antioxidant sources and promising candidates for food and pharmaceutical industries.

Keywords: phytochemistry, antioxidant analysis, TPC, RSA, TFC

COMPARISON OF ANTIOXIDANT ACTIVITIES OF VARIOUS SOLVENT EXTRACTS FROM ROOT AND AERIAL PARTS OF LIMONIUM SINUATUM

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ABSTRACT

Limonium sinuatum L. (Plumbaginaceae) is an ornamental and medicinal plant species widely found in saline and coastal habitats. This study aimed to evaluate and compare the antioxidant activities of hexane, acetone, and methanol extracts from the root and aerial parts of *L. sinuatum*. Antioxidant capacity was determined using cupric ion (Cu2+) reducing ability (CUPRAC) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays. CUPRAC results showed that methanol extracts of both aerial parts (3.11±0.13 mmol TR g^{-1}) and roots (3.29±0.06 mmol TR g^{-1}) had the highest antioxidant capacity, followed by acetone (2.11±0.24 and 3.04±0.77 mmol TR g^{-1}, respectively) and hexane (1.41±0.19 and 2.78±0.66 mmol TR g^{-1}, respectively) extracts. The DPPH assay showed concentration-dependent scavenging activity in all extracts. At a concentration of 20 mg/mL, the acetone root extract showed the strongest inhibition (89.89%), followed by methanol root (89.37%), methanol aerial (85.93%), hexane aerial (85.71%), acetone aerial (82.19%), hexane root (81.76%), and methanol aerial (85.93%) extracts. Notably, root extracts generally displayed higher antioxidant activity than aerial parts, particularly in acetone and methanol solvents. The results suggest that solvent polarity significantly influences the extraction of antioxidant compounds, with polar solvents yielding more potent extracts. These findings indicate that *L. sinuatum*, especially its root-derived methanol and acetone extracts, possesses considerable antioxidant potential and may serve as a promising natural source of antioxidants for further phytochemical and pharmacological investigations.

Keywords: Limonium sinuatum, antioxidant activity, root, aerial parts, solvent extraction

A THEORETICAL STUDY OF PARACETEMOL DRUG ADSORPTION ON SI-CNT: DFT INVESTIGATION

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ABSTRACT

Paracetamol, also known as acetaminophen, is a widely used analgesic and antipyretic drug that provides pain-relieving effects similar to acetylsalicylic acid without significant anticoagulant activity. Its interaction with nanostructured materials is of considerable interest for potential sensing and drug-delivery applications. In this study, the adsorption and interaction of paracetamol with Si-doped carbon nanotubes (Si-CNTs) were systematically investigated using density functional theory (DFT) calculations at the M06-2X/6-31G(d) level. Particular attention was given to the role of the different functional groups of paracetamol, including the hydroxyl (–OH), a, and carbonyl (C=O) groups, in determining the adsorption behaviour and intermolecular interactions with the Si-CNT surface. The structural, electronic, and energetic properties of the paracetamol–SiCNT complexes were analyzed, such as adsorption energies, charge transfer, frontier molecular orbitals, and HOMO–LUMO energy gaps. The results demonstrate that Si doping can significantly modify the electronic characteristics of the carbon nanotube and influence its interaction with paracetamol, suggesting that Si-doped CNT systems may provide an enhanced platform for the adsorption and detection of paracetamol. The NLO properties, including dipole moment, average polarizability, polarizability anisotropy, and first hyperpolarizability, were also calculated to assess the influence of paracetamol adsorption on the optical response of the nanostructures. The obtained results indicate that Si-doped CNTs substantially modify the electronic structure, intermolecular interactions, charge-transfer characteristics, and NLO response of the system, suggesting that Si-doped carbon nanotubes may serve as promising nanostructured platforms for paracetamol sensing and related biomedical applications.

Keywords: Si-CNTs, Paracetemol, Sensors, NLO, DFT

DEVELOPMENT AND CHARACTERIZATION OF A ROSEMARY OIL-LOADED NANOEMULGEL FOR THE TREATMENT OF HERPES LABIALIS AND EVALUATION OF ITS IN VITRO EFFICACY

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ABSTRACT

Background: Herpes simplex virus (HSV) infections are a significant global health issue, typically treated with topical antivirals like acyclovir. However, the emergence of drug-resistant strains, particularly in immunocompromised patients, necessitates the development of novel antiviral agents. Natural plant extracts, such as rosemary oil (*Rosmarinus officinalis*), contain phenolic compounds and flavonoids that offer a broad-spectrum antiviral alternative.
Objective: The primary aim of this study was to develop a stable topical nanoemulgel formulation containing rosemary essential oil and to evaluate its in vitro antiviral activity against HSV-1. **Methodology:** Nanoemulsions were prepared using the ultrasonication method with a formulation consisting of 4.5% rosemary oil, a natural surfactant (Quillaja Saponaria), and a cosurfactant (Transcutol HP). The optimized nanoemulsion was converted into a nanoemulgel by incorporating 1% xanthan gum. Characterization included droplet size analysis, zeta potential measurements, and accelerated stability tests (centrifugation and thermal stress). In vitro cytotoxicity and antiviral efficacy were tested on Vero cells infected with the HSV-1 Kos strain. **Results:** The optimized nanoemulsion (F2P1) exhibited a droplet size of 53.0 nm, which increased to 134.9 nm upon conversion to a nanoemulgel, with a stable zeta potential of -49.3 mV. Accelerated stability tests confirmed that the formulations maintained their physical integrity without phase separation or creaming. Cytotoxicity studies determined the lethal dose (LD) range to be between 1/500 and 1/1500, leading to the selection of a 1/2000 dilution for antiviral testing. At this concentration, the rosemary nanoemulgel demonstrated significant antiviral activity, providing a 94.37% inhibition rate and a 17.78-fold reduction in viral load compared to the untreated control group. **Conclusion:** The developed rosemary-loaded nanoemulgel is a physically stable and highly effective natural alternative for the topical treatment of HSV-1. These findings suggest that nano-drug delivery systems can significantly enhance the therapeutic potential of essential oils in managing viral infections.

Keywords: HSV-1, nanoemulsion, nanoemulgel, rosemary (Rosmarinus officinalis) essantial oil, antiviral activity

DEVELOPMENT AND CHARACTERIZATION OF A NISIN-LOADED AMARANTH OIL NANOEMULGEL WITH HYDROLYZED WHEAT PROTEIN FOR TOPICAL DELIVERY IN ATOPIC DERMATITIS

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ABSTRACT

Atopic dermatitis (AD) is a chronic inflammatory skin disorder characterized by epidermal barrier dysfunction and microbial dysbiosis, with *Staphylococcus aureus* predominance frequently associated with disease flares. Nisin is a naturally derived antimicrobial peptide, while amaranth oil is rich in squalene and unsaturated fatty acids with potential dermatological benefits. Nanoemulgels combine nanoscale delivery with the rheological and skin-retention advantages of gel systems. This study aimed to develop and characterize a nisin-loaded amaranth oil nanoemulgel containing hydrolyzed wheat protein for potential topical application in AD. Nanoemulsions were prepared by ultrasonication and subsequently incorporated into xanthan gum-based gels. The final nanoemulgels contained nisin (0.05%, w/w), amaranth oil (1%, w/w), hydrolyzed wheat protein (0.5%, w/w), and xanthan gum at final concentrations of 0.5% or 0.75% (w/w). The formulations were characterized in terms of droplet size, polydispersity index (PDI), zeta potential, physicochemical properties, and rheological behavior. Accelerated stability was evaluated by centrifugation and thermal stress tests at 40, 60, and 80 °C. Nanoemulgels containing 0.5% and 0.75% xanthan gum exhibited mean droplet sizes of 151.37 ± 1.78 and 167.57 ± 0.84 nm, PDI values of 0.18 and 0.22, and zeta potentials of −25.90 ± 3.21 and −34.97 ± 0.32 mV, respectively. Rheological analysis demonstrated shear-thinning behavior, with apparent viscosity decreasing from 115.76 ± 2.62 to 27.12 ± 0.21 cP and from 218.00 ± 7.58 to 42.84 ± 1.86 cP, respectively, as the shear rate increased from 75 to 750 s^{-1}. Overall, the formulations demonstrated acceptable physical stability under accelerated testing conditions, together with favorable physicochemical and rheological characteristics. Three-month stability and efficacy studies in AD are currently ongoing, and the results will be included in the study.

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Keywords: Atopic dermatitis, Nisin,amaranth oil, Nanoemulgels

MICROSTRUCTURAL AND STRUCTURAL PROPERTIES OF THE MECHANICALLY ALLOYED CU-ZN-SN POWDERS

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ABSTRACT

Copper-based alloys such as bronze (Cu–Sn) and brass (Cu–Zn) have long been utilized due to their excellent wear resistance, mechanical strength, corrosion resistance, good electrical and thermal conductivity. In recent years, the copper–zinc–tin (Cu–Zn–Sn) ternary system has attracted increasing attention as it combines the advantageous properties of both bronze and brass. In our study, the Cu-Zn-Sn alloy was prepared using a mechanical alloying technique of elemental powders in a Retsch PM400 planetary ball mill under argon atmosphere. The obtained powders were studied by X-ray diffraction (XRD) using a Bruker D8-advanced diffractometer in a (θ–2θ) Bragg Brentano geometry equipped with Cu-Kα radiation source. The main objective is to understand the influence of the milling time on the evolution of phase composition, structural, and microstructural parameters. The effect of the structural disorder is highlighted by the presence of several overlapping peaks and spread over the milling time range .The result of the Rietveld refinement of the XRD pattern, using an anisotropic model with Maud program, indicates that during the milling of the powders up to 5 h, several phases with different structure are detected: fcc α-Cu_5Zn_3, ɣ-brass Cu_5Zn_8, $Cu_{10}Sn_3$, $Cu_{41}Sn_{11}$ and trigonal α-Cu_3Zn. The microstructural study with an anisotropic model of grain sizes and microstrains field has demonstrated the stability of the ternary phase with very little deformed grains and stable average grain sizes. The refinement of the grain size and the increase of the average rate of micro-stresses exhibit significant distortion of the crystal lattices.

Keywords: Brass alloy, bronze alloy, XRD, Cu-Zn-Sn, Maud program, anisotropic model

EFFECT OF CA SUBSTITUTION ON THE MAGNETOCALORIC PERFORMANCE OF $ND_{0.6}SR_{0.4-x}CA_xMNO_3$ PEROVSKITES FOR LOW-TEMPERATURE MAGNETIC REFRIGERATION

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ABSTRACT

The influence of Ca substitution on the structural, magnetic, and magnetocaloric properties of $Nd_{0.6}Sr_{0.4-x}Ca_xMnO_3$ (x = 0 and 0.1) perovskite manganites was systematically investigated with the aim of improving their performance for low-temperature magnetic refrigeration. The samples were synthesized by the auto-combustion method using metal nitrates and glycine as fuel. Phase purity and crystal structure were examined by X-ray diffraction combined with Rietveld refinement, confirming the formation of a single-phase orthorhombic structure with the Pnma space group for both compositions. Ca substitution induces slight structural distortions, reflected by modifications of the lattice parameters and MnO_6 octahedral geometry, while preserving the overall crystal symmetry. Magnetic measurements reveal a second-order ferromagnetic-paramagnetic transition in both samples. The Curie temperature (Tc) increases from approximately 100 K for the parent compound to about 110 K after Ca substitution, indicating strengthened ferromagnetic interactions associated with lattice distortion. Above the Curie temperature, the inverse magnetic susceptibility deviates from the Curie-Weiss law, suggesting the presence of a Griffiths-like phase arising from magnetic inhomogeneity. The magnetocaloric effect was evaluated from magnetic isotherms using the Maxwell relation. The Ca-substituted sample exhibits an enhanced maximum magnetic entropy change (ΔS_{max}) together with a significant increase in the relative cooling power (RCP), demonstrating an improvement in the overall refrigeration efficiency over a broader operating temperature range. The enhanced magnetocaloric performance is attributed to the structural distortions induced by Ca substitution, which modify the magnetic exchange interactions while maintaining the Mn^{3+}/Mn^{4+} ratio. These findings indicate that Ca substitution is an effective strategy for optimizing the magnetocaloric response of $Nd_{0.6}Sr_{0.4-x}Ca_xMnO_3$ perovskites and highlight their potential as promising candidates for cryogenic magnetic refrigeration applications.

Keywords: Perovskite manganites, Calcium substitution, Structural distortion, Griffiths phase, Magnetocaloric effect, Cryogenic magnetic refrigeration

EFFECT OF ANNEALING TEMPERATURE ON THE MAGNETOCALORIC PERFORMANCE OF $NDBAMN_2O_6$ DOUBLE PEROVSKITE FOR INTERMEDIATE-TEMPERATURE MAGNETIC REFRIGERATION

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ABSTRACT

The effect of annealing temperature on the structural, magnetic, and magnetocaloric properties of $NdBaMn_2O_6$ double perovskite was systematically investigated to evaluate its potential for intermediate-temperature magnetic refrigeration. The compound was synthesized by the sol–gel method and annealed at different temperatures to examine the influence of thermal treatment on cation ordering and magnetic behavior. Phase evolution and crystal structure were analyzed by X-ray diffraction combined with Rietveld refinement. The results reveal that increasing the annealing temperature promotes the transformation from a partially ordered orthorhombic structure containing secondary phases to a highly ordered single-phase tetragonal structure. This structural evolution is accompanied by an increase in crystallite size and a reduction in lattice strain, as confirmed by Size-Strain Plot (SSP) analysis, while scanning electron microscopy (SEM) observations indicate significant grain growth and improved microstructural homogeneity. Magnetic measurements demonstrate that enhanced structural ordering strengthens the ferromagnetic exchange interactions, leading to an increase in the Curie temperature and a sharper magnetic transition. The magnetocaloric effect was evaluated from isothermal magnetization measurements using the Maxwell relation. The sample annealed at the higher temperature exhibits an enhanced maximum magnetic entropy change (ΔS_{max}) together with a higher relative cooling power (RCP), indicating improved refrigeration efficiency over a wider operating temperature range. The observed enhancement is attributed to the increased B-site ordering and reduced structural disorder achieved through high-temperature annealing, which favor stronger magnetic exchange interactions. These findings demonstrate that annealing temperature is a key parameter for tailoring the structural and magnetic properties of $NdBaMn_2O_6$ and optimizing its magnetocaloric performance, highlighting its potential as a promising refrigerant material for intermediate-temperature magnetic refrigeration applications.

Keywords: Double perovskite, Magnetocaloric effect, Sol-gel synthesis, Annealing temperature, Intermediate-temperature magnetic refrigeration

NUMERICAL INVESTIGATION OF HEAT TRANSFER MIXED CONVECTION AND GREEN NANOFLUID FLOW IN A SMOOTH PIPE

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ABSTRACT

This study presents a comprehensive numerical investigation into the convective heat transfer performance and hydrodynamic behavior of an eco-friendly green nanofluid flowing through a horizontal smooth pipe. The investigated nanofluid consists of green-synthesized zinc oxide (ZnO) nanoparticles dispersed in a propylene glycol and water (PG-W 50:50) mixture as the base fluid. Simulations are conducted using the finite volume method (FVM) to discretize the coupled Navier-Stokes and energy equations. The numerical model accounts for buoyancy effects via the Boussinesq approximation at a Reynolds number of Re = 2000 under a constant wall heat flux condition. The influence of nanoparticle volume fractions (φ = 0 % to 2.0 %) on the local and average Nusselt numbers (Nu), friction factor (f), and pressure drop is systematically evaluated. The results indicate that the integration of green ZnO nanoparticles significantly enhances thermal performance, leading to a substantial increase in the Nusselt number compared to the pure PG-W base fluid. More importantly, due to the eco-friendly formulation, a reduction in dynamic viscosity is observed, preventing the sharp pressure drop penalty typically associated with conventional nanofluids. This research demonstrates that the sustainable ZnO–PG-W nanofluid provides a highly efficient, thermally superior, and environmentally friendly alternative to conventional synthetic coolants in modern industrial heat exchangers and solar thermal systems.

Keywords: Green Nanofluid, Zinc Oxide (ZnO), Propylene Glycol-Water, Heat Transfer Enhancement, Smooth Pipe, FVM.

EFFECT OF ADSORBENT/ADSORBATE PAIR ON SOLAR AIR-CONDITIONER ADSORPTION SYSTEM'S

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ABSTRACT

The use of solar energy for environmental control is receiving much attention as result of the projected world energy shortage. Refrigeration is particularly attractive as a solar energy application because of the near coincidence of peak cooling loads with the available solar power. Solar refrigeration, especially solar refrigeration with adsorption has the potential to improve the quality of life of people who live in areas with electricity shortage. It is usually used for storage of agricultural products, food and medicines (e.g. vaccines) in remote areas.
It is largely identifies that one of the most significant problems in the design of a refrigerating machine with adsorption is the choice of pair adsorbent / adsorbate. Many adsorbent-adsorbate pairs can be considered as working materials in solar adsorption refrigeration systems, and a careful selection of this pairs is essential, because, the thermal performance coefficient of these systems depends on it, however, its selection depends on certain desirable physical and chemical characteristics. This paper presents a detailed thermodynamic and parametric analysis of simple intermittent cycle of a solar adsorption refrigerator. The basic fundamentals of adsorption process and the criteria for choice of the adsorbent-adsorbate pairs are discussed. The Dubinin-Astakhov (D-A) equation is used to describe the isotherm of adsorption for a different activated carbon /methanol pairs. Factors mostly influencing the performance of the system and the cold quantity produced at evaporator level are discussed. The best pair used in this kind of machines is also investigated.

Keywords: Adsorption, adsorbent/adsorbate pair, air-conditioner systems and parametric study.

COMPARATIVE MOLECULAR DOCKING ANALYSIS OF SELECTED AROMATIC COMPOUNDS WITH DISTINCT ENZYME SYSTEMS

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ABSTRACT

Aromatic amines and phenolic compounds are widely used in the cosmetic and chemical industries, particularly in hair dye formulations, and their interactions with enzymatic systems are relevant to biotransformation, contaminant removal and industrial bioprocesses. In this study, the binding tendencies of 3-aminophenol, 4-aminophenol, p-phenylenediamine, resorcinol and the toxicologically important aromatic amine 2-naphthylamine toward Cel7A cellobiohydrolase (PDB: 1EGN), cytochrome P450cam (PDB: 1GJM) and a fungal laccase (PDB: 3PPS) were investigated by molecular docking. Cel7A was selected to represent the potential interaction of aromatic compounds with enzymes involved in lignocellulosic processing, whereas P450cam and laccase represented heme- and copper-dependent oxidative biotransformation systems, respectively. The predicted binding energies of the 15 protein–ligand complexes ranged from −4.5 to −7.3 kcal/mol. 2-Naphthylamine generated the most negative docking scores for all three targets, with binding energies of −7.2, −7.3 and −6.8 kcal/mol for 1EGN, 1GJM and 3PPS, respectively. The remaining ligands produced closely clustered binding energies ranging from −4.5 to −5.5 kcal/mol. These findings indicate a distinct and consistent predicted binding tendency of 2-naphthylamine toward three microbial enzymes with different structural and catalytic properties. The results may provide preliminary data for further experimental investigations into the enzymatic biotransformation and removal of dye industry-related aromatic compounds and their potential interactions with industrially relevant enzymes.

Keywords: Molecular docking, computational biophysics, protein–ligand interactions, binding energy, aromatic compounds.

THREE-DIMENSIONAL MODELING OF MIXED CONVECTION WITH SIMULTANEOUS HEAT AND MASS TRANSFER

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ABSTRACT

Fluid flows with simultaneous heat and mass transfer garner significant interest within the scientific community due to their widespread applications in diverse industrial fields, such as electronic component cooling, heat exchangers, air conditioning, drying processes, seawater desalination, and solar collectors. The presence of temperature and concentration gradients within these flows leads to fluid-density in homogeneities, which in turn generate highly complex convective motions of profound scientific importance. Furthermore, the resulting buoyancy forces greatly influence the hydrodynamic and thermal fields, as well as the overall heat and mass transfer rates. In the present work, the effects of thermal and mass buoyancy forces on the development of laminar mixed convection in a horizontal tube, subjected to constant wall heat and mass fluxes, were investigated using a three-dimensional elliptic model. The development of the velocity, thermal, and mass fields, as well as the axial evolution of the heat and mass transfer rates, are presented for different Schmidt and Grashof numbers. The results show that the heat and mass transfer rates increase when the thermal and mass buoyancy forces act in the same direction and decrease when they act in opposite directions. Furthermore, the Schmidt number is found to have a significant influence on both heat and mass transfer.

Keywords: Heat and Mass Transfer, Buoyancy Forces, Schmidt Number, Grashof Number, 3D, Horizontal Tube.

PROBING SOME MODELS PARAMETRIZING THE QCD PHASE TRANSITION AT HIGH TEMPERATURE AND ZERO BARYO-DENSITY

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ABSTRACT

The present work deals with the study of the thermally driven QCD phase transition from confined hadronic matter to deconfined Quark Gluon Plasma (QGP), at vanishing baryonic density (zero chemical potential), within three phenomenological models using interpolating and switching functions. Our study considers two systems, the first one describes the transition from a pion gas to a QGP composed of gluons, massless up and down quarks, and anti-quarks, and the second system describes the transition from a nuclear gas to a QGP which includes, in addition, massive strange quarks. In the context of this study, we examine the behavior of several thermodynamic quantities as a function of temperature, within the framework of the previously introduced models. We obtain many interesting results, and the main conclusion of our work is that, in a finite volume, the first-order phase transition assumed by the phase coexistence model is converted into a rounded transition, and the thermodynamic quantities vary smoothly on the whole range of temperature due to finite-volume effects. Furthermore, we demonstrate that both interpolating function and switching function constructed in the used models, allow for controlling the continuity of the phase transition, and hence its rounding, from a first-order transition to a smooth crossover. Finally, this phenomenological parametrization allows for the reproduction of the transition behavior predicted by lattice QCD calculations.

Keywords: Deconfining Phase Transition, Quark-Gluon Plasma, Thermodynamic quantities, Zero baryonic density, Crossover, Lattice QCD.

THEORETICAL INVESTIGATION OF THE STRUCTURAL AND MOLECULAR PROPERTIES OF BOSCALID FUNGICIDE USING HARTREE–FOCK AND DENSITY FUNCTIONAL THEORY

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ABSTRACT

Boscalid is a systemic fungicide belonging to the succinate dehydrogenase inhibitor (SDHI) class and is widely used for the control of fungal diseases in fruits, vegetables, and field crops. Due to its extensive agricultural application, its environmental persistence, residue formation, and potential effects on living organisms have become important research topics in recent years. Therefore, the theoretical investigation of the molecular structure of Boscalid is of considerable importance for a better understanding of its physicochemical properties. In this study, the structural and vibrational properties of the Boscalid molecule were investigated using Hartree–Fock (HF) and Density Functional Theory (DFT) methods. The molecular geometry was optimized at the HF/6-311++G(d,p) and B3LYP/6-311++G(d,p) levels of theory, and the bond lengths, bond angles, and other fundamental geometric parameters were comparatively evaluated. In addition, the vibrational frequencies of the molecule were calculated, and the theoretical vibrational frequencies were scaled using an appropriate scaling factor before being compared with the experimental FT-IR spectrum reported in the literature. The characteristic vibrational bands were assigned and discussed in detail. The structural and vibrational parameters obtained from the HF and DFT calculations were compared to evaluate the performance of both theoretical approaches in describing the molecular characteristics of Boscalid. The present study provides reliable theoretical data for the Boscalid molecule, contributing to the interpretation of its experimental FT-IR spectrum and serving as a valuable reference for future theoretical investigations of structurally related fungicides.

Keywords: Boscalid, Hartree–Fock, Density Functional Theory, B3LYP, Geometry Optimization, Vibrational Analysis, FT-IR Spectroscopy.

DOPING EFFECT ON PHOTOCATALYTIC ACTIVITY OF ZNO

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ABSTRACT

In recent years, semiconductor oxides have reached an important place in new technologies. Among these oxides, ZnO thin films are attractive materials since they present several remarkable properties, such as applications in semiconductor devices, laser-emitting devices, display technologies, and high effectiveness in degrading dyes and organic species. Using semiconductor oxides as photocatalysts is very effective for the degradation of organic pollutants and helps eliminate hazardous species in air and water without causing secondary pollution. Therefore, doping ZnO thin films has been widely investigated and is considered a promising alternative for enhancing their photocatalytic activity. This work consists of the fabrication and characterization of Co-doped ZnO (ZnO/Co) thin films. The samples were fabricated using the sol–gel method. The pure ZnO and ZnO/Co films were deposited on glass substrates using the dip-coating technique. XRD and Raman characterizations show that the ZnO thin films crystallize in the wurtzite structure. XRD also shows that the ZnO and ZnO/Co thin films present a preferential orientation along the (002) plane and that the crystallite sizes are in the nanometer range. The optical properties of the doped ZnO thin films reveal that doping changes the optical band gap of ZnO. Photocatalytic activity analysis shows a significant improvement as the Co doping concentration increases.

Keywords: ZnO, thin films, photcatalysis, doping, sol-gel, dip coating

INVESTIGATION OF STRUCTURAL AND MICROSTRUCTURAL PROPERTIES IMPACT ON FE-CO-AL MAGNETIC ONES

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ABSTRACT

The present study investigates the evolution of phase formation, structural, microstructural, and magnetic properties of Fe–Co–Al powder mixture subjected to high-energy mechanical milling for different milling durations. The Rietveld refinements of XRD patterns manifest the formation of a heterogeneous nanostructured solid solution Fe(Co,Al) with a body-centered cubic structure, accompanied by an allotropic phase transformation of Co from the face-centered cubic (FCC) to the hexagonal close-packed (HCP) phase. The severe plastic deformation induced by mechanical milling promotes microstructural refinement and the accumulation of crystalline defects. The increase in dislocation density and grain boundary fraction leads to crystal lattice distortion, resulting in an increase in the lattice parameter from 0.28663 ± 0.00001 nm to 0.28760 ± 0.00002 nm. Magnetic characterization, carried out by vibrating sample magnetometry , highlighted the strong correlation between milling-induced nanostructuring and the magnetic response. Magnetic measurements have revealed that the milled powders exhibit a soft ferromagnetic behaviour at room temperature, with novel magnetic properties that are sensitive to the size of crystallites (L), microstrain rates (1/2), and density of dislocations (ρ). The combination of high saturation magnetization (Ms) and low coercivity (Hc) makes the FeCoAl alloy a promising material for soft magnetic applications.

Keywords: Ball milling, XRD parameters, Rietveld, Magnetic Properties.

A THEORETICAL STUDY OF THIOPHENE ADSORPTION ON BIPHENYLENE NANOTUBES: DFT INVESTIGATION

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ABSTRACT

In this study, the adsorption behaviour of thiophene molecules on pristine and metal-doped biphenylene nanotubes (BP-NTs and metalBP-NTs) was investigated using density functional theory (DFT) calculations. The Al-, Si- and Zn-doped BP-NTs were considered. The structural, electronic, and energetic properties of the thiophene/BP-NT and thiophene/metal-doped BP-NT systems were investigated to evaluate how different dopant atoms influence the interaction between thiophene and the nanotube surface. Different configurations, corresponding adsorption energies, equilibrium geometries, charge transfer, and electronic structure were also studied. The results reveal that thiophene adsorption on pristine BP-NT is relatively weak, whereas substitutional doping with Al, Si and Zn significantly modifies the adsorption characteristics of the nanotube. In particular, the dopant atoms create active adsorption sites and enhance the interaction between the thiophene molecule and the Biphenylene nanotube (BPNT) surfaces, resulting in changes in adsorption energy and charge redistribution. Furthermore, electronic structure analysis shows that thiophene adsorption induces noticeable changes in the density of states (DOS) and the electronic properties of doped nanotubes. Among the investigated systems, Al-, Si-, and Zn-doped BPNTs exhibit different sensitivities to thiophene, indicating that the nature of the dopant plays a crucial role in controlling adsorption properties. These findings suggest that doped BPNTs have considerable potential as detecting and sensing materials for thiophene.

Keywords: Thiophene, Biphenylene nanotubes, Sensors, DFT

MULTISPECTRAL 3D PHENOTYPING FOR PLANT GROWTH DYNAMICS AND STRESS RESPONSES

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ABSTRACT

Sensor-based plant phenotyping enables non-destructive, objective, and repeatable evaluation of plant morphological and physiological traits under varying environmental and stress conditions. Compared with manual measurements, this approach reduces observer bias and allows dynamic monitoring of plant growth and responses over time. It also facilitates high-throughput data acquisition, improving the precision and consistency of plant trait analysis across experimental conditions. In our research, we employed the automated TraitFinder (Phenospex) platform equipped with PlantEye sensors. This system combines active laser scanning with multispectral sensing to generate three-dimensional plant models. The resulting 3D point clouds integrate spatial information with reflectance data in the red, green, blue (RGB), and near-infrared (NIR) spectral bands, enabling simultaneous assessment of plant architecture and physiological status. This integrated approach allows detailed characterization of both structural and functional plant traits. Based on spectral data, vegetation indices such as Normalized Difference Vegetation Index (NDVI) and Plant Senescence Reflectance Index (PSRI) are used to assess chlorophyll content, plant vitality, and senescence-related stress changes. By combining structural parameters with spectral indices and time-resolved measurements, this technology enables early detection of stress responses and subtle physiological disturbances before visible symptoms appear. The presentation will primarily focus on biostimulant seed priming effects in clover and alfalfa. This study evaluated growth dynamics and biomass accumulation in six legume genotypes. Results revealed clear species-specific responses, with alfalfa and crimson clover exhibiting faster growth, while zigzag clover demonstrated the strongest relative response to biostimulant treatment. Strong correlations between digital and conventional measurements confirmed the accuracy and reliability of 3D phenotyping. Overall, these results emphasize the importance of genotype-specific evaluation and demonstrate the value of multispectral 3D phenotyping as a robust tool for plant research and early stress detection.

Keywords: High-throughput phenotyping, 3D imaging, plant stress, growth dynamics

COMPARISON OF ANTIOXIDANT AND ANTI-INFLAMMATORY EFFECTS OF METHANOLIC EXTRACT OF PENNYROYAL: MENTHA PULEGIUM L. COLLECTED FROM TWO ALGERIAN LOCALITIES (SÉTIF AND SKIKDA)

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ABSTRACT

Background and Objective: Mentha pulegium L. (pennyroyal), a Lamiaceae species, is traditionally used for its medicinal properties. This study aimed to valorize its therapeutic potential by comparing the antioxidant and anti-inflammatory activities of methanolic extracts from two Algerian regions (Skikda and Setif) and relating these activities to their phenolic compositions. **Methodology**: Aerial parts from both regions were extracted with methanol, and the resulting extracts were analyzed by HPLC to identify major phenolic compounds, focusing on phenolic acids and flavonoids . Antioxidant activity was assessed using the DPPH free radical scavenging assay, while anti-inflammatory potential was evaluated in vitro through inhibition of bovine serum albumin (BSA) denaturation, a commonly used model of protein-denaturation–mediated inflammation. **Results**: HPLC profiling revealed two phenolic acids common to both extracts, caffeic acid and chlorogenic acid, along with region-dependent components such as rutin, quercetin, and cinnamic acid, in line with previous reports that Mentha pulegium L. is rich in diverse phenolics and flavonoids. The Skikda pennyroyal extract showed stronger antioxidant activity (DPPH IC50 = 68.47 μg/mL) than the Setif extract, consistent with the positive correlation between higher phenolic content and lower IC50 values reported for M. pulegium L.from other localities. Similarly, the Skikda extract exhibited better protection against BSA denaturation (IC50 = 243.94 μg/mL), suggesting greater anti-inflammatory efficacy. **Conclusion**: These findings support a close relationship between phenolic composition and both antioxidant and anti-inflammatory activities in Mentha pulegium L. The plant, particularly chemotypes richer in phenolic acids and flavonoids, may represent a readily accessible source of natural antioxidant and anti-inflammatory molecules, with potential applications in phytotherapy and functional formulations

Keywords: Mentha pulegium L., HPLC, Antioxidant activity, Anti-inflammatory activity

ANALYSIS OF SPECIES DIVERSITY AND DISTRIBUTION PATTERNS OF THE APIACEAE FAMILY IN THE NAKHCHIVAN AUTONOMOUS REPUBLIC

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ABSTRACT

The present study provides a comprehensive analysis of the species diversity, distribution patterns, ecological characteristics, and phytochemical potential of the Apiaceae family in the Nakhchivan Autonomous Republic. The family is represented by 57 genera and 107 species, making it one of the most species-rich plant groups within the regional flora and an important component of local biodiversity. Particular attention is given to rare and endangered taxa, especially Prangos acaulis (DC.) Bornm., which is included in the Red Book of Azerbaijan and plays a significant role in the conservation of regional plant diversity. The study integrates floristic, ecological, and recent pharmacological data to evaluate the biological and applied significance of this species. P. acaulis is characterized as a drought-tolerant xerophytic plant distributed mainly in mountainous and semi-arid environments, where it contributes to ecosystem stability, vegetation dynamics, and adaptation to arid climatic conditions. Phytochemical investigations reveal a diverse composition of bioactive compounds, including essential oils, flavonoids, coumarins, and terpenoids, with notable variation across different plant organs. These variations are closely related to environmental conditions and ecological factors. Recent studies (2023–2026) demonstrate that P. acaulis exhibits significant antibacterial, antifungal, antioxidant, anti-inflammatory, cytotoxic, and immunomodulatory activities, highlighting its potential for therapeutic applications.

Furthermore, the application of plant extracts in nanotechnology has shown enhanced bioactivity, improved bioavailability, and increased therapeutic efficiency, indicating promising prospects for pharmaceutical development and innovative drug design. Despite these advances, several research gaps remain, particularly regarding in vivo effects, toxicological evaluation, and dose–response relationships, which require further detailed investigation. Overall, the findings emphasize the ecological importance and pharmacological potential of P. acaulis, as well as the urgent need for its conservation, rational utilization, and sustainable management within the region.

Keywords: Apiaceae, Prangos acaulis, biodiversity, Nakhchivan Autonomous Republic, phytochemistry, pharmacological activity, essential oils, antioxidant activity, conservation, nanotechnology

EVALUATION OF SUDANESE AMARANTHUS FRACTIONS AS NATURAL HERBICIDES: GC-MS PROFILING AND LEMNA MINOR PHYTOTOXICITY ASSAY

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ABSTRACT

The current investigation has been designed with the objectives to identify the volatile chemical composition and the phytotoxic activity of three sudanese Amaranthus plants which include A. graecizans, A. spinosus, and A. viridis. The samples were collected from their natural growing regions and after taxonomic authentication; extracts were prepared by soaking the materials in an 80% solution of methanol. Further on, fractionation of the crude extracts was carried out using four organic solvents of increasing polarities, such as n-hexane, chloroform, ethyl acetate, and n-butanol. The volatile components were separated by vacuum liquid chromatography method. The chemical compositions of the volatile components were determined via GC-MS analysis. From the results, it can be noted that Phytol constituted the most abundant volatile metabolite detected in the samples of all three species analyzed with concentration values from 35.0% to 40.1%. Besides, other compounds like fatty acid esters and squalene were also detected with their varying concentrations based on species type and fraction type. The evaluation of the potential phytotoxic effect for all fractions was performed with a standard test using aquatic plants such as Lemna minor. For all fractions, different concentrations such as 10, 100, and 1000 µg/ml were used to determine the potential for phytotoxicity. Amongst all the analyzed samples, the most potent sample with high growth inhibition was the n-butanolic fraction of A. viridis where inhibition rate achieved up to 75% when exposed to the highest concentration (1000 µg/ml). On the other hand, the hexane fraction of A. graecizans showed excellent activity where 65% of the inhibition rate was attained for the highest concentration (1000 µg/ml). These findings provide the first comparative phytochemical and bioactivity data for these specific Sudanese taxa, highlighting the potential of Amaranthus volatile oils and polar fractions as sources of natural herbicidal compounds or growth regulators.

Keywords: Amaranthus, Phytol, Lemna minor bioassay, Natural herbicides

CONTROL OF POSTHARVEST BLACK SPOT AND LEAF SPOT DISEASES OF TOMATOES BY COMPOUND MICROBIAL FLORA F5

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ABSTRACT

The concept of biological control in postharvest disease management has been studied for the past four decades. Even if there are promising results at the lab level, commercial and practical application is still limited. One of the major drawbacks is the low biocontrol efficacy of single antagonistic microbes used in postharvest disease management setups. Therefore, the concept of applying compound microbial flora that have synergistic behavior can increase their efficiency and survival. Based on this concept, we developed a compound microflora named F5 from antagonistic microbes Pantoea agglomerans B10 and Meyerozyma caribbica Y9 isolated from healthy tomatoes at a ratio of 2:1 to control Alternaria tenuissima and Cladosporium cladosporioides pathogens. In vitro and in vivo experiments were carried out to study the physiological control mechanism of the complex flora F5. The results showed that the volatile organic compounds (VOCs) produced by F5 could better inhibit the growth of A. tenuissima and C. cladosporioides . GC-MS was used to analyze the composition of VOCs produced and found that the proportion of alcohols was highest in the compound microflora F5. In addition, treatment with F5 increased the activity of resistance enzymes, and the content of disease resistance substances in tomato fruits. . It also enhanced the activity of tomato reactive oxygen species (ROS) scavenging system and reduced ROS accumulation. Compared with the control and individual strains, F5 microflora could significantly reduce the decay and quality deterioration of tomatoes during storage. It can also increase the abundance of antagonistic microbes and beneficial bacteria such as Pseudomonas and Acinetobacter and reduce the proportion of pathogenic genera such as Acremonium and Verticillium. Therefore, it can be concluded that F5 microflora can better control black spot and leaf spot diseases of tomato by inducing fruit resistance, direct inhibition through production of antifungal VOCs, and modulating the fruit surface microbiome than single application. This study provides a new biological control strategy and technical support for postharvest biological control of tomatoes and other perishable produces.

Keywords: Compound microflora F5, Pantoea agglomerans, Meyerozyma caribbica, tomato, black spot, leaf spot

METHIONINE PROTECTS PLANTS AGAINST ACIDITY VIA GROWTH MAINTENANCE WHILE INCREASING CHROMOSOMAL ABNORMALITIES

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ABSTRACT

Exogenous supply of or increasing endogenous L-Methionine (MET) content promotes plant growth and confers stress tolerance in plants. However, its effects on cell cycle and cell division in plants remain largely unexplored. In this study, the short term effects of MET were investigated in barley (Hordeum vulgare L. cv. Tarm-92). Two-day-old barley seedlings were treated with various concentrations of MET (5, 10, 15, 20 and 25 mM) for 24 hours, followed by a 24 hour-recovery period under MET-free conditions. Because the MET stock solution was prepared in hydrochloric acid (HCL), a HCL-control, of which HCL concentration is same of the highest MET solution, alongside a water-control, was included in the treatment regime. Low concentrations (5 and 10 mM) promoted growth compared to the HCl control, whereas 25 mM dramatically reduced fresh and dry weights (DW) and root and shoot lengths. Moderate concentrations (15, 20 and notably 10 mM), increased chlorophyll b, pheophytin b and carotenoid contents compared to both control groups, particularly HCL-control. Intriguingly, 10 mM MET treatment increased both mitotic index (MI) and the chromosomal abnormality index (AI). MET-treated plants were able to recover from the treatment except for DW, MI and AI. Principal component analysis segregated the water-control, HCL-control and MET groups both before or after recovery, identifying AI as the primary trait associated with MET treatment. Together, these findings demonstrate that while MET ameliorates acidity stress through maintenance of growth and pigment contents, it induces chromosome abnormalities. We suggest that MET exerts its effects mainly on chromosome structure.

Keywords: Barley, Methionine, Chromosome abnormalities, Photosynthetic pigments, Acidity stress, Principal component analysis

ACETIC ACID INHIBITS PLANT GROWTH VIA OXIDATIVE STRESS AND CELL DEATH BUT CAUSES ACCUMULATION OF UV-ABSORBING PIGMENTS

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ABSTRACT

Acetic acid (AA) is an organic acid utilized as both a food ingredient and an industrial chemical. AA, as a phytotoxin originating from decomposition of organic matter, is known for its inhibitory effects on plant growth. However, newer papers have conversely reported its stress-mitigating effects in plants. Due to climate change, plants are increasingly exposed to adverse conditions and, therefore, maintenance of plant growth and yield is becoming challenging. In this context, the application of biostimulants and priming agents, such as AA, represents a promising strategy to enhance stress tolerance. In this study, 0, 2.5 and 5 mM concentrations of AA were applied to 2-day-old barley (Hordeum vulgare L. cv. Bornova-92) seedlings for 2 days, followed by a 2-day recovery period under AA-free conditions. AA inhibited root and shoot growth; decreased water content, fresh weight, chlorophyll, pheophytin, and carotenoid contents without affecting dry weight. However, anthocyanin and flavonoid contents, as well as the levels of UV-absorbing compounds and a UV-B marker increased in the leaves of AA-treated plants. Furthermore, AA elevated hydrogen peroxide (H2O2) content in shoots and induced cell death in roots. While soluble carbohydrate content decreased, insoluble carbohydrate content increased in the roots of AA-treated plants. Our results demonstrate that even moderate concentrations of AA impair plant growth within 2 days under stress-free conditions. Cell death induced by oxidative stress might explain growth inhibition. Reduction in soluble carbohydrates, some of which act as osmolytes, coupled with the of insoluble carbohydrate synthesis, which consume NADPH and compromise antioxidant defenses, might have resulted in oxidative stress as seen by the increase in H2O2 content. The harmful effects of AA might prolong after the removal of AA.

Keywords: Acetic acid, Cell death, Hydrogen peroxide, UV-absorbing compounds

ENHANCING BIOLOGICAL CONTROL IN TOMATO CROPPING SYSTEMS THROUGH COMPANION PLANT SELECTION: BEHAVIORAL AND REPRODUCTIVE RESPONSES OF NESIDIOCORIS TENUIS REUTER (HETEROPTERA: MIRIDAE)

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ABSTRACT

Tomato (Solanum lycopersicum) is one of the most important horticultural crops worldwide, but its production is severely threatened by insect pests, particularly the South American tomato pinworm Tuta absoluta. Increasing concerns over pesticide resistance and environmental impacts have intensified the search for sustainable pest management strategies. The zoophytophagous mirid predator Nesidiocoris tenuis is an effective natural enemy of tomato pests; however, its establishment in cropping systems is often limited when prey availability is low. This study evaluated the potential of native Mediterranean companion plants to improve the recruitment and performance of N. tenuis. Five flowering species were assessed under laboratory conditions : Anethum graveolens, Diplotaxis harra, Erucaria pinnata, Glebionis segetum, and Pseuderucaria clavata. Female behavioral responses were examined using dual-choice Y-tube olfactometer bioassays comparing tomato-companion plant odor blends with tomato alone. Volatile organic compound (VOCs) were characterized by HS-SPME–GC-MS analysis. In addition, no-choice oviposition assays were conducted to evaluate host plant suitability through nymphal emergence. Only the tomato–G. segetum combination significantly attracted N. tenuis females, whereas the tomato–A. graveolens blend induced significant avoidance. The Brassicaceae species elicited neutral responses. VOC analysis identified 102 compounds, with G. segetum displaying the richest volatile profile, dominated by monoterpenes and sesquiterpenes, while A. graveolens was characterized by high levels of α-phellandrene and D-limonene. Brassicaceae species were distinguished by glucosinolate-derived isothiocyanates. Reproductive assays revealed the highest nymphal emergence on tomato and G. segetum, whereas A. graveolens did not support offspring development. These findings identify G. segetum as a promising companion plant capable of enhancing N. tenuis establishment through both attraction and reproductive support. Its integration into tomato agroecosystems could strengthen conservation biological control and contribute to biodiversity-based, environmentally sustainable management of T. absoluta and other tomato pests.

Keywords: tomato agroecosystems, Nesidiocoris tenuis, companion plants, sustainable pest management

CHANGES IN ASCORBATE CONTENT IN YELLOW LUPINE INFECTED WITH THE PATHOGENIC FUNGUS COLLETOTRICHUM GLOEOSPORIOIDES

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ABSTRACT

The aim of the study was to determine the effect of *Colletotrichum gloeosporioides* infection on ascorbate levels in the leaves and roots of yellow lupine (*Lupinus luteus* L.) seedlings of the Bursztyn cultivar. Biochemical analyses were performed on 10-day-old lupine seedlings grown *in vitro* on Murashige and Skoog medium. The contents of ascorbic acid (As), dehydroascorbic acid (DAs), and total ascorbate (Total As) were determined at 24, 48, 96, and 120 hours after inoculation with the pathogen *C. gloeosporioides*. Infection with the pathogenic fungus induced distinct metabolic responses in the examined organs, namely leaves and roots. In leaves, the contents of As and Total As were lower than in the control from 24 to 96 hours of culture, whereas an increase in As was observed only after 120 hours. The early decrease in As content, accompanied by an increase in DAs, may indicate intensive consumption of the reduced form of ascorbate in the direct neutralization of reactive oxygen species (ROS). The DAs level in leaves increased transiently after 48 hours and then decreased sharply after 120 hours. In roots, significant disturbances were observed 48 hours after inoculation. At this time point, there was a drastic decrease in As, DAs, and Total As contents compared with the control, in which these values reached their maximum. Such a pronounced collapse of the antioxidant pool in roots after 48 hours may indicate a rapid, localized defense response, known as an oxidative burst. At 96 hours, a compensatory increase in DAs was observed in infected roots, while at 120 hours, a slight accumulation of all analyzed fractions was observed compared with the control. Based on the obtained results, it can be concluded that infection with *C. gloeosporioides* strongly disrupts the antioxidant system of yellow lupine. The sharp decrease in the ascorbate pool in roots after 48 hours indicates that this organ is the site of an early and intensive response to stress induced by *C. gloeosporioides* infection. In contrast, the changes observed in leaves were more gradual over time. The results confirm that the antioxidant response of yellow lupine to *C. gloeosporioides* infection shows clear tissue- and time-specific patterns.

Keywords: ascorbic acid, yellow lupine, Colletotrichum gloeosporioides,

PHYSIOLOGICAL RESPONSES OF GRASS TO POST-MINING WASTE-BASED GROWING MEDIA

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ABSTRACT

The study aimed to evaluate the physiological responses of grasses grown on growing media prepared from post-mining waste, Piast and Rydułtowy. Plant material was collected at two time points, enabling comparison of metabolic changes at different growth stages. The analyses included superoxide anion, anthocyanins, flavonols, phenolic compounds, carotenoids, total chlorophyll a+b, sugars, and nitrates. The results showed that grass responses depended on both substrate type and sampling date. At the first sampling date, plants showed higher chlorophyll and sugar contents, suggesting more intensive photosynthetic activity and more favorable assimilate allocation. At the second sampling date, changes in reactive oxygen species and secondary metabolites indicated the activation of adaptive mechanisms. In the Piast substrate, grasses accumulated more anthocyanins and phenolic compounds, suggesting activation of non-enzymatic antioxidant protection. In contrast, the Rydułtowy substrate promoted higher carotenoid content, indicating stronger involvement of photoprotective mechanisms. Flavonol levels remained relatively stable, confirming their role as a basic component of cellular protection. Changes in nitrate content reflected modifications in nitrogen metabolism and nutrient availability. The results indicate that grasses effectively adjust their metabolism to substrate properties, and their response involves coordinated photosynthetic, antioxidant, photoprotective, and nutritional processes. The data also suggest that neither substrate caused a clearly toxic effect, but rather differentiated the intensity of physiological processes. Therefore, grasses may serve as a useful model for assessing the suitability of post-mining substrates in studies on the sustainable use of post-industrial materials. The comparison of two sampling dates was particularly important, as it revealed the dynamics of plant responses, from initially dominant photosynthetic processes to stronger oxidative-stress protection and secondary-metabolism regulation. These relationships confirm the high physiological plasticity of grasses under variable growth conditions and mineral substrates.

Keywords: post-mining waste, grass, oxidative stress, secondary metabolism

EFFECT OF THE ABIOTIC ELICITOR SALICYLIC ACID ON THE ANTIOXIDANT METABOLITES IN ARNICA MONTANA IN VITRO PROPAGATED IN A RITA BIOREACTOR

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ABSTRACT

This study was conducted to answer the question: “Is salicylic acid an effective elicitor of Arnica montana plantlets' antioxidant metabolites?” Arnica montana L. (Asteraceae) is a medicinal plant widely valued for its anti-inflammatory, antimicrobial, and antioxidant properties, which are attributed to its rich content of bioactive secondary metabolites. Due to increasing demand and the species' limited natural populations, in vitro culture techniques are increasingly employed to enhance biomass production and stimulate the accumulation of valuable phytochemicals. A. montana L. is known for producing a wide range of biologically active compounds, including phenolic acids and flavonoids with strong antioxidant activity. The application of elicitors such as salicylic acid in in vitro cultures has emerged as a promising strategy to enhance the biosynthesis and accumulation of these valuable antioxidant metabolites. The present study investigated the effects of varying concentrations of salicylic acid (SA), a key abiotic elicitor, on the growth dynamics and non-enzymatic antioxidant activity of in vitro-propagated Arnica montana L. plantlets. Explants (nodal segments 1.0 cm long) were cultured in a sterilised temporary immersion reactor for plant tissue culture (RITA). The stock solution of SA was filter-sterilised through a 0.22 µm syringe Millipore filter and then added aseptically to the autoclaved MS medium at concentrations of 50, 100, or 200 µM. Control shoots were grown on an MS nutrient medium without elicitor supplementation. After 5 weeks, the best treatment was selected based on the mean number of shoots per explant, mean height, and mean fresh weight. Analysis of the total phenolic content (TPC) in Arnica montana plantlet methanol/water extracts revealed a decrease following salicylic acid (SA) treatment at all tested concentrations. The lowest TPC was recorded in plantlets treated with 100 mg L^{-1} SA. A similar pattern was observed for the total flavonoid content (TFC), which was reduced in all SA-treated samples compared with the untreated control. Furthermore, the levels of water-soluble antioxidant metabolites (WS-AOM) and lipid-soluble antioxidant metabolites (LS-AOM) also declined after SA application, indicating a negative effect of the elicitor on the accumulation of antioxidant metabolites under the experimental conditions. Consistent with these findings, antioxidant activity, as assessed by the ferric reducing antioxidant power (FRAP) assay, was significantly reduced in SA-treated plantlets. In contrast, no significant differences were observed in DPPH radical scavenging activity between treated and control plants. The results demonstrated that salicylic acid treatment at concentrations of 50, 100, and 200 mg L^{-1} led to a reduction in the levels of total phenolic compounds, flavonoids, and both water- and lipid-

soluble antioxidant metabolites in Arnica montana plantlets compared with untreated controls. Among the tested treatments, 100 mg L^{-1} SA exerted the strongest inhibitory effect, resulting in the lowest accumulation of antioxidant metabolites.

Acknowledgment: This research was funded by National Science Fund—Bulgaria, grant number КП-06-Н76/5 (05.12.2023)

Keywords: Arnica montana, in vitro propagation, Rita bioreactor, Salicylic acid

EFFECT OF SILICON DIOXIDE NANOPARTICLES ON ANTIOXIDANT ENZYME ACTIVITY DURING MICROPROPAGATION OF ARNICA MONTANA L.

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ABSTRACT

Arnica montana L. (Asteraceae) is a well-known medicinal species with a long history of use in European traditional medicine. Different parts of A. montana contain various bioactive compounds, including sesquiterpene lactones, thymol derivatives, phenolic acids, and flavonoids, which are associated with numerous biological effects, including anti-inflammatory, cytoprotective, antioxidant, and anti-tumour activities. The use of in vitro propagation techniques for A. montana is a crucial strategy for the large-scale production of this valuable medicinal plant. This approach not only ensures genetic uniformity but also helps conserve wild germplasm that is at risk from unsustainable harvesting practices. Nanoparticles are increasingly used in plant biotechnology as elicitors of abiotic stress, improving micropropagation and promoting the accumulation of biologically active metabolites. Silicon dioxide (SiO_2) nanoparticles are used in in vitro cultures due to their unique physicochemical properties and excellent biocompatibility. They can stimulate growth and improve plant cells and tissues, allowing nutrient uptake and increasing resistance to abiotic stress. In in vitro plant systems, silicon dioxide nanoparticles are used to increase the frequency of regeneration, stimulate root formation, and increase biomass. This study aimed to assess the antioxidant enzyme activity of A. montana micropropagated plants after SiO_2NP treatment. Nodal segments 0.5-1 cm in length, which were obtained from 3-month-old in vitro plantlets, were cultured on Murashige and Skoog nutrient medium, containing 0.5 mg/L benzylaminopurine and various concentrations of SiO_2NPs (50, 100 and 200 mg/L). The results showed the beneficial effect of SiO_2NPs on the multiplication rate and growth of shoots, which corresponded to a higher biomass yield compared to the control. The activities of superoxide dismutase, catalase, ascorbate peroxidase, and guaiacol peroxidase were measured using spectrophotometric methods. The findings indicated that silicon dioxide nanoparticles modulated the activity of studied antioxidant enzymes, thereby contributing to the regulation of plant responses to oxidative stress.

Acknowledgment: This research was funded by National Science Fund—Bulgaria, grant number КП-06-Н76/5 (05.12.2023)

Keywords: in vitro shoots, elicitation, nanoparticles, SOD, CAT, APX, GPX

ENHANCEMENT OF PHENOLIC COMPOUNDS INDUCED BY YEAST EXTRACT ELICITATION DURING MICROPROPAGATION OF ARNICA MONTANA L. IN TEMPORARY IMMERSION SYSTEM RITA®

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ABSTRACT

Arnica montana L. (Asteraceae) is an herbaceous perennial plant found in mountainous regions of Europe, including alpine meadows, pastures, and light forests reaching the alpine level. The plant contains various pharmacologically active compounds - sesquiterpene lactones, essential oils, phenolic acids, flavonoids, etc. These compounds exhibit strong biological activities, such as anti-inflammatory, cytoprotective, antioxidant, tissue regenerative, immunomodulatory, and antitumor effects. A. montana natural populations are threatened by habitat disturbance and insufficient control. Plant tissue cultures can be an alternative tool for rapid propagation and sustainable synthesis of important secondary metabolites under precisely controlled conditions. A Temporary Immersion System bioreactor RITA [X] for plant propagation is an automated in vitro cultivation system that periodically immerses plant tissues in a liquid nutrient medium to enhance growth and multiplication under sterile, controlled conditions. Yeast extract is a complex organic supplement added to culture media to stimulate cell growth and trigger the production of desired secondary metabolites. This study aimed to assess the effect of yeast extract added at concentrations of 50, 100, and 200 mg/L to Murashige and Skoog liquid nutrient medium containing 0.5 mg/L Benzylaminopurine in a temporary immersion system (TIS) bioreactor on shoot multiplication and the synthesis of phenolic compounds. Ten shoots (approximately 1 cm in length) were placed in each vessel containing 200 mL of liquid culture medium. An air supply of 0.25 vvm was maintained, and the shoots were immersed in the medium for 6 minutes four times per day. The results showed that yeast extract elicitation improved the multiplication and growth of A. montana shoot cultures. The application of yeast extract at 200 mg/L enhanced the total phenolic and flavonoid content, as well as the production of water- and lipid-soluble metabolites with antioxidant potential. Total antioxidant capacities assessed by ferric-reducing antioxidant power (FRAP method) showed an increment level in shoots treated with the highest concentration of yeast extract. The established technique for mass propagation of A. montana is used to produce planting material that possesses antioxidant properties, thus contributing to the conservation of the species.

Acknowledgment: This research was funded by National Science Fund—Bulgaria, grant number КП-06-Н76/5 (05.12.2023)

Keywords: in vitro shoots, liquid medium, yeast extract, total phenolic content, total flavonoid content, FRAP

PHYTOCHEMICAL PROFILE AND IN VITRO ANTIOXIDANT ACTIVITY OF VIOLA ODORATA EXTRACTS

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ABSTRACT

Oxidative stress is implicated in the pathophysiology of many diseases, thus increasing interest in naturally occurring antioxidants. This study aims to evaluate the antioxidant activity of Viola odorata extracts to explore their potential as a source of bioactive compounds. Phytochemical screening of phenolic compounds in the prepared extracts revealed the presence of flavonoids, tannins, quinones, and coumarin. Anthraquinones and alkaloids were not detected. The levels of polyphenols, total flavonoids, and tannins determined in the extracts were 61.83 and 69.35 µg GAE/mg E; 14.10 and 16.34 µg EC/mg E; and 17.19 and 16.46 µg EC/mg E. The results obtained regarding antioxidant activity revealed a promising effect of this extract. Incubation of the prepared extracts (0.5 mg/ml) with DPPH showed a reducing power of 84.54% and 89.11%. Ascorbic acid, used as a positive control, reduced DPPH (0.005 mg/ml) by 92.08%. The antiradical activity against the ABTS radical showed an inhibition of 55.85% and 93.55% at concentrations of 0.04 and 0.06 mg/ml of extract. The extracts also demonstrated iron reducing power at EC50 values of 0.188 mg/ml and 0.217 mg/ml. The total antioxidant capacity showed values of 39.27 and 42.51 µg eq GA/mg of extract. The data obtained suggest that Viola odorata represents a promising natural source of antioxidant substances.

Keywords: Viola odorata, phenolic compounds, antioxidant potential

INTERACTIVE EFFECTS OF PHOTOPERIOD AND SALINITY ON GROWTH AND METABOLOME SHIFTS IN ROOT AND SHOOT OF SPINACH (SPINACIA OLERACEA L.)

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ABSTRACT

This study investigated the interactive effects of photoperiod and salinity on growth and physiological traits in spinach (Spinacia oleracea L.). Plants were exposed to either a long photoperiod (22 hours light:2 hours dark) or a normal photoperiod (12 hours light:12 hours dark) and subjected to four salinity levels (0, 100, 200, and 300 mM NaCl). This study demonstrates that increasing salinity reduces spinach growth and biomass, but plants exposed to a long photoperiod (22L:2D) consistently outperform those under a normal photoperiod (12L:12D), even at high salinity levels. The greatest declines occur at 300 mM NaCl, especially with normal photoperiod, while long photoperiod substantially mitigates these negative effects—yielding more than double the biomass and physiological indices. LC-MS metabolite profiling reveals that photoperiod and salinity induce distinct metabolic shifts in both roots and shoots. Salt stress enhances lysine and glutamine in roots, whereas long daylight elevates allantoin and serine; metabolites group by association with either growth or stress response. In shoots, betaine, lysine, and glutamine most strongly differentiate treatments, with citric acid and allantoin also contributing. Most shoot metabolites correlate positively with biomass, while proline and alanine indicate stress or reduced growth. Overall, optimizing light duration emerges as a practical strategy to promote growth and shift metabolism toward resilience in saline environments.

Keywords: Salinity, Photoperiod, Metabolome Shifts, Root and Shoot, Spinach

ANTIMICROBIAL AND ANTIPROLIFERATIVE POTENTIAL OF EXTRACTS OBTAINED FROM DIFFERENT BY-PRODUCTS OF BLUE POPPY (PAPAVER SOMNIFERUM)

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ABSTRACT

Plant-derived by-products represent a valuable source of bioactive compounds with potential applications in the development of novel functional ingredients and natural agents with biological activities. Blue poppy (Papaver somniferum) is a plant species rich in diverse secondary metabolites, while its processing residues (roots, leaves, stems, capsules, and seed cake) remaining after oil extraction, represent underutilized sources of potentially valuable phytochemicals. The aim of this study was to evaluate the antimicrobial and antiproliferative potential of extracts obtained from different blue poppy by-products, including roots, leaves, stems, capsules, pressed-cake obtained after cold pressing and defatted pressed-cake obtained by Soxhlet extraction. Antimicrobial activity was assessed by determining the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) against six bacterial strains (three gram-positive and three gram-negative bacteria) and one Candida species. The antiproliferative activity was evaluated using two human cancer cell lines: HeLa (cervical adenocarcinoma) and MCF-7 (breast adenocarcinoma). The obtained results demonstrated that root, stem, and capsule extracts exhibited antimicrobial activity against all tested microorganisms, and the root extract showed the strongest antimicrobial effect. All investigated extracts displayed antiproliferative activity against both tested cell lines; however, the stem extract showed the highest activity, with IC_{50} values of 163.14 ± 12.46 µg/mL for HeLa cells and 193.65 ± 12.55 µg/mL for MCF-7 cells. In contrast, the pressed-cake extract exhibited the weakest antiproliferative potential. Overall, these findings indicate that blue poppy by-products represent promising sources of bioactive compounds with antimicrobial and antiproliferative properties, highlighting particularly root and stem extracts as valuable candidates for further investigation and potential valorization within biotechnological and pharmaceutical applications.

Keywords: Poppy by-products, antimicrobial activity, antiproliferative activity.

ANTIMICROBIAL AND CYTOTOXIC ACTIVITY OF UNDER-EXPLORED PLANTS FROM ASTERACEAE FAMILY

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ABSTRACT

Asteraceae family is a widespread family in Balkan peninsula with long lasting application in diet and traditional medicine. The aim of this study was to investigate the antimicrobial and cytotoxic activity of hydrophilic extracts of ten under-explored Asteraceae plants. Ethanolic extracts (60%) from ten different plants (Cichorium endivia, Cichorium intybus, Cota tinctoria, Eupatorium cannabinum, Inula ensifolia, Solidago virgaurea, Tanacetum parthenium, Tanacetum vulgare, Tragopogon pratensis and Tussilago farfara) were obtained using conventional solid/liquid extraction for 24 h, 1:20 m/v solid/liquid ratio, at room temperature with constant shaking (180 rpm). Antimicrobial activity was expressed as a zone of inhibition and as minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). Six different bacterial strains were used, including one clinical strain (Staphylococcus aureus, Enterococcus faecalis, Listeria monocytogenes, Escherichia coli, Pseudomonas aeruginosa, and Salmonela enterica subsp. enteritidis) and one fungi Candida albicans. The highest zone of inhibition expressed extracts from S. virgaurea, E. cannabinum, and T.farfara against Gram-positive bacteria, while against Gram-negative bacteria widest zone of inhibition was observed for P. aeruginosa and S.enteritidis in extracts E. cannabinum, T. pratensis, T. vulgare, T.farfara, C. endivia, and I. ensifolia. Ethanolic extracts of E. cannabinum and T. pratensis had the highest antimicrobial activity against L. monocytogenes (MIC and MBS 6.3%), and against S.enteritidis extracts of C. intybus, T. pratensis, C.tinctoria, and I. ensifolia (MIC and MBC 6.3%). Cytotoxic activity of ten tested extracts was evaluated against the spontaneously immortalized human keratinocyte cell line (HaCaT) and the human cancer cell lines HeLa (cervical adenocarcinoma), MCF-7 (breast adenocarcinoma), and CaCo-2 (colorectal adenocarcinoma). The moderately cytotoxic activity was obtained against HeLa and MCF-7 in E. cannabinum extract with IC50-110.75±7.55 µg/mL and IC50-135.86±9.98 µg/mL, respectively. Ethanolic extracts of under-explored plants from Asteraceae family represent a promising natural source with pharmaceutical properties that could be utilized for various medicinal products.

Keywords: Asteraceae family, hydrophilic extracts, antimicrobial activity, cytotoxic activity

BIOACTIVE METABOLITES FROM TWO SPECIES ALTERNARIA PHOENICIS AND ALTERNARIA OUEDRIGHENSIS ASSOCIATED WITH LEAF SPOT AND BLIGHT DISEASES OF DATE PALM

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ABSTRACT

Date palm (*Phoenix dactylifera* L.) is a key crop in arid regions; however, outbreaks of leaf spot and blight diseases are causing severe yield and quality losses. Two recently described fungal pathogens, *Alternaria phoenicis* and *A. ouedrighensis*, were identified as the causal agents of these diseases in Algeria (Djellid et al., 2025). Symptoms caused by these emerging pathogens suggest the potential involvement of phytotoxic metabolites in the host–pathogen interaction. *Alternaria* is well-known for its ability to produce a wide range of specialized metabolites. These compounds often exhibit excellent bioactivities, such as anticancer, antibacterial, antioxidant, and enzyme inhibitory effects; some of them are also classified as mycotoxins. Given remarkable capacity of *Alternaria* spp. to produce bioactive secondary metabolites, including phytotoxins (Chen et al., 2021), this study focused on the isolation and chemical characterization of these compounds. Accordingly, the phytotoxic activity of the crude extracts obtained from the culture filtrates of two isolates of these *Alternaria* spp. was evaluated using seeds of the model plant (*Portulaca oleracea*), and the main metabolites were purified from the same crude extracts using chromatographic techniques. Chemical structures were elucidated by NMR spectroscopy, mass spectrometry and optical methods. Interestingly, *A. phoenicis* essentially produced altenusin and tenuazonic acid, two bioactive metabolites commonly associated with *Alternaria* species. In addition, *A. ouedrighensis* produced curvulalic acid, which is reported here for the first time from an *Alternaria* species.

Keywords: Phytopathogenic fungi, Specialized metabolites, Structure elucidation, Phytotoxicity, Seed germination

EXTRACTION, ISOLATION, AND CHARACTERIZATION OF WOUND HEALING–RELATED PHYTOCHEMICALS FROM ALOE VERA LEAF GEL (ALOE BARBADENSIS MILLER)

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ABSTRACT

This study provides a comprehensive chemical characterization of bioactive phytochemicals in fresh Aloe vera leaf gel, with recognized wound-healing potential. The optimized Aloe vera gel preparation, using the hand-filleted extraction method, preserved the gel's bioactive compounds, achieved a 50.61% extraction yield, ensured microbiological safety, and exhibited an antioxidant capacity of 62.78% DPPH inhibition. The chemical profile revealed that the fresh gel contained 99.36% water and exhibited an acidic pH (4.16), with titratable acidity of 0.10%, vitamin C content of 11.6 mg/100 g, phytosterols at 8.7 µg/100 g, proteins at 0.014%), and polysaccharides at 0.21%. The minerals composition of the ash (0.178%) indicated that calcium was the predominant mineral (1.797 mg/L in the fresh gel), followed by sodium (0.989 mg/L). Other minerals including magnesium, copper, manganese, and zinc were detected at lower concentrations (0.143, 0.115, 0.044, and 0.020 mg/L in the fresh gel, respectively). Proteins were extracted from Aloe vera gel by ammonium sulfate precipitation (30–70%), followed by purification and characterization using polyacrylamide gel (12.5%) electrophoresis, revealing a mixture of proteins with molecular weights ranging from 7.6 to 115.3 kDa. Two intense low-molecular-weight bands at 7.6 and 8.2 kDa were observed, along with minor bands at 18.1, 38.7, and 115.3 kDa. The polysaccharide fraction, obtained by ethanol precipitation, was purified and characterized by FTIR spectroscopy. The spectrum exhibited two characteristic absorption bands of acetyl groups at 1737.96 cm^{-1} and 1245.13 cm^{-1}, confirming the presence of acetylated glucomannan (acemannan) as a key bioactive compound and quality marker of A.vera gel, while acetylation plays a crucial role in its therapeutic and biological properties. Our study demonstrates that Aloe vera gel represents a promising source of bioactive compounds, with significant potential for incorporation into pharmaceutical formulation to enhance wound healing process.

Keywords: Hand-filleted extraction of Aloe vera leaf gel, SDS-Page, FTIR spectroscopy Bioactive phytochemicals for Wound Healing, acemannan, glycoproteins, phytosterols, vitamins, minerals

AQUEOUS EXTRACT OF ALPINIA OFFICINARUM MAY MODULATE THE LIVER TOXICITY INDUCED BY SPIROTETRAMAT IN DOMESTIC PIGEON

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ABSTRACT

The objective of this study is to evaluate the effect of spirotetramat, an insecticide, applied at a rate of 10 g/kg/day, and the protective effect of the aqueous extract of Alpinia officinarum applied at 0.05 g/l, prepared by infusion, on the metabolic activity of the domestic pigeons (Columba livia domestica). Spirotetramat and the aqueous extract are administered orally for 6 weeks. For this purpose, a group of 20 individuals was subdivided into four groups of five pigeons each. A negative control group received 1 ml of distilled water, a second group received spirotetramat, a third group was fed the plant, and the last group received a mixture of spirotetramat and the aqueous extract of the plant. Estimates of liver enzyme activity, body weight, and liver weight were used as biomarkers of metabolic activity. The obtained results showed a decrease in body weight in all groups. A decrease in liver enzymes (TGO and TGP) was observed in the treated groups except for the group receiving Alpinia officinarum, in which an increase in TGO activity was observed. Liver weight of pigeons demonstrate that spirotetramat increases the liver weights, but the use of aqueous extract modulates this effect. To conclude, Alpinia officinarum, extract may etunnuate the toxic effect of spirotetramat in domestic pigeons.

Keywords: pigeon, spirotetramat, Alpinia officinarum, liver, toxicity

ANTIOXIDANT, ANTIFUNGAL, AND A-AMYLASE INHIBITORY ACTIVITIES OF HYDROETHANOLIC GRAPE SEED EXTRACT

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ABSTRACT

Grape seeds, an abundant agro-industrial by-product, are a rich source of phenolic compounds with diverse biological activities and considerable potential for food and pharmaceutical applications. In the present study, grape seed extract was analyzed for its total phenolic content and evaluated for its antioxidant, antifungal and α-amylase inhibitory activities. The extract exhibited a high total phenolic content of 135.86 mg GAE/g of extract. The antioxidant capacity was assessed using the DPPH radical scavenging assay. An IC_{50} value of 1.04 mg/mL was obtained, indicating a moderate antioxidant activity. The antifungal activity was tested using the microdilution method against five phytopathogenic fungi: Aspergillus carbonarius, Aspergillus flavus, Aspergillus terreus, Penicillium sp., and Alternaria sp.. The extract demonstrated a notable antifungal potential, particularly against Penicillium sp. and Alternaria sp., with a minimum inhibitory concentration value (MIC) of 0.15 mg/mL. In contrast, A. flavus was the most resistant strain, with an MIC of 0.62 mg/mL. The extract also exhibited fungicidal effects, with minimum fungicidal concentrations ranging from 0.15 to 5 mg/mL. The in vitro antihyperglycemic activity of the extract was assessed via α-amylase inhibition. A moderate α-amylase inhibitory activity was observed with an IC50 value of 1.48 mg/mL. These findings demonstrate that grape seed extract possesses promising antioxidant and antifungal properties, highlighting its potential applications as a natural preservative in food products.

Keywords: Phenolic compounds, grape seeds, antifungal, antioxidant, α-amylase Inhibition.

EUPHORBIA FALCATA ETHANOLIC EXTRACT COULD MODULATE THE HEPATOTOXICITY INDUCED BY ABAMECTIN IN RATS

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ABSTRACT

The objective of this work is to evaluate the effect of the ethanolic extract of Euphorbia falcata following a hepatotoxicity induced by abamectin on several aspects: biochemical and histological, in Wistar rat. The study was conducted on 30 rats divided into six groups: Group 1 served as control, ABM group treated with 1mg/kg/day of abamectin, The third (EF1) and fourth (EF2) were treated with 5mg/kg/day and 100mg/kg/day of E. falcat ethanolic extract, respectively. Group 5 (ABM+ EF1) and group 6 (ABM+EF2) were treated with the combination abamectin and the plant extract. The treatment was performed orally during the 28 days of experimentation. The biochemical assay of certain parameters, as well as the histological study of the liver were estimate. The obtained results show that abamectin treatment led to an increase in plasma glucose and ALT levels. A decrease in alkaline phosphatase, cholesterol, total protein and bilirubin. On the other hand, the administration of the extract of the medicinal plant Euphorbia falcata alone or in combination with abamectin induces a non-significant increase in blood glucose levels, a significant increase in cholesterol and ALT levels and a non-significant decrease in alkaline phosphatase, triglycerides, and ASAT. A very significant decrease in protein and bilirubin levels.The histological examination highlights vascular congestion, inflammatory infiltration, and slight disorganization of the hepatocyte compartments in rats treated with abamectin.Treatment with Euphorbia falcata extract preserved hepatic architecture with little or no significant histological alterations. In conclusion, abamectin caused significant metabolic disruptions in the Wistar rat. However, the extract of Euphorbia falcata could moderate these disturbances.

Keywords: Euphorbia falcata, abamectin, liver, toxicity, rats

SUSTAINABLE AGRO-BIOTECHNOLOGICAL PRIMING STRATEGIES TO BOOST THE BIOCHEMICAL PROFILE AND ANTIOXIDANT CAPACITY IN SPRING RAPESEED

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ABSTRACT

Seed priming represents a cost-effective and sustainable biotechnological approach to enhance the physiological resilience and biochemical quality of seeds. For rapeseed (*Brassica napus* L.), a major global oilseed crop valued for its nutritional and industrial applications, optimizing seed biochemical composition is essential for improving metabolic adaptability and stress tolerance. This study aimed to evaluate the impact of various exogenous priming agents on the secondary metabolism and antioxidant capacity of rapeseed. The experimental design included hydropriming, proline, polyethylene glycol, rutin, gallic acid, and gibberellic acid treatments. Following the application of these pre-sowing treatments, detailed biochemical analyses were performed to quantify the concentrations of key secondary metabolites, including total polyphenols, flavonoids, and tannins, as well as to determine the overall antioxidant activity of the seed extracts. The findings indicate that all tested priming treatments significantly improved the biochemical profile of rapeseed, primarily by upregulating the synthesis and accumulation of antioxidant-related metabolites. Specifically, seed priming with GA_3 produced the highest total polyphenol content, highlighting the role of this phytohormone in stimulating phenylpropanoid biosynthesis. In parallel, treatments with PEG and proline substantially increased tannin production, yielding maximum concentrations of 1.38 mg gallic acid equivalents (GAE) per gram of extract and 143.05 mg catechin equivalents (CE) per gram, respectively. These biochemical modifications demonstrate that targeted priming effectively fortifies the endogenous antioxidant defense systems of the seeds prior to sowing. Consequently, these results validate the use of multifactorial seed priming as a viable and eco-friendly agro-biotechnological strategy to enhance the biochemical quality and oxidative stress resistance of rapeseed. Future research should focus on elucidating the specific molecular pathways and transcriptional networks responsible for these metabolic shifts, alongside field trials to assess the long-term stability of these biochemical improvements under agricultural conditions.

Keywords: Brassica napus, Seed priming, Antioxidant capacity, Secondary metabolites, Biochemical quality

ETHNOBOTANICAL SURVEY ON THE USE OF MEDICINAL PLANTS AND NATURAL SUBSTANCES IN DERMATOLOGY IN ALGIERS

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ABSTRACT

Dermatological conditions such as acne, eczema, and psoriasis are among the most common reasons for consultations, particularly among young adults. Faced with the perceived limitations of conventional medicine and the easy access to natural remedies, many individuals turn to herbal medicine. This ethnobotanical study aims to evaluate the use of medicinal plants in the management of dermatological disorders in Algiers. A survey was conducted between January and March 2025 among 385 residents of the Algiers province, using a structured questionnaire. Data collected included sociodemographic profiles, dermatological history, used plants, methods of preparation and administration, as well as perceived effects. Results show that 70.37% of participants are familiar with medicinal plants used for dermatological purposes, mainly women (55.29%) and young adults aged 18–25. Acne was the most commonly reported condition (81.8%), followed by eczema (19.3%) and psoriasis (11.8%). Thirty-four plant species belonging to thirty botanical families were identified. The most frequently cited plants included Aloe vera (Aloe vera L.), black seed (Nigella sativa L.), olive (Olea europaea L.), prickly pear (Opuntia ficus-indica L.), and chamomile (Matricaria chamomilla L.). Leaves (61.6%) were the most commonly used parts, mostly applied topically in the form of gels or essential oils. Phytotherapy was considered moderately to highly effective by 64.5% of users, although side effects such as skin irritation (55.5%) and allergic reactions (31.3%) were reported. This study highlights the importance of traditional knowledge in managing skin conditions and emphasizes the need for rigorous scientific approaches to validate the safety and efficacy of locally used natural remedies.

Keywords: ethnobotanical survey, dermatological diseases, phytotherapy.

DETECTION OF HIGH PLAINS WHEAT MOSAIC VIRUS IN SWEET CORN IN UKRAINE

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ABSTRACT

Emaravirus tritici (High Plains wheat mosaic emaravirus, HPWMoV) causes High Plains disease in wheat and maize plants, resulting in significant economic losses. Genetic resistance against HPWMoV in wheat is not available, but most commercial corn hybrids are resistant while sweet corn varieties remain susceptible. HPWMoV has been first detected in the United States in 1993, and was first recorded in Europe in 2018 in Ukraine. Later on, its spread has also been documented in France. The aim of the study was to test sweet corn crops in Vinnytsia region of Ukraine for the presence of HPWMoV. Following the crop inspection in five fields in 2025, plants with mosaic and mottling symptoms were found in only one of them. Ten symptomatic sweet corn plants were tested using a double-antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA) with an HPWMoV-specific kit from Agdia (Elkhart, IN, USA). Each plant was treated as a separate sample. DAS-ELISA analysis revealed one plant infected with HPWMoV, representing 10 per cent incidence. Reverse transcription PCR (RT-PCR) confirmed the presence of HPWMoV in ELISA-positive sample. For HPWMoV detection, specific primer pair WMoV-R1/WMoV-F1 was used (Abdullahi et al., 2020). The nucleotide sequence obtained from isolate UA-HPWMoV-sw-corn was sequenced and submitted to GenBank under accession number PZ727225. The Ukrainian isolate from sweet corn was found to be 98.24% identical to the Ukrainian isolate UA-HPWMoV-Vi-Sv10 from *Setaria verticillata*, which in due time was also collected in Vinnytsia region. These results represent the first report of sweet corn as a natural host of HPWMoV in Ukraine and indicate that it may act as a reservoir, facilitating virus persistence and spillover between cropping cycles.

Acknowledgment: This research was partly funded by the Ministry of Education and Science of Ukraine (project 26AF036-01 'Epidemiological analysis of maize viral pathogens and risk assessment of their spread for biosecurity in Ukraine').

Keywords: Emaravirus, Zea mays L., virus reservoirs, alternative hosts

IMPACT OF PLANT VIRAL INFECTIONS ON YIELD OF AN EARLY-MATURING TOMATO VARIETY IN UKRAINE

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ABSTRACT

It is well established that the greatest crop losses are caused by viral pathogens with multiple transmission routes. Recently, plant virologists have focused on the role of seed transmission as a source of primary infection in crops, with direct consequences for productivity and phytosanitary security. Our study addressed the impact of viral infection on the productivity of an early-maturing indeterminate hybrid tomato, in which virus-like symptoms were observed from germination. Infected plants exhibited stunting, mosaic, leaf deformation and, subsequently, reduced fruit set and fruit size. Symptomatic and asymptomatic samples were screened by a modified DAS-ELISA using Loewe test kits for ten viruses frequently infecting tomatoes in Ukraine: AMV, CMV, TAV, ToMV, TSWV, ToRSV, TRV, PMMV, PVX, and PVY. The results indicated the presence of tomato aspermy virus (TAV) in symptomatic plants, which was further confirmed by RT-PCR using a specific primer pair targeting the coat protein gene (Raj, 2007). Quantitative analysis revealed a statistically significant reduction in plant height of infected plants by 54%, a decrease in fruit number by 86%, and a decline in yield by 91% compared to uninfected control plants. The early onset of symptoms at the seedling stage convincingly indicates seed as the primary source of inoculum. These findings underscore the need for routine seed testing, use of certified seed lots, and implementation of integrated phytosanitary measures to prevent introduction and spread of TAV and similar seed-associated viral pathogens in Ukrainian tomato production.

Acknowledgment: This research was partly funded by the Ministry of Education and Science of Ukraine (project 0125U002320, Variability in the species composition of phytopathogens under climate change as a threat to food security and national health).

Keywords: tomato aspermy virus, seed transmission, yield loss, Ukraine

SEED MORPHOLOGY OF SOME TRIFOLIUM L. (FABACACEAE) SPECIES GROWING IN THRACE

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ABSTRACT

This study aimed to investigate the seed morphology of Trifolium taxa naturally distributed in the Thrace Region and to evaluate their taxonomic significance. The genus Trifolium, one of the ecologically and economically important members of the Fabaceae family, exhibits high species diversity, making the identification of reliable diagnostic characters essential for accurate taxonomic classification. In this context, the study focused on determining the taxonomic value of seed characteristics, which are generally less affected by environmental factors and are considered stable morphological markers. The research material consisted of seed samples belonging to 26 Trifolium taxa collected from the Thrace Region between 2021 and 2022. The seeds were examined under a digital stereo microscope, and their morphological features, including shape, color, surface texture, hilum characteristics, length, and width measurements, were recorded. The obtained morphological characters were coded into a data matrix, and a UPGMA cluster analysis was performed using the Mesquite software package. The results demonstrated that seed shape, surface characteristics, and size constitute important diagnostic traits for distinguishing Trifolium taxa. Based on the morphological data, the cluster analysis grouped the studied taxa into two major clusters, each further divided into subgroups. The resulting classification reflected morphological similarities and potential phylogenetic relationships among the taxa. In conclusion, seed morphology was found to possess high taxonomic value in the identification and classification of Trifolium species. The evaluated seed characters provided reliable and stable criteria for distinguishing taxa and clarifying taxonomic boundaries. The findings contribute to a better understanding of the flora of Thrace and provide a valuable scientific basis for future taxonomic, ecological, and plant breeding studies involving the genus Trifolium.

Keywords: Trifolium, Fabaceae, seed morphology, taxonomy, Thrace Flora.

FIVE-YEAR STUDY OF THE PHOTOSYNTHETIC PIGMENT CONTENT IN WILD PLANT SPECIES AT DIFFERENT ALTITUDES

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ABSTRACT

Altitudinal gradients provide natural environmental conditions for studying plant physiological adaptation to multiple abiotic stress factors. Rila Mountain, the highest mountain on the Balkan Peninsula, represents an appropriate natural model because of the pronounced changes in climatic conditions with altitude. Environmental conditions vary considerably with increasing altitude. Plants have to cope with the combined effects of environmental factors such as altitude, temperature, and increased solar UV radiation. Photosynthetic pigments are widely used as physiological indicators of plant adaptation to environmental stress associated with altitudinal gradients and climate variability. This study aims to evaluate changes in the photosynthetic pigment content in wild plant species along with altitude over five years. Five wild species were chosen as plant material: *Fragaria vesca* L. (Rosaceae), *Myosotis sylvatica* Ehrh. (Boraginaceae), *Achillea millefolium* L. (Asteraceae), *Epilobium angustifolium* L. (Onagraceae) and *Dactylis glomerata* L. (Poaceae). Plants were collected from different altitude sites: one low-altitude site at 595 m – Sofia and two high-altitude sites at 1500 m a.s.l., and 1782 m a.s.l. in Rila Mountain, in July-August in five growing seasons from 2020 to 2024. Sofia was selected as a low-altitude reference site with potential anthropogenic influence. The contents of total chlorophylls, chlorophyll a, chlorophyll b, total carotenoids and chlorophyll a/b ratio were determined as endpoints. The obtained results indicate species-specific differences in photosynthetic pigment responses to altitude, suggesting different adaptive strategies among the studied species. The observed species-specific variations in photosynthetic pigment content may reflect an integrated response to multiple environmental factors, including altitude-related changes, local habitat conditions and potential anthropogenic influences. These findings may contribute to a better understanding of the plant responses to complex abiotic and local habitat factors under different environmental conditions along with altitude.

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Keywords: altitude, photosynthetic pigment content, wild plant species, abiotic stress, plant adaptation

FIBER ANALYSIS OF DIFFERENT VARIETIES OF LUFFA SPP. IN THE COLLECTION AT BRGV BUZAU

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ABSTRACT

Luffa spp. is a vine plant belonging to the Cucurbitaceae family and is widely cultivated in tropical and subtropical regions, mostly in India and China. While the immature fruits are consumed in many Asian countries, the matured fruits develop a fibrous lightweight network which is used in different industries. The chemical composition of luffa fibers consists mainly of cellulose, hemicellulose and lignin. The high cellulose content contributes to their strength and durability. In Türkiye, the luffa sponges have been used in soundproofing materials, shoe insoles and removing heavy metals from wastewater. In China the luffa fibers could be used as mattress filling material, allowing airflow which help reducing heat buildup. In India the dried luffa was used as an external insulation sheet for the Mitticool refrigerator for its good insulating properties to reduce heat gain, improve cooling efficiency and help the fridge maintain lower temperatures for longer. Due to the growing environmental, biodegradable and mechanical strength, luffa fibers have emerged as a promising renewable material with applications in engineering, environmental science and green manufacturing. In this context, this study aims to characterize the fiber of different *Luffa* spp. varieties from BRGV Buzau collection, in order to establish the most suitable uses for each variety. Fiber content varied between 61% and 65% cellulose and between 8.7% and 10.4% for lignin. The results highlighted the *Luffa cylindrica* "Elida" as variety having the highest content of cellulose and the variety *Luffa cylindrica* "Bucov" the highest content of lignin.

Keywords: Cucurbitaceae, sponge gourd, fibers, loofah

ASSESSMENT OF HEAVY METAL ACCUMULATION IN BUTOMUS UMBELLATUS L. FROM GOLBASI LAKE (HATAY, TÜRKIYE) AND ITS POTENTIAL AS A BIOINDICATOR WITHIN A FRESHWATER ECOSYSTEM

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ABSTRACT

Heavy metal pollution is one of the most important environmental issues affecting freshwater ecosystems under the impacts of agricultural, industrial, and urban influences. Aquatic macrophytes are used for monitoring environmental pollution, as they can uptake heavy metals from water and sediment and accumulate them in their tissues. These plants also show high potential for phytoremediation. The present study was carried out to investigate the accumulation characteristics of heavy metals in Butomus umbellatus L., which is naturalized in Hatay Golbasi Lake, and to assess the ability of the plant to serve as a biomonitor in freshwater ecosystems. In this sense, the concentrations of cadmium, cobalt, chromium, copper, iron, manganese, nickel, lead, and zinc were analyzed in the root, stem, and leaf organs of the plant specimens collected from the lake during the autumn season, along with water and sediment samples taken from the same collection points, through inductively coupled plasma optical emission spectrometry (ICP-OES). It was found that heavy metals accumulated specifically in different organs of the plant with respect to their element, and the distributions of these elements in plant organs were found to be related to the bioavailability of the metal and the plant's ability to uptake and transport the metal. The analysis of the plant tissues in combination with water and sediment samples allowed determining the current heavy metal pollution status in Golbasi Lake ecosystem and assessing the capability of B. umbellatus to be an indicator of metal pollution in the environment. In particular, the accumulation differences of heavy metals in the roots, stems, and leaves of the plant pointed out the organ-specific metal retention and transport characteristics of the species. Consequently, it was concluded that B. umbellatus was an aquatic macrophyte native to the region, with a high capacity for accumulation of heavy metals, and it could be used as a suitable biomonitor for assessing heavy metal pollution in freshwater ecosystems.

Keywords: Aquatic macrophytes, Flowering rush, ICP-OES, Phytoremediation, Water-Soil-Plant relationships

COMPARATIVE GERMINATION ANALYSIS OF LUFFA SPP SEEDS FROM DIFFERENT HARVEST YEARS

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ABSTRACT

Germination is a physiological process through which seeds transition from a dormant state to a state of active growth, possessing all the essential structures for development. Seed quality is expressed in terms of germination capacity, genetic purity, physical purity and vigor. Seed quality was determined by testing the germination and viability of Luffa cylindrica and Luffa acutangula. The seeds used for this study have been selected from different harvested years, Luffa cylindrica - 2017, 2019, 2023, 2024 and Luffa acutangula – 2020 and 2024. The seed samples randomly selected from the 2017, 2019, 2020, 2023, and 2024 harvests were visually examined for uniformity, and those with damaged seed coats were discarded. To ensure an optimal environment for seed germination, filter paper with a basis weight of 80 g/m² was used and the seeds were placed between the layers, spaced so as not to touch one another on the germination surface. Luffa acutangula seeds had a higher germination between 95% and 100% than the seeds of Luffa cylindrica which had the germination between 93% and 97%.
This study aims to show the germination potential of each variety from different harvest years, as well as analyzing the ability to retain germination potential under optimal storage conditions.

Keywords: Luffa cylindrica, Luffa acutangula, germination, viability, biodiversity

ACCELERATING DURUM WHEAT IMPROVEMENT THROUGH THE IDENTIFICATION OF HIGH-PERFORMING AND STABLE GENOTYPES

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ABSTRACT

The Mediterranean regions is the largest production area of durum wheat (Triticum turgidum L. subsp. durum), and North Africa presents the largest import market. Durum Wheat is the most widely-grown cereal crop in Tunisia but production is highly limited by abiotic stress in semi-arid regions and biotic stress in sub-humid parts. The performance of durum wheat yield often varies due to significant genotype × environment interaction; therefore the yield stability of performance is an important consideration in the breeding program. Thus, selection of relatively high and stable yielding genotypes is a common wheat breeding objective. This study determined grain yield response and stability among elite genotypes. The aim of the research was to exploring the GEI pattern and yield stability of 50 durum wheat promising lines evaluated across six environments (E) in field experiment under rainfed conditions, in semi-arid region (Kef) during 3 cropping season and in sub-humid region (Beja) during 3 cropping seasons using GGE (Genotype and Genotype by Environment Interaction) biplot method. Variance analysis showed that environments were the main source of yield variation it accounts 72.05 % followed by the interaction environments × genotypes (25.31 %) and genotypes (2.62 %). Grain yield of 24 promising lines ranged from 1.92 to 2.45 t/ha. GGE biplot analysis showed that the first two component were significant and they explained 48.03% (PC1=29.35% and PC2= 18.68%) of the total variation. The results indicate that the grain yield of different lines was significantly influenced by environmental effect. The greater GE interaction relative to genotype effect suggested significant environmental groups with different top-yielding genotypes. This analysis recognized tow environments as ideal environment and 2 genotypes as ideal genotype. These selections are recommended to be developed in multi-environment in several regions of Tunisia.

Keywords: Environment, GGE Method, Stability

AN INVESTIGATION OF HEAVY METAL ACCUMULATION IN SOME ORNAMENTAL PLANTS IN EDIRNE PROVINCE

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ABSTRACT

In our environment, the paint industry, the use of pesticides and artificial fertilisers, urban or industrial solid, liquid and gaseous waste, and vehicle exhaust fumes lead to the release of excessive amounts of heavy metals into the environment. Environmental pollution is also leading to an increase in heavy metal contamination in ornamental plants. In this study, a total of 28 ornamental plants were analysed for their heavy metal content: 16 were selected from outdoor ornamental plants growing along roadsides, in parks and gardens in Edirne during 2024–2025 and 12 were selected from indoor ornamental plants grown in greenhouses and under standard conditions. The plants studied were Abies nordmanniana, Cedrus libani, Pinus nigra, Laurus nobilis, Pycarantha coccinea, Salix babylonica, Tilia platyphyllos, Lavandula sp., Hedera helix, Magnolia grandiflora, Nerium oleander, Lilium sp., Aesculus hippocastanum, Rosa x damascena, Acer sp., Picea pungens, Veronica spicata, Monstera deliciosa, Ficus elastica, Ficus benjamina, Nephrolepis exaltata, Cyperus longus, Cyclamen persicum, Impatiens walleriana, Yucca sp., Schefflera arboricola, Sanseviera sp. and Dahlia sp. Samples were taken from the leaves of these ornamental plants and analysed for the heavy metals lithium, aluminium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, cadmium, tin and lead using atomic absorption spectrophotometry. Elemental analyses of the plants were carried out using an Agilent Technologies 7700 ICP-MS (inductively coupled plasma mass spectrometer). Based on the data obtained, the heavy metal concentrations in the plants were determined and the results are presented in comparative tables. Looking at the overall results, it was observed that the heavy metal accumulation detected in indoor ornamental plants was generally lower than that in outdoor ornamental plants. However, in some of the indoor ornamental plants examined in the study, higher levels of Zn, Ar and Sn were detected compared to those in outdoor ornamental plants. This study is the first research conducted in Edirne on the accumulation of heavy metals in ornamental plants. The aim of this basic research is to encourage the wider use of ornamental plants that accumulate heavy metals in landscaping, with a view to preventing environmental pollution in future studies.

Keywords: Edirne, heavy metal, ornamental plant, phytoremediation

DETERMINATION OF HEAVY METAL CONTENTS IN SOME MEDICINAL PLANTS SOLD IN HERBAL SHOPS IN EDIRNE

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ABSTRACT

This study was carried out to determine the heavy metal content in medicinal plants sold by herbalists in Edirne. Although medicinal plants contain beneficial components for health, they are contaminated with heavy metals due to environmental factors. In the study; medicinal plants sold from Edirne herbalists and used by the public were examined. Urtica dioica, Hypericum perforatum, Salvia rosmarinus, Tilia platyphyllos, Matricaria chamomilla, Salvia fruticosa, Foeniculum vulgare, Helichrysum arenarium, Camellia sinensis, Lavandula officinalis, Olea europaea, Melissa officinalis, Persea americana samples taken from 13 different medicinal plants were analysed by ICP-MS method and the concentrations of lithium, aluminium, chromium, iron, nickel, copper, arsenic, cadmium, tin and lead were determined. The statistical data of the study were analysed by using one-way analysis of variance ANOVA in SPSS 20 programme. The data obtained as a result of the analysis were compared with the reference values of the World Health Organization. According to the results of the analysis, arsenic, cadmium and iron were found mostly in Hypericum perforatum; aluminium and chromium were found mostly in Lavandula officinalis; lead was found mostly in Salvia rosmarinus, nickel was found mostly in Camellia sinensis and copper was found mostly in the leaf of Olea europaea. Heavy metal contents of medicinal plants sold in Edirne herbalists were determined for the first time in this study. Since high levels of these metals can have toxic effects on human health, it is recommended to buy these plants from reliable sources with known growing conditions.

Keywords: heavy metal, herbalist, Edirne, medicinal plant

IN VITRO CULTIVATION OF EDELWEISS (LEONTOPODIUM SP.) FOR CONTROLLED PHYSIOLOGICAL AND MOLECULAR STUDIES

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ABSTRACT

Edelweiss (*Leontopodium* spp.) represents a distinctive alpine plant group with ecological, ornamental and biotechnological significance, yet its biology and adaptive responses remain challenging to investigate. This study aimed to establish and characterize an *in vitro* culture system for edelweiss as a platform for controlled physiological and molecular studies. A protocol for seed surface sterilization, germination and establishment of aseptic cultures was developed using commercially obtained seeds, generating three independent experimental lines (L1–L3). Comparative assessment of biomass and propagation dynamics identified L3 as the most actively proliferating line, with superior regeneration capacity prolonged culture, and was therefore selected for subsequent physiological experiments. The taxonomic identity of the plant material was assessed using the DNA barcoding method. Chloroplast (*rbcL*, *trnH-psbA*) and nuclear (ITS) markers were amplified by PCR, sequenced and compared with sequences from NCBI using BLAST. Phylogenetic trees were constructed and analysed in Geneious Prime based on individual barcode regions and their combinations. The phylogenetic trees confirmed the taxonomic assignment of analyzed material to *Leontopodium alpinum* (synonym for *Leontopodium nivale* subsp. *alpinum).* In addition, karyological analysis revealed a somatic chromosome number of 2n = 48 consistent with reported diploid chromosome numbers in *Leontopodium*. Together, these results establish a characterized *in vitro* edelweiss system integrating plant tissue culture, growth phenotyping, DNA barcoding and cytogenetic analysis. The resulting experimental platform provides a defined source of plant material for future studies of edelweiss physiology, development, stress responses and biotechnological potential.

Keywords: alpine flora, edelweiss, in vitro micropropagation, physiology, DNA barcoding, chromosomes

MICROSATELLITE ANALYSIS OF RHOPALOSIPHUM PADI (L.) POPULATIONS FROM EUROPEAN RUSSIA REVEALS GENETIC DIFFERENTIATION ASSOCIATED WITH REPRODUCTIVE STRATEGY

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ABSTRACT

The bird cherry-oat aphid, Rhopalosiphum padi L., is one of the major pests of cereals. Its ecological success is associated with different reproductive strategies, ranging from holocycly to anholocycly. Information on the genetic structure of Russian populations remains scarce. We analyzed 71 clonal lineages collected from diferent northwestern and southern regions of European Russia. Clone genetic diversity was assessed with 7 polymorphic SSR loci (Wilson et al.,1999;Simon et al.,2001). Reproductive mode was determined experimentally by evaluating remigration, production of sexual morphs, and overwintering ability. Northwestern populations of aphids were represented by holocyclic clones, whereas southern populations mainly consisted of anholocyclic forms, although holocyclic clones were also detected. SSR analysis identified 116 alleles and revealed higher allelic diversity in northwestern populations. AMOVA based on allele frequencies showed significant differentiation between geographic populations aphids. Cluster analyses (NJ, UPGMA, PCoA) separated most clones according to geographic origin and life cycle, while several southern clones grouped with northwestern holocyclic lineages, indicating a continuum of reproductive strategies. Several SSR alleles showed very strong associations with life cycle type and may serve as foundation for development molecular markers for predicting reproductive mode. The work was carried out within the framework of the Russian Science Foundation grant No. 24-76-10009.

Keywords: Bird cherry-oat aphids, SSR analys, clones

PHENOTYPING WILD GRASSES AS A BASIS FOR PREDICTING RHOPALOSIPHUM PADI OUTBREAKS

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ABSTRACT

Climate change altered landscapes, spreading wild grasses. Of 183 Poaceae species recorded as hosts for *Rhopalosiphum padi*, most are wild. We tested 25 grass species using 21 clones from southern and northwestern Russia. Plant identity, clonal origin, and their interaction determine reproduction and winged disperser production (ART ANOVA, P) Generally**,** *Poa trivialis*, *Lolium multiflorum*, and *Hordeum* spp. ranked with wheat and maize as highly favorable hosts. *Panicum miliaceum*, *Leymus arenarius*, *Agrostis capillaris*, *Setaria viridis*, *Elymus repens*, and *Bromus erectus* were poor hosts, with C4 species less suitable. Regional differences in host use emerged across cultivated and wild grasses: southern clones performed better on maize, while northwestern clones favored *Poa trivialis*; additional differences were noted in other wild species. Aphids responded to poor hosts by producing winged offspring even at low densities ($r = -0.49$, $P = 0.01$). This response was stronger in northwestern clones (holocyclic) than southern (anholocyclic), indicating regional differences in dispersal tactics. Identifying favorable and unfavorable hosts helps predict outbreaks beyond crops. Poor hosts may trigger early dispersal, increasing virus spread. Findings refine monitoring, support region-specific thresholds, and help assess climate-driven shifts in grass biodiversity impacts on pest dynamics. Supported by Russian Science Foundation grant No. 24-76-10009.

Keywords: Climate change, Rhopalosiphum padi, aphids clones

BIOCHAR APPLICATION BOOSTS WATER RETENTION AND IMPROVES CROP PRODUCTIVITY IN SANDY SOILS OF ARID ENVIRONMENTS

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ABSTRACT

The agriculture sector of Saudi Arabia is characterized by predominantly sandy soils, water scarcity, high temperatures, and lower organic matter. The sandy soils have poorly developed structure, low poor water retention, coarse drainage and limited store of plant available water. Immediate attention is need to address these challenges to ensure sustainable crop production in sandy soils. Our greenhouse pot trials using date palm biochar (pyrolysed at 450–500°C) and sieved into four biochar particle fractions (2–1, 1–0.5, 0.5–0.1, and <0.1 mm) and applied at 4% to sandy loam soil demonstrated that the finest particle fraction resulted in the greatest increase in both field capacity water content and plant-available water. The higher water content with biochar application could be due to the elevated microporosity, internal surface area, and pore structure of highly pulverized biochar. Both the saturated hydraulic conductivity and bulk density were decreased in all particle sized fractions after the application of ultrafine biochar particle size. However, biochar with high particle size was not able to significantly increase available water content. In another study, we evaluated the performance of the spent Arabica and Colombian waste biochars (pyrolysis at 550°C) to enhance water retention in loamy sand. Results showed that the application of biochar at 5% rate resulted in significant reduction in water evaporation (57–66%), water holding capacity (101–130%) and cumulative infiltration (124–181%) compared with controls. In follow-up greenhouse studies, an increase in maize root biomass (0.51 g to 2.12–2.38 g, CC to 5%) shoot growth (~35% increase), and plant height (~98% increase) (from 15.71 cm to 30.94–33.23 cm) was observed with biochar application. Therefore, our work makes an evidence-based, a mechanistically sound proof for fine-particle biochar amendment as a scalable water conservation management strategy for sandy soils in arid regions, and on-farm application in irrigated agriculture in arid regions to reduce irrigation demand and improve crop water productivity.

Keywords: Biochar, Sandy Soils, Water Retention, Water Scarcity

MODELLING SOIL WATER RETENTION USING PEDOTRANSFER FUNCTIONS IN THE UPPER CHELIFF PLAIN

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ABSTRACT

Knowledge of soil water retention properties is necessary for assessing their Water potential and for better management. In order to address the lack of data on soil water retention properties, and given that measuring these properties is particularly difficult, many researchers sought early on to predict these properties based on soil characteristics that are much easier to measure. In recent years, significant attention has been directed towards predicting soil retention properties within the soil physics community. Due to the challenges associated with direct measurement, many researchers have sought to predict this capacity using soil properties that are more readily quantifiable. This is the context for the present work, the objective of which is to seek methods that can contribute to the estimation of water retention and thereby improve the management of water resources, which are in short supply. This modelling is based on, applied pedotransfer functions (PTFs) for soils in the upper Cheliff plain. The use of these approache was motivated by the need for a more effective and reliable means of estimating soil water retention. These technique led to the prediction of soil water retention based on a database containing 493 horizons from the agro-pedological study of the Haut Cheliff plain. After establishing a stratification that takes into account texture, bulk density, texture and bulk density simultaneously. The modelling results and validation tests of the pedotransfer functions show that textural-structural stratification significantly improves prediction quality, confirmed by an R2 of 0.90 during validation for fine clay-loam horizons of Da (1.4 g/cm3) and potential (-10kPa), with a slight tendency to overestimate (EMP = 0.06%). Furthermore, structural stratification shows poor predictions with ETPs varying between 1.09% and 1.95% and underestimates water retention (EMP (-2.08%) and (-1.32%).

Keywords: Water potential, FPT pedotransfer functions, modelling, the upper Cheliff Plain, stratification, prediction, water retention

ASSESSMENT OF SELECTED MACRO- AND MICRONUTRIENT CONCENTRATIONS IN SOILS AND WHEAT IN THE NARLI PLAIN

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ABSTRACT

Evaluating soil nutrient availability together with plant nutrient concentrations provides a comprehensive understanding of crop nutritional status. Accordingly, this study aimed to assess the macro- and micronutrient status of wheat grown in the Narlı Plain of Kahramanmaraş, Türkiye. Soil samples were collected from a depth of 0–30 cm, and flag leaf samples were collected immediately before heading from 11 wheat-growing fields. Soil samples were analyzed for pH, calcium carbonate ($CaCO_3$) and organic matter contents, available phosphorus (Olsen-P), exchangeable potassium (K), calcium (Ca), and magnesium (Mg), and DTPA-extractable iron (Fe), zinc (Zn), copper (Cu), and manganese (Mn). Plant samples were analyzed for P, K, Ca, Mg, Fe, Zn, Cu, and Mn concentrations. The soils were slightly to moderately alkaline, with organic matter contents ranging from 2.13% to 4.50% and $CaCO_3$ contents ranging from 19.84% to 41.09%. Soil Olsen-P concentrations varied between 7.98 and 35.38 mg kg^{-1}, while the mean DTPA-extractable Fe, Zn, Cu, and Mn concentrations were 11.73, 1.05, 1.50, and 9.65 mg kg^{-1}, respectively. The mean exchangeable K, Ca, and Mg concentrations were 339.55, 3461, and 1145 mg kg^{-1}, respectively. The mean P, K, Ca, and Mg concentrations in wheat flag leaves were 0.28%, 2.60%, 0.80%, and 0.18%, respectively, whereas the mean Fe, Zn, Cu, and Mn concentrations were 97.93, 21.84, 6.75, and 40.41 mg kg^{-1}, respectively. The results showed that wheat grown in the Narlı Plain was generally adequately supplied with the macro- and micronutrients examined. However, the variation in soil and plant nutrient concentrations among the sampled fields suggests that wheat nutrient status may be influenced by differences in soil nutrient reserves, fertilizer management, and other soil properties. These findings highlight the importance of evaluating soil and plant analyses together when developing field-specific nutrient management strategies for wheat production in the region.

Keywords: Calcareous soil, flag leaf, mineral nutrition, wheat.

RELATIONSHIPS BETWEEN SOIL STRUCTURE AND CARBON DIOXIDE EMISSIONS

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ABSTRACT

Soil structure is the most dynamic physical factor directly governing atmospheric CO_2 emissions through aggregate development, pore size distribution, and gas diffusion capacity. The CO_2 released from soil originates from two main sources: heterotrophic respiration from microbial decomposition and autotrophic respiration from root activity. Soil structure regulates this release via two protective barriers: aggregation and porosity. In terms of aggregation, microaggregates smaller than 250 micrometres physically entrap organic carbon within narrow micropores, rendering it inaccessible to microbial enzymes and limiting oxygen diffusion, thereby slowing decomposition. However, intensive tillage disrupts these aggregates, exposing protected carbon to rapid mineralization and causing sudden CO_2 bursts. The second barrier is the soil's pore network, which determines gas exchange rates by regulating diffusion pathways for oxygen and CO_2. Well-structured soils with balanced pore continuity facilitate optimal aeration while limiting carbon loss. Compaction or pore blockage can alter decomposition dynamics and influence greenhouse gas production. The interaction between pore geometry and soil moisture also affects diffusion rates and the balance between aerobic and anaerobic processes. Therefore, sustainable agricultural practices such as no-till cropping, cover crop integration, and organic amendments can preserve and enhance soil physical quality. These approaches increase binding agents like glomalin-related proteins, improve aggregate stability, and optimize pore continuity. They also enhance organic matter content, reinforcing structural resilience. Ultimately, such management strategies strengthen the soil's function as a carbon sink while minimizing CO_2 emissions that contribute to global warming and climate change.

Keywords: Soil, structure, porosity, carbon dioxide, emission

EFFECTS OF BIOCHAR AND POTASSIUM-SOLUBILIZING BACTERIA APPLICATIONS ON WHEAT GROWTH, POTASSIUM CONTENT, AND pH AND EC

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ABSTRACT

This study was conducted to investigate the effects of potassium-solubilizing bacteria (KSB) and biochar applications on the growth, potassium content, and soil pH and electrical conductivity (EC) of wheat (Triticum aestivumL.). The experiment was carried out in a controlled climate room for 45 days in a completely randomized factorial design with three replications. The treatments consisted of KSB inoculation (inoculated and non-inoculated) and four different biochar doses (0%, 1%, 2%, 4%). Results showed that KSB application significantly increased plant height (6.2%), fresh weight (15.8%), dry weight (16.0%), and plant potassium content (7.9%). Biochar application, especially at the 4% dose, increased plant height by 20.3%, dry leaf weight by 43.1%, and dry root weight by 43.2%. However, plant potassium content decreased by 23.7% with increasing biochar doses. This was attributed to high-dose biochar adsorbing potassium, a dilution effect, or changes in soil pH. Analysis of variance revealed that the KSB × biochar interaction had highly significant effects on plant fresh weight, dry weight, dry leaf and root weight, as well as soil pH and EC. In conclusion, while KSB and biochar applications promote wheat growth, it should be considered that high doses of biochar may negatively affect potassium uptake. For optimum benefit, it is recommended to determine the appropriate dosage ratios that will minimize potassium adsorption.

Keywords: Biochar, electrical conductivity, plant development, potassium content, potassium-solubilizing bacteria, soil pH, wheat (Triticum aestivum L.)

A COMPARATIVE ANALYSIS OF THE MYCORRHIZOGENIC INFECTIOUS POTENTIAL OF RHIZOSPHERE SOILS ASSOCIATED WITH THE GENUS THYMUS IN THE MORROCAN MIDDLE ATLAS

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ABSTRACT

Arbuscular mycorrhizal fungi (AMF) play a major role in the functioning of terrestrial ecosystems due to their ability to improve plant mineral nutrition, enhance resistance to abiotic stress, and promote the stability of plant communities. The mycorrhizogenic infectivity potential (MIP) of soils serves as a relevant indicator of the ability of mycorrhizal propagules to colonize roots and ensure the maintenance of these symbioses in natural ecosystems. This study aims to conduct a comparative analysis of the mycorrhizal infectivity potential of rhizosphere soils associated with the genus Thymus in the Moroccan Middle Atlas ,the investigations were conducted at seven sites representing different ecological and environmental contexts. Rhizosphere and control soil samples were collected and subjected to tests to assess their mycorrhizal infectivity potential. The results revealed a high infectivity potential in the studied soils, with MIP values reaching 80% in rhizosphere soils, while control soils showed MIP values ranging from 40% to 60%. These results highlight spatial variability in mycorrhizal infectivity potential among the studied sites, suggesting that edaphic and climatic conditions, as well as the composition and abundance of local mycorrhizal communities, may influence the infectivity potential of soils. This study contributes to a better understanding of the distribution of mycorrhizal resources in Thymus ecosystems of the Middle Atlas and highlights the importance of arbuscular mycorrhizal fungi in conserving biodiversity and enhancing ecosystem resilience in the face of climate change.

Keywords: Arbuscular mycorrhizal fungi, Mycorrhizogenic infectivity potential, Thymus, Rhizosphere soil, Biodiversity, Climate change, Moroccan Middle Atlas

ESTIMATING SURFACE SOIL MOISTURE USING A LOCAL PEDOTRANSFER FUNCTION INTEGRATING SOIL PHYSICOCHEMICAL PROPERTIES AND ELECTROMAGNETIC INDUCTION DATA

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ABSTRACT

This study aimed to develop and validate a local empirical pedotransfer function (PTF) for estimating surface soil moisture from soil physicochemical properties and electromagnetic induction (EMI) measurements. This approach minimizes the errors associated with evaporation and structural alterations that inevitably occur during the transport of soil samples to the laboratory. The proposed model is based on multiple linear regression incorporating calcium carbonate ($CaCO_3$) content, soil pH, electrical conductivity (EC), and apparent electrical conductivity measurements acquired in situ using electromagnetic induction in both horizontal (EMH) and vertical (EMV) orientations. A total of 17 soil samples were used to develop and evaluate the pedotransfer function. Model performance was assessed by comparing the estimated soil moisture values with the measured values using the coefficient of determination (R^2), the root mean square error (RMSE), and the mean absolute error (MAE). The results showed that the pedotransfer function explained 77.3% of the variability in soil moisture ($R^2 = 0.773$), with an RMSE of 0.851 and an MAE of 0.695, indicating good predictive accuracy. Statistical validation using the non-parametric Wilcoxon signed-rank test revealed no statistically significant differences between the measured and estimated soil moisture values ($p > 0.05$), confirming the reliability of the model under the conditions of this study. These findings demonstrate that the proposed pedotransfer function provides a simple, rapid, and cost-effective tool for estimating actual soil moisture directly in the field using readily measurable parameters while minimizing the biases associated with sample transport and storage. This approach represents a promising alternative for soil moisture monitoring, particularly in agricultural areas and in situations where time and resources are limited.

Keywords: Soil moisture, Pedotransfer function, Habra- Algeria, EM38

EFFECTS OF MYCORRHIZA-BASED MICROBIAL FERTILIZERS ON BASIL (OCIMUM BASILICUM L.) AGRICULTURAL CHARACTERISTICS UNDER DEFICIT IRRIGATION CONDITIONS

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ABSTRACT

The application of microbial fertilizers on plants has gained increasing importance as a sustainable strategy to enhance crop stress tolerance and plant productivity under challenging deficit irrigation conditions. This study aimed to evaluate the effects of various mycorrhiza-based microbial fertilizer formulations on the growth performance of broad-leaved basil (Ocimum basilicum L.) grown in a sandy-loam calcareous soil. The study focused on how these microbial amendments influence plant resilience across four deficit irrigation levels: full irrigation (SS100) and three deficit irrigation regimes (SS80, SS60, and SS40). The results indicated that deficit irrigation conditions severely restricted vegetative growth parameters in unfertilized control groups. However, microbial fertilization significantly alleviated the adverse effects of drought stress. Basil plants treated with mycorrhizal formulations, particularly dual or combined microbial treatments, exhibited notable improvements in plant growth dynamics. Key parameters including plant height, stem diameter, and total leaf number were positively affected by the microbial amendments even under high water deficit. Additionally, plants treated with microbial fertilizers recorded significantly higher chlorophyll levels (SPAD values), demonstrating sustained photosynthetic efficiency under stress. At harvest, a substantial increase in dry biomass accumulation was observed in mycorrhiza-treated plots compared to the control group, highlighting the role of these symbiotic microorganisms in optimizing root surface area and nutrient uptake. Overall, mycorrhiza-based applications emerged as highly effective inputs for mitigating drought-induced limitations in basil cultivation.

Keywords: Mycorrhiza, Biostimulants, Drought tolerance, Sustainable agriculture

CLIMATE CHANGE AND ITS IMPACTS ON AGRICULTURAL PRODUCTION, YIELD, AND QUALITY IN THE TURKISH REPUBLIC OF NORTHERN CYPRUS: A REVIEW

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ABSTRACT

Climate change represents one of the major challenges facing agricultural production in the Mediterranean region, where increasing temperatures, irregular precipitation, recurrent droughts, and water scarcity are expected to substantially affect crop productivity and product quality. The Turkish Republic of Northern Cyprus (TRNC), characterized by a Mediterranean climate and limited freshwater resources, is particularly vulnerable to these changes. Agriculture in the region includes important perennial and annual crops such as citrus, cereals, vegetables, grapes, olives, carob, and forage crops, many of which are highly sensitive to changes in temperature and water availability. This review evaluates the potential and observed impacts of climate change on agricultural production in the TRNC, with particular emphasis on crop yield and product quality. The review examines changes in temperature and precipitation patterns, increasing drought and evapotranspiration, water scarcity, soil salinity, and the potential changes in pest and disease pressure and their effects on agricultural systems. Particular attention is given to the effects of climate-related stresses on yield components and quality parameters, including fruit size, total soluble solids, titratable acidity, grain yield and protein content, nutritional quality, and postharvest characteristics. The role of irrigation management, soil and water conservation, improved fertilization, drought- and heat-tolerant cultivars, treated wastewater, precision agriculture, and other climate-smart agricultural practices in reducing climate-related risks is also discussed. The review highlights the need for long-term climate and agricultural production datasets, crop-specific climate impact assessments, and locally adapted adaptation strategies. Developing climate-resilient agricultural systems will be essential for maintaining sustainable production, protecting product quality, improving water-use efficiency, and strengthening food security in the TRNC under future climate conditions.

Keywords: Climate change, Crop quality, Mediterranean agriculture, Water scarcity

COMPARATIVE ANALYSIS OF SOIL MICROBIAL DIVERSITY AND EDAPHIC CHARACTERISTICS IN TWO MAIZE-GROWING SITES IN BULGARIA

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ABSTRACT

Soil microbial communities contribute to nutrient cycling, soil functioning, and crop productivity. The Knezha region in Bulgaria is characterized by fertile chernozem soils and favourable conditions for maize cultivation, making it a suitable reference site for identifying microbial and edaphic features associated with productive maize-growing soils. Soils from the Maize Research Institute in Knezha and the Educational and Experimental Base (EEB) Dragalevtsi, Sofia, were compared. Shotgun metagenomic sequencing (untargeted sequencing of total microbial DNA) was used to characterize the soil microbiome. Microbial diversity was analysed and compared with the chemical and mechanical composition of the soils. Knezha showed higher microbial richness and diversity and contained several bacterial genera not detected in Dragalevtsi, predominantly Actinobacteria associated with nutrient transformations and stress adaptation. The strongest physical contrast between the sites was soil texture: Knezha contained substantially higher silt and clay fractions and very little sand, whereas Dragalevtsi was considerably sandier. This finer texture may favour greater water and nutrient retention, properties particularly relevant for maize because adequate soil water availability is critical during periods of rapid vegetative growth and reproductive development. Knezha also showed more than twice the K and Mg concentrations and slightly higher P and Zn levels. These results identify a combination of higher microbial diversity, finer soil texture with potentially greater water and nutrient retention, and increased K and Mg levels as characteristic features of the Knezha site. These parameters may represent key soil attributes to consider when evaluating or improving less favourable maize-growing environments.

Keywords: soil microbiome, maize, shotgun metagenomics, soil texture, microbial diversity, Actinobacteria

THE INTERPLAY BETWEEN FEEDING PRACTICES AND THE NUTRITIONAL QUALITY OF MILK IN DAIRY COWS

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ABSTRACT

Pregnant heifers of the Prim'Holstein (PH) and Montbéliarde (MB) dairy breeds were imported (between the 5th and 6th months of gestation). They were prepared for their future careers as dairy cows under different rearing conditions, particularly with regard to diet and breeding practices. Once they arrived in Algeria, these pregnant heifers were confronted with variable rearing and feeding conditions. Their adaptation to the new rearing conditions, which were often restrictive, particularly in terms of feeding, had a short-term impact on their first-lactation performance and a long-term impact on their dairy careers. The performance achieved fell short of the milk production and reproductive potential of both breeds. Performance was better in the MB breed: 4,211 ± 340 (MB) and 3,965 ± 328 kg (PH) in the first lactation, 5,024 ± 360 (MB) and 4,660 ± 420 kg (PH) in the second lactation, 5,700 ± 530 (MB) and 5,180 ± 400 kg (PH) in the third lactation. Body condition scores were insufficient at the start of lactation, particularly in the second and third lactations (≤2), and at this stage, total protein (TP) levels ranged between 25.4 and 29.4 g/kg of milk. Overall, the trend in BC and SP values suggests not only an energy deficit but also a possible case of acidosis. The TB/TP ratio during the first week of lactation is close to 1.5, which may indicate a suspected case of ketosis with an energy deficit. The objective of this study is to evaluate, compare, and correct zootechnical responses—specifically the quantity and quality of milk produced by these cows—in relation to their adaptability.

Keywords: MB, PH, lactation, TP, TB, BCS

EFFECTS OF GRAZING SYSTEMS AND TREATMENT REGIMENS ON GASTROINTESTINAL NEMATODES' ANTHELMINTHIC RESISTANCE DYNAMICS: A SIMULATION APPROACH

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ABSTRACT

This study presents a stochastic simulation model of gastrointestinal helminths transmission and the evolution of anthelmintic resistance in gut strongyles' populations in mixed flocks of sheep. The model incorporates host-level parasite burdens, environmental contamination, and differential drug efficacy against susceptible and resistant parasite populations. Transmission dynamics are governed by probabilistic processes, including Poisson distributed egg production, binomial survival under treatment, and density-dependent establishment of infective larvae. Three grazing-management scenarios were evaluated over 52-week period: common grazing, separate grazing, and integrated grazing with strategic pasture rotation. Resistance dynamics were quantified as the proportion of resistant worms, defined as the number of resistant worms at a given time divided by the total worm population, where the total population consists of both susceptible and resistant worms. Results demonstrated that management strategies exert strong selective pressures on parasite populations. The integrated grazing system yielded the highest final resistance level followed by the separate system while the common grazing scenario maintained low resistance. Conversely, total worm burdens were minimized under intensive management (approximately 1559-1998 worms) and maximized under common grazing (approximately 12276 worms). Resistance did not exceed the threshold in any scenario. Intensive management (integrated, separate) demonstrated strong parasite control and rapid increase in resistance. Low intervention (common grazing) demonstrated higher parasite burden and slower resistance development. These findings highlight a fundamental trade-off between parasite suppression and resistance selection, driven by treatment intensity and genetic features of strongyles. The model provides a quantitative framework for evaluating sustainable parasite control strategies.

Acknowledgment: This research was supported by Project AP32728489 “Development of sustainable parasite management for sheep to prevent the anthelmintic drug resistance (AR) of gastrointestinal nematodes (GINs) in the Northern and Central Regions of Kazakhstan” funded by the Ministry of Science and Higher Education of Kazakhstan.

Keywords: sheep, gastrointestinal strongyles, anthelmintic resistance, stochastic simulation modelling

ISOLATION, MOLECULAR IDENTIFICATION, AND ANTAGONISTIC ACTIVITY OF LACTOBACILLUS STRAINS ISOLATED FROM ALGERIAN INDIGENOUS POULTRY AS POTENTIAL PROBIOTICS

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ABSTRACT

The widespread misuse of antibiotics in the poultry sector has accelerated the emergence of multidrug-resistant strains, significantly limiting the therapeutic efficacy of these compounds and raising serious public health concerns. In this context, the use of probiotics represents a promising alternative strategy aimed at promoting a healthy gut microflora antagonistic to pathogens, while reducing dependence on antibiotics as growth promoters. In the present study, the gastrointestinal microflora of two Algerian indigenous roosters was investigated to isolate and identify lactic acid bacteria (LAB) with potential probiotic properties for use in food animal production. A total of 22 strains were isolated from six distinct gastrointestinal compartments, including the crop, cecum, ileum, jejunum, gizzard, and colon, and subsequently evaluated for their probiotic characteristics, including acid and bile salt tolerance, adhesion capacity, and hemolytic activity. Molecular identification was performed using species-specific primers targeting partial regions of the 16S rDNA gene, followed by sequencing of the amplified fragments of approximately 480 bp, allowing the assignment of isolates to the Lactobacillus genus. The antagonistic activity of the isolated Lactobacillus strains was assessed against several reference pathogenic strains, including both Gram-positive and Gram-negative bacteria, revealing a strong inhibitory activity likely attributable to the production of bacteriocins and organic acids. Collectively, these findings suggest that the identified strains possess key probiotic attributes that warrant further in vivo investigation. Once fully characterized, these strains represent promising candidates for incorporation into poultry feed as natural, antibiotic-free growth promoters and health-protecting agents, contributing to more sustainable and responsible poultry production practices.

Keywords: Lactic acid bacteria, Lactobacillus, probiotics, poultry, gastrointestinal microflora, 16S rDNA, antibiotic resistance, antibiotic alternatives, indigenous microflora, Algeria

ENTEROBACTERIA ISOLATED FROM POULTRY FARMS INTENDED FOR HUMAN CONSUMPTION: PRELIMINARY STUDY OF THEIR RESISTANCE TO 07 ANTIBIOTIC MOLECULES BELONGING TO THE CEPHALOSPORIN FAMILY

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ABSTRACT

The worrying development of antibiotic resistance, caused primarily by the careless use of antibiotics, is becoming a growing global concern. In humans, it has been scientifically proven that most antimicrobial resistant bacteria originate primarily from animals raised for human consumption. It was also recognized that these bacteria could easily contaminate products derived from these animals. It is therefore with the aim of having a precise idea of the state of the evolution of resistance to antimicrobials belonging to the cephalosporin family, in the poultry industry of the north-eastern of Algeria, which this study was carried out. This is why, antibiograms were carried out, on 205 isolates of avian Enterobacteria belonging to broiler farms and broiler turkey farms located in the North-East of Algeria, with regard to 07 antibiotic molecules belonging to the cephalosporin family (Cephalotin, Cefoxitin, Cefotaxime, Ceftazidime, Ceftiofur, Ceftriaxone and Cefepime). The results obtained were then processed statistically and they mainly expressed a general profile of antibiotic resistance characterized by moderate rates of resistance to molecules belonging to the cephalotin family (34.22%). The highest rate of resistance was recorded against ceftazidime, where high resistance to antibiotics (59.02%), a third generation cephalosporin, was revealed. The state of resistance to the antibiotics tested and revealed during our study is worrying, especially when we know that white meat is the most consumed in our country. These results would therefore constitute a real danger for the health of the Algerian consumer; this is why drastic measures must be applied to remedy this public health problem.

Keywords: Antibiotic resistance, Enterobacteria, cephalosprins, poultry farms

EPIDEMIOLOGICAL STUDY OF CONTAGIOUS ECHTYMA IN RUMINANTS IN THE SÉTIF REGION (ALGERIA)

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ABSTRACT

Contagious Ecthyma is a skin disease prevalent worldwide. It is a viral infection caused by a parapoxvirus, one of the most common viruses found in ruminants. This viral infection is generally mild but can lead to significant losses when rearing conditions are unfavorable. The objective of our study was to determine the prevalence of this disease in ruminants (sheep and cattle) on farms located in the Sétif region (northeast Algeria). Our epidemiological survey of Ecthyma in ruminants was based on data and observations collected on three farms over a three-month period. The disease was detected on only one sheep farm. The results showed a high prevalence of Ecthyma on this farm, affecting all age groups except yearlings. In sheep aged 0 to 6 months, the prevalence was 67.4%, and in those over 18 months, it was 67.7%. Ecthyma affected both sexes, with very similar rates in males (66.31%) and females (61.2%).Contagious Ecthyma is a skin disease prevalent worldwide. It is a viral infection caused by a parapoxvirus, one of the most common viruses found in ruminants. This viral infection is generally mild but can lead to significant losses when rearing conditions are unfavorable. The objective of our study was to determine the prevalence of this disease in ruminants (sheep and cattle) on farms located in the Sétif region (northeast Algeria). Our epidemiological survey of Ecthyma in ruminants was based on data and observations collected on three farms over a three-month period. The disease was detected on only one sheep farm. The results showed a high prevalence of Ecthyma on this farm, affecting all age groups except yearlings. In sheep aged 0 to 6 months, the prevalence was 67.4%, and in those over 18 months, it was 67.7%. Ecthyma affected both sexes, with very similar rates in males (66.31%) and females (61.2%).

Keywords: Ruminants, Echtyma, prevalence, sex, age, Sétif

RETROSPECTIVE STUDY ON THE EVOLUTION OF BOVINE TUBERCULOSIS IN EASTERN ALGERIA (ANNABA REGION)

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ABSTRACT

Bovine tuberculosis is a major public health problem that has received sustained global attention in recent years, while continuing to cause losses in the cattle farming sector. Economically, cattle farming in Algeria plays a dominant role in agricultural economic accounts and provides a significant portion of the human food supply through milk and red meat production. This study presents a retrospective analysis of bovine tuberculosis, based on data collected between 2020 and 2025. The study was conducted in eastern Algeria, specifically in the Annaba region, known for its high consumption of beef and raw milk. Veterinary inspection services identify cases of bovine tuberculosis each year through livestock screening. The bacterium (Mycobacterium bovis), responsible for this zoonotic disease, can be transmitted to humans through the consumption of raw milk or meat from infected animals. The results obtained during our study by the veterinary inspection services show a variable evolution of tuberculosis outbreaks in cattle between 2020 and 2025, ranging from 67 to 180 cases at the Seybouse regional slaughterhouse in Annaba. Regarding the consequences of these findings, seizures ranging from 282 kg to 664 kg were reported in the lungs, while smaller seizures were recorded in the liver, ranging from 66 kg to 173 kg. Emphasis must be placed on the need to implement a control program focusing primarily on methods of control, control and prophylaxis and to improve the conditions of ante-mortem and post-mortem inspections to prevent zoonoses which expose human and animal health to a real public health danger.

Keywords: bovine tuberculosis, meat, milk, consumption, inspection, prophylaxis.

COMPARATIVE EVALUATION OF SEMEN QUALITY IN ÎLE-DE-FRANCE RAMS OBTAINED BY ARTIFICIAL VAGINA AND ELECTROEJACULATION

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ABSTRACT

Reproductive efficiency is a key factor for the sustainable development of sheep farming and for the successful implementation of modern biotechnological methods in breeding programs. The collection of high-quality semen samples is essential for evaluating the breeding potential of male animals, as well as for the application of technologies such as artificial insemination and cryopreservation for genetic improvement of flocks. Among the most commonly used methods for semen collection in rams are the artificial vagina and electroejaculation, each of which has specific advantages and limitations regarding applicability and the quality of the obtained samples. The aim of the present study was to compare the quantitative characteristics of semen collected by artificial vagina and electroejaculation in young post-pubertal Île-de-France rams aged 9 months. The study included 10 clinically healthy breeding males from which semen samples (n = 10) were collected using both methods. The obtained ejaculates were subjected to standard laboratory evaluation using a computer sperm analyser (CASA), including determination of ejaculate volume, sperm concentration, total motility, percentage of progressively motile spermatozoa, and sperm velocity parameters. The results showed that both methods allow for the successful collection of semen suitable for reproductive purposes. Although no differences were observed in the average sample volume, samples collected using the artificial vagina method were characterized by a statistically significantly higher sperm concentration and percentage of progressively motile spermatozoa ($p < 0.05$) compared to samples obtained by electroejaculation. No statistically significant differences were found in the sperm velocity parameters between the two semen collection methods ($p > 0.05$). These results indicate better preservation of the functional characteristics of spermatozoa when using an artificial vagina as an effective method for semen collection in rams. The findings of this study may be useful for optimizing reproductive management practices and genetic improvement programs in sheep breeding.

Keywords: semen ejaculate, artificial vagina, electroejaculation, ram, Île-de-France

MULTI-CRITERIA PRIORITIZATION OF PROSPECTIVE M. BOVIS ANTIGENS FOR THE DEVELOPMENT OF A DIVA-COMPATIBLE SEROLOGICAL ASSAY

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ABSTRACT

Introduction. Bovine tuberculosis, caused mainly by Mycobacterium bovis, remains an important problem for livestock production, veterinary surveillance, wildlife management, and public health. Current diagnostic programs rely primarily on the tuberculin skin test and interferon-gamma release assays. Although these methods are widely used, their performance may vary depending on the stage of infection, the immune status of the animal, previous vaccination, and exposure to environmental mycobacteria. Serological assays may complement cell-mediated tests because they are suitable for large-scale screening, require relatively simple laboratory equipment, and can detect antibody responses associated with progressive infection. However, the use of a single antigen often provides insufficient diagnostic coverage because infected animals differ in the timing and intensity of their immune responses. Therefore, the development of multicomponent assays requires a rational selection of antigens with complementary biological and diagnostic properties. MPB70, MPB83, Ag85B, and ESAT-6 are among the most extensively studied immunoreactive proteins of M. bovis. MPB70 and MPB83 are strongly produced by M. bovis, whereas ESAT-6 is associated with the RD1 region and is absent from commonly used BCG vaccine strains. Nevertheless, additional antigens may improve the recognition of animals at different stages of infection and increase the potential of Differentiating Infected from Vaccinated Animals, or DIVA, diagnostics. The value of combining antigens with different immune-response profiles has also been emphasized in previous studies of M. bovis biomarkers. The aim of this study was to prioritize additional M. bovis antigens that could complement MPB70, MPB83, Ag85B, and ESAT-6 in a future DIVA-compatible serological assay for bovine tuberculosis. Materials and Methods. A literature-based multi-criteria assessment was used to prioritize additional Mycobacterium bovis antigens for a future DIVA-compatible serological assay. CFP-10, MPB80, EspA, EspC, EspD, LpqH, LprG, PknG, Zmp1, PE_PGRS20, and PE_PGRS47 were evaluated, while MPB70, MPB83, Ag85B, and ESAT-6 were considered the reference panel. The candidates were assessed according to evidence of antibody recognition in cattle, secretion or surface localization, DIVA potential, diagnostic specificity, sequence conservation, feasibility of recombinant production, and complementarity to the reference antigens. Each criterion was scored from 0 to 3, and the proteins were classified into high-, intermediate-, and lower-priority groups. Results. MPB80, CFP-10, and EspC were assigned to the highest-priority group. MPB80 was selected because of its strong immunogenicity, secretion, and suitability for recombinant production. However, its close similarity to MPB70 may limit the additional diagnostic information it provides. CFP-10 showed strong DIVA potential because it is associated with the RD1 region and is absent from BCG strains. Its antibody response in cattle may be less consistent than its cell-mediated response, suggesting that it is more suitable as a complementary antigen. EspC was also

considered promising because it is an ESX-1-associated secreted protein and may complement MPB-family antigens. Nevertheless, its serological reactivity in cattle requires further confirmation. EspA and LpqH were classified as intermediate-priority candidates. LprG, PknG, Zmp1, PE_PGRS20, and PE_PGRS47 received lower priority because evidence of stable antibody recognition in infected cattle is limited, despite their important roles in virulence and host–pathogen interactions. Conclusion. The multi-criteria assessment identified MPB80, CFP-10, and EspC as the most promising additional antigens for further investigation. Their combination with MPB70, MPB83, Ag85B, and ESAT-6 may improve antigenic coverage and support the development of a multicomponent DIVA-compatible serological assay. Further studies should include recombinant production of the selected proteins and comparative evaluation using sera from infected, vaccinated, and tuberculosis-free cattle.

Keywords: Mycobacterium bovis, bovine tuberculosis, DIVA diagnostics, serological assay, antigen prioritization, MPB80, CFP-10, EspC.

PRODUCTION AND EVALUATION OF THE RECOMBINANT ANTIGENS TNAP, TNFATP, AND TNPXDP FOR THE SEROLOGICAL DIAGNOSIS OF TRICHINELLA NATIVA

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ABSTRACT

Trichinellosis is a zoonotic parasitic disease of humans and animals caused by nematodes of the genus Trichinella and transmitted primarily through infected meat. The genus comprises ten recognized species and the distinct genotypes T6, T8, and T9. Among genotyped isolates, the most frequently identified taxa are T. spiralis (40.4%), T. britovi (37.5%), and T. nativa (17.1%). Trichinella nativa is of particular epidemiological importance because its larvae remain infective for prolonged periods in frozen game meat, increasing the risk of human infection and contamination of the food chain. In Kazakhstan, this risk is enhanced by the sustained circulation of the parasite among wild carnivores. Diagnosis includes artificial digestion and microscopy, molecular species identification, and serological assays. However, the serological window and limited species specificity of conventional antigens require alternative molecular targets. Promising candidates include aminopeptidase, the long-chain fatty acid transporter protein (FATP), and the PX domain-containing protein. Aminopeptidase is of particular interest because its T. spiralis homolog is highly immunoreactive and abundantly expressed during intestinal infection. The aim of the present study was to produce the recombinant T. nativa proteins TnAP, TnFATP, and TnPXdp and to perform a preliminary evaluation of their immunoreactivity as potential components of a serological diagnostic system. **Materials and Methods:** The genes encoding aminopeptidase, FATP, and the PX domain-containing protein of Trichinella nativa were selected as potential diagnostic targets. Gene-specific PCR generated the expected amplicons of 846, 792, and 969 bp, respectively. The PCR products were sequenced, cloned into the pJET1.2/blunt vector, and transformed into competent Escherichia coli DH5α cells. Following insert verification, the target fragments were subcloned into the pET-28c(+) expression vector using the restriction enzymes NcoI and XhoI. Recombinant protein expression was induced with 0.2 mM IPTG. The proteins accumulated predominantly in inclusion bodies, were solubilized in 6 M urea, and purified by nickel-affinity chromatography. Protein concentration and molecular weight were determined spectrophotometrically and by SDS-PAGE, respectively. Immunoreactivity was evaluated by Western blot analysis using sera from experimentally infected rabbits (n = 12) and naturally infected pigs (n = 50), with the excretory-secretory (ES) antigen and the commercial VetLine Trichinella assay used as reference systems. **Results:** PCR amplification produced aminopeptidase, FATP, and PX domain gene fragments of T. nativa with the expected sizes of 846, 792, and 969 bp, respectively. DNA sequencing confirmed that the amplified fragments corresponded to the target genes. Following cloning and restriction digestion with NcoI and

XhoI, expression constructs based on the pET-28c(+) vector were successfully generated. Induction with isopropyl β-D-1-thiogalactopyranoside resulted in the expression of the recombinant proteins TnAP, TnFATP, and TnPXdp, which were predominantly localized in inclusion bodies. Following solubilization and nickel-affinity purification, protein concentrations reached 365, 238, and 1,400 μg/mL, respectively. SDS-PAGE revealed distinct protein bands with apparent molecular weights of approximately 32 kDa for TnAP, 29 kDa for TnFATP, and 38 kDa for TnPXdp, consistent with the predicted values. Western blot analysis demonstrated that all three recombinant proteins were recognized by antibodies present in sera from experimentally infected rabbits and naturally infected pigs. The mean antibody titres obtained using the recombinant antigens were 1:7,350 in rabbit sera and 1:3,680 in pig sera. The corresponding titres obtained using the excretory-secretory antigen and the commercial diagnostic assay were 1:7,880 and 1:3,940, respectively. The differences between the recombinant and reference antigen systems did not exceed 6.7% for rabbit sera and 6.6% for pig sera. The results confirm the immunoreactivity of TnAP, TnFATP, and TnPXdp and support their further evaluation as candidate antigens for serological diagnosis. Additional studies should assess their sensitivity, specificity, reproducibility, and cross-reactivity with other Trichinella species and helminth infections.

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Keywords: Trichinella nativa, trichinellosis, recombinant antigens, immunoblotting, serodiagnosis.

VACCINATION IN COMPANION ANIMALS: CURRENT APPROACHES

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ABSTRACT

Vaccination is one of the most effective preventive measures in veterinary medicine for protecting companion animals against infectious diseases and reducing the transmission of zoonotic pathogens. Advances in immunology and vaccine technologies have significantly improved vaccination strategies in dogs and cats, leading to evidence-based vaccination protocols recommended by international organizations. This study evaluates the immunological basis of vaccination, current vaccine types, core and non-core vaccination protocols, factors affecting vaccine efficacy, adverse reactions, vaccine storage conditions, and legal and ethical aspects of vaccination in companion animals based on current scientific literature and international vaccination guidelines. Core vaccines provide essential protection against highly contagious and life-threatening diseases and are recommended for all dogs and cats regardless of their lifestyle, whereas non-core vaccines should be administered according to individual risk assessment, environmental exposure, and geographical disease prevalence. Successful immunization depends on appropriate vaccination schedules, consideration of maternal antibody interference, maintenance of the cold chain conditions, and individualized vaccination programs. Although mild local or systemic adverse reactions may occasionally occur following vaccination, serious complications are rare, and the protective benefits of vaccination greatly outweigh the associated risks. In addition to improving animal health and welfare, vaccination contributes significantly to public health by reducing the circulation of zoonotic pathogens within the framework of the One Health concept. Current evidence indicates that individualized vaccination protocols based on scientific guidelines remain the most effective strategy for preventing infectious diseases in companion animals and promoting sustainable veterinary preventive medicine.

Keywords: Dogs, Cats, Vaccination, Immunization, Core vaccines, Non-core vaccines, One Health.

EVALUATION OF RISK FACTORS FOR COLOSTRAL QUALITY AND PASSIVE TRANSFER OF IMMUNITY IN NEWBORN CALVES

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ABSTRACT

This study included 123 cow–calf pairs from three regions of Tizi-Ouzou Province, with the primary objective of evaluating the risk factors associated with poor immunological colostrum quality and failure of passive transfer of immunity (FPT). The immunological quality of colostrum was assessed using the glutaraldehyde coagulation test (COL-IgG-Test), while its bacteriological quality was evaluated using the California Mastitis Test (CMT) and standard bacteriological examination (SBE). Passive transfer was assessed in calves aged 2 to 6 days using the Calf-IgG-Test. The results showed that 62.6% of colostrum samples were of good quality (>50 g/L IgG), whereas 37.4% were of insufficient quality. Successful passive transfer was observed in 64.2% of calves, while 35.8% experienced failure of passive transfer. The incidence of neonatal diarrhea was 34.1%, and calf mortality reached 21.1%. Univariate analysis (Chi-square test) identified eight factors significantly associated with poor colostrum quality: CMT score ($\chi^2 = 81.7$), bacterial contamination ($\chi^2 = 82.2$), bacteriological quality ($\chi^2 = 79.8$), type of calving ($\chi^2 = 58.96$), energy balance ($\chi^2 = 54.9$), breed ($\chi^2 = 17.65$), and dry-period antibiotic therapy ($\chi^2 = 17.93$). All associations were highly significant ($p < 0.001$). Multivariate logistic regression analysis (Pseudo-$R^2 = 0.637$) identified only two independent predictors: dystocia (adjusted OR = 29.89; 95% CI: 5.95–150.33) and positive energy balance (adjusted OR = 0.015; 95% CI: 0.002–0.155). Bacteriological examination revealed a contamination rate of 28.5%, with *Staphylococcus aureus* (25.7%), *Escherichia coli* (25.7%), and *Streptococcus agalactiae* (25.7%) as the predominant bacterial species, followed by *Pseudomonas aeruginosa* (11.4%). All calf deaths (100%) and 95.5% of neonatal diarrhea cases occurred in calves with failure of passive transfer, highlighting the almost absolute protective effect of successful passive immunization. Failure of passive transfer of immunity is the main determinant of neonatal morbidity and mortality. Preventing dystocia and optimizing maternal energy balance during late gestation should therefore be considered priority strategies to improve colostrum quality and enhance passive immunity in newborn calves.

Keywords: cow, calf, immunoglobulin, colostrum, immunity, diarrhea, mortality

EVALUATION OF THE EFFECTS OF ANTIBIOTICS AND PROBIOTICS ON BOVINE SPERM PARAMETERS: AN IN VITRO EXPERIMENTAL STUDY BY CASA ANALYSIS

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ABSTRACT

This experimental study aimed to evaluate, in vitro, the respective effects of antibiotics and probiotics on frozen bovine sperm quality, using an automated sperm analysis system (CASA). While the scientific literature already attests to the harmful effects of antibiotics on male gametes, our work aims, on the one hand, to examine the potential of probiotics as a biological alternative to conventional antibiotic therapies in the management of genital infections, and, on the other hand, to identify possible synergies between certain antibiotics devoid of spermatic toxicity and probiotic strains, with a view to broadening the therapeutic spectrum of action within the framework of combined strategies. This research was conducted at the Laboratory of Animal Reproductive Biotechnology (LBRA) of the Veterinary Institute of Blida 1. The biological material used consisted of frozen bovine semen straws, sourced from the National Center for Artificial Insemination and Genetic Improvement (CNIAAG). The adopted methodology was structured in three successive phases. In the first instance, eight antibiotics commonly used in human and veterinary medicine were selected, namely tetracycline (TE 30), ciprofloxacin (Cip5), erythromycin (E5), rifampicin (Rif30), gentamicin (GN10), cotrimoxazole (CT10), colistin (Co10), as well as the amoxicillin-clavulanic acid combination (AMC30) – and were incubated at 37 °C for 4 hours with the semen, in accordance with the previously established minimum inhibitory concentrations. In the second instance, a similar incubation was carried out with a probiotic strain of lactobacilli, at a concentration set at 10^6 CFU/g, in accordance with the recommended effective dose. Finally, a third step consisted of selecting, among the previously tested antibiotics, those whose harmlessness to spermatozoa had been observed, in order to carry out an antibiogram after inoculation of the lactobacilli, with the aim of identifying a potential synergistic association.

The results obtained confirm the deleterious effect of antibiotics on the integrity and motility of spermatozoa, while incubation with probiotics induced a significant improvement in all the sperm parameters evaluated. These preliminary findings pave the way for further investigations, which should allow, on the one hand, the selection of antibiotics compatible with sperm functionality, and, on the other hand, the validation of a possible antibiotic-probiotic combination for therapeutic purposes.

Keywords: Semen, antibiotics, probiotics, artificial insemination, CASA system.

PREVALENCE AND MOLECULAR CHARACTERIZATION OF OVINE HERPESVIRUS-2 IN CATTLE AND SHEEP IN BALOCHISTAN, PAKISTAN

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ABSTRACT

Malignant Catarrhal Fever (MCF) is a fatal lymphoproliferative disease affecting cattle, while sheep act as asymptomatic natural reservoir hosts. The current study was designed to determine the prevalence of sheep-associated Malignant Catarrhal Fever (SA-MCF) in both sheep and cattle populations across Balochistan, Pakistan. A total of 100 blood samples were collected in EDTA containing tubes from sheep (n=50) and cattle (n=50) from Balochistan Pakistan. Genomic DNA was extrracted from buffy coat layer of collected blood samples and subsequently subjected to Hemi-Nested Polymerase Chain Reaction (PCR). Two sequential rounds of PCR were performed using ORF75 gene primers. For the first round of PCR, the primer pair 556 and 755 was utilized, while the primer pair 556 and 555 was used for the second round. A total of 12 samples out of 100 were found positive, successfully displaying the expected target band size of 238 bp. The confirmed positive samples were subjected to gene sequencing to verify ORF75 gene sequence. Upon sequencing, the resulting ORF75 gene sequences were compared with reference sequences available in the NCBI database using the BLAST alignment tool. Phylogenetic analysis performed via MEGA 7 software revealed that the local ORF75 gene shared up to 90% sequence similarity with isolates reported from India, Japan, Brazil, United Kingdom, South Africa, Germany, and Turkey. These findings confirm that SA-MCF is prevalent in Balochistan and circulating virus has genetic alignment with global isolates. Strict biosecurity measures and mixed-species grazing management are required to minimise cross-species transmission and control the disease.

Keywords: Malignant Catarrhal Fever, Ovine Herpesvirus-2, Hemi-Nested PCR, ORF75

SPECIFIC WELFARE REQUIREMENTS ON COMMERCIAL CATTLE FARMS IN ROMANIA

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ABSTRACT

On commercial cattle farms in Romania, it is essential to comply with the specific requirements regarding animal welfare and protection in accordance with the applicable European legislative framework. In particular, this article focuses on higher welfare standards for young cattle in fattening operations. The study focuses on cattle farms authorized by the sanitary-veterinary authorities that house young female and male cattle up to 32 months of age, with a minimum live weight of 450 kg per head, and addresses three specific requirements that support the welfare of these animals, namely: an increase of at least 15% in the space allocated to each animal, ensuring enhanced comfort in the resting area, and providing optimized feed rations to enhance animal welfare and reduce greenhouse gas emissions. For each of the three specific requirements, a set of assessment criteria is taken into account. First of all, the measurements of the usable floor area within the unit are carried out for each space or compartment. Several parameters are recorded, including the live weight of the fattening cattle and the minimum space allowance required for the respective category of animals. Secondly, on-site inspections are conducted to verify the availability and use of absorbent bedding materials, including mats and hygroscopic bedding, depending on the type of farming system. Last but not least, the monthly feed analysis reports issued by an accredited specialized laboratory are examined to verify compliance with the established requirements. It can be concluded that the results observed as a result of the improved animal welfare following the implementation of these requirements will be appropriately highlighted for the farms analyzed.

Keywords: young cattle, animal welfare, greenhouse gas emissions

EVALUATION OF TYLOXAPOL IN THE ATTENUATION OF PATHOLOGICAL EFFECTS OF INDUCED INTRA-ABDOMINAL SEPSIS IN RABBITS

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ABSTRACT

Intra-abdominal sepsis caused by the colonic flora is considered the second most common source of sepsis, responsible for unacceptably high morbidity and mortality, both in humans and animals. Sepsis is a systemic response to infection, typically characterized by excessive inflammation, induced by the cascade of cytokines and chemokines, eventually leading to endothelial cell damage and multiple organ dysfunction. Due to the irrational use of antibiotics in the treatment of sepsis, antibiotic resistance develops. Thus, there is a need for alternative drugs for the treatment of sepsis. To this end, Tyloxapol is a non-ionic surfactant that protects macrophages against activation and prevents the release of proinflammatory cytokines. Therefore, this study was designed to investigate the effectiveness of Tyloxapol in attenuating induced intra-abdominal sepsis. For this purpose, 36 adult healthy rabbits were randomly divided into three equal groups (A, B and C). These rabbits were induced with sepsis through Cecal Ligation and Puncture (CLP). After induction of sepsis, Group A was considered positive control and was not treated with any drug. Group B was considered positive control and was treated with intravenous injection of Meropenem and Flunixin Meglumine @ 20 mg/kg and 2 mg/kg body weight, respectively. Group C was treated with an intravenous injection of Tyloxapol @ 200 mg/kg Body weight. Two rabbits from each group were randomly selected for sampling at t = 0 h, t=12h, t = 24 h, t = 48 h, t=72h and t = 96 h after treatment for hematological, and haemato-biochemical parameters, and the survival of rabbits were observed for up to 96 hours. Results showed improvement in hemodynamic parameters by Tyloxapol. Similarly, Tyloxapol showed a better recovery trend compared to Meropenem by altering the hematological parameters at t=48 hr with a significant improvement in neutrophil, monocyte, lymphocyte, and leucocyte count. Tyloxapol also prevents liver and kidney damage through a significant decrease in ALT, AST, Bilirubin, Creatinine, and Urea Levels. Histopathological study showed the protective effect of Tyloxapol on Liver, kidney and lung damage.

Keywords: Sepsis, Tyloxapol, E. coli, Resuscitation, Cecal Ligation and Puncture, Cytokines, Chemokines

THERAPEUTIC POTENTIALS OF COLEBROOKEA OPPOSITIFOLIA AGAINST DOXORUBICIN-INDUCED TOXICITY IN RATS

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ABSTRACT

Background: Therapeutic potentials of Colebrookea Oppositifolia (family Lamiaceae), have been reported as anti-microbial, anti-inflammatory, anti-oxidant, antiulcer and cardioprotective. However, the protective potentials of the plant against the toxicity of chemotherapeutic drugs including Doxorubicin (DOX) is not studies so far. **Aim:** The purpose of this study was to investigate the therapeutic potentials of Colebrookea Oppositifolia (E) against DOX-induced toxicity in pulmonary tissues of rats. **Experimental Design of study:** Four to five weeks old, healthy male Sprague-Dawley rats were divided into 5 groups including Control, Dox-treated (I.P injected), Dox + E200 (oral gavage), Dox + E400 (oral gavage), and E400 (oral gavage) only. The experiment was conducted for 6-7 weeks. Histopathological examination of lung tissues, antioxidant enzymes, genomic DNA, qRT-PCR, and western blot analyses were conducted. **Results:** A significant loss in body weight along with remarkable histopathological changes were observed DOX-treated group. The activities of antioxidant marker enzymes; CAT, SOD and POD were decreased while the activity of LPO was increased in DOX-treated group. Furthermore, the expressions of p53, p21, Bax and Caspase 3 were significantly dysregulated at mRNA and proteins level in the DOX-treated group. On the other hand, a notable recovery in the body weight, histology of lung tissues, antioxidant enzymes activities and expression patterns of the targeted genes and proteins were observed in C.oppositifolia group. **Conclusion:** Altogether, the present results showed that C.oppositifolia has significant potential to overcome the DOX-induced toxicity in pulmonary tissues of rats. A detailed analysis of the bioactive ingredients of C.oppositifolia is further needed to understand the protective mechanism of action of active compounds against DOX-induced toxicity.

Keywords: Doxorubicin, Pulmonary toxicity, Apoptosis, Colebrookea oppositifolia

MECHANISM OF ACTION OF CHEMOTHERAPEUTIC DRUG; DOXORUBICIN-INDUCED TOXICITY AND APOPTOSIS IN RAT MODEL

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ABSTRACT

Background: Doxorubicin (DOX) is a commonly used anticancer drug which is highly recommended for the treatment of both solid tumors and liquid malignancies. Despite a broad-spectrum chemotherapeutic drug, its clinical applications are limited due to pyroptosis and inflammation based cardiotoxicity of cardiomyocyte and hepatotoxicity. Furthermore, the side effects of DOX on other organs than heart are still not fully understood. **Aim:** The aim of this study was to investigate the molecular mechanism of action of DOX-induced toxicity and apoptosis in rat Model. Moreover, protective potentials of a selected medicinal plant; Colebrookea Oppositifolia (L. Lamiaceae) against DOX were evaluated. **Methodology:** Five groups of four to five weeks old, healthy male Sprague-Dawley rats were made including Control, Dox-treated (I.P injected), Dox + E200- Dox + E400-, and E400 (oral gavage) only. The experiment was conducted for around six to seven weeks. Histopathological examination of various tissues (liver, lungs, kidney etc.), antioxidant enzymes, genomic DNA, qRT-PCR, and western blot analyses were conducted. **Results:** A significant reduction in the body weight along with a remarkable histopathological alteration was found in the DOX-treated rats. The level of antioxidant marker enzymes; catalases, superoxide dismutases, and peroxidases were decreased, however the activity of lipids peroxidases were increased in DOX-treated group. A significant damage was observed in the genomic DNA isolated from various tissues of male rats treated with DOX. Furthermore, the expressions of p53, p21, Bax, Caspase 3, Caspase 9 and Parp-1 were significantly dysregulated at mRNA and proteins level in the DOX-treated group. On the other hand, a significant recovery in the body weight, histology of various tissues, antioxidant enzymes and expression pattern of the targeted genes and proteins were observed in the groups treated with an extract of Colebrookea Oppositifolia. **Conclusion:** Altogether, the present results showed that DOX-induced toxicity and apoptosis in various tissues of rats followed the genomic DNA/p53-dependent intrinsic signaling pathway of apoptosis. Furthermore, C.oppositifolia has the potential to recover the DOX-induced toxicity and apoptosis in various tissues of rat model.

Keywords: Doxorubicin, Chemotherapy, Toxicity, Apoptosis, Rat, Colebrookea oppositifolia.

EUGENOL EXTRACTS AS FUNCTIONAL FEED ADDITIVES: IN VITRO BIOACTIVITY ASSESSMENT FOR SUSTAINABLE ANIMAL NUTRITION

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ABSTRACT

The transition toward antibiotic-free livestock production has intensified the search for plant-derived functional feed additives capable of supporting animal health, productivity, and product quality. Among phytogenic compounds, eugenol - the principal phenolic constituent of clove (Syzygium aromaticum, representing 70–90% of its essential oil), has attracted increasing attention due to its broad-spectrum biological activity and favorable safety profile. Recent studies highlight its multifunctional role in modulating microbial populations, oxidative stress, and inflammatory responses, positioning it as a promising alternative to conventional growth promoters. Unlike many plant-derived additives that exhibit narrow or species-specific effects, eugenol demonstrates combined antimicrobial and antioxidant properties, enabling simultaneous targeting of gut microbial balance and systemic oxidative status. Its lipophilic nature facilitates interaction with bacterial cell membranes, contributing to its efficacy against both Gram-positive and Gram-negative bacteria, while its phenolic structure underlies its radical scavenging capacity. Despite these advantages, its dose-dependent effects, bioavailability, and long-term physiological impacts in animal systems remain insufficiently characterized. This study presents a preliminary chemico-biological evaluation of eugenol-rich clove hydrosols and residual fractions with potential application in animal nutrition. Antimicrobial activity was assessed using broth microdilution assays against Bacillus subtilis 3562 and Escherichia coli K12, with growth inhibition reaching up to 96% at selected concentrations. Antioxidant capacity was evaluated via DPPH radical scavenging, yielding EC50 values between 0.48 and 2.39 mg/mL. These findings confirm that clove-derived matrices retain significant bioactivity, even outside purified essential oil fractions. From an agricultural perspective, such properties are particularly relevant for monogastric livestock systems, including poultry, swine, and rabbits, where intestinal health is closely linked to feed conversion efficiency and immune competence. Emerging evidence suggests that phytogenic additives such as eugenol may contribute to improved gut integrity and reduced reliance on synthetic antimicrobials, aligning with sustainable and welfare-oriented production models. Based on the present in vitro results, eugenol-rich extracts demonstrate potential for incorporation into feed formulations at controlled inclusion levels. However, their dual bioactivity also necessitates careful dose optimization to avoid potential pro-oxidant or microbiome-disruptive effects at higher concentrations. **In conclusion**, this study provides a scientifically grounded basis for further in vivo validation and highlights eugenol as a multifunctional, yet still underexplored, candidate in the development of next-generation functional feed additives for sustainable animal production.

Keywords: phytogenic feed additives, animal nutrition, antimicrobial activity, antioxidant capacity.

THE USE OF ESSENTIAL OILS IN POULTRY FARMS: PRELIMINARY STUDY VALIDATING THE ANTIBIOTIC ACTION OF 02 ALGERIAN ESSENTIAL OILS ON MULTI-RESISTANT AVIAN ENTEROBACTERIA

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ABSTRACT

The overuse and inappropriate use of antimicrobials has ultimately destroyed the curative power of these molecules. Following this observation, our approach consisted of considering the use of new substances likely to have the same antibacterial effect as antibiotics while offering the advantage of avoiding the selection of new resistant bacteria. This is why we naturally thought of medicinal plants and more specifically their essential oils. After isolating 69 multi-resistant strains of avian Enterobacteria belonging to three bacterial species: E.coli, Proteus vulgaris and Proteus mirabilis and identifying their antibiotic resistance profile against 21 antibiotic molecules, we subjected them, by carrying out aromatograms in triplicate, to the action of two essential oils, Rosemary (Rosmarinus officinalis L.) and Thyme (Thymus vulgaris L.) and this in order to determine their possible antibacterial effect. Gas chromatography coupled with mass spectrometry (GC-MS) allowed us to identify the main chemical components of each essence, which turned out to be 1,8 Cineole (39.75%) for Rosemary essence and Carvacrol (73.03%) for Thyme essential oil. The production of aromatograms confirmed that Thyme essential oil had, in vitro, a superior antibacterial power (average diameter of the inhibition zones estimated at 29.06±0.327 mm) compared to that revealed by Rosemary essence (average diameter of the inhibition zones estimated at 11.42±0.263 mm) and that the most sensitive bacterial species was Proteus vulgaris (average diameter of the inhibition zones estimated at 32.47±0.247 mm). In poultry farming, these results, obtained in vitro, seem very promising in the case where we are considering replacing antibiotics with essential oils.

Keywords: Antibiotic resistance, Enterobacteria, Rosmary essential oil, Thyme essential oil.

ASSESSMENT OF THE EFFECT OF CHITOSAN PRIMING ON THE GERMINATION OF PEPPERS UNDER LOW-TEMPERATURE CONDITIONS USING MACHINE LEARNING METHODS

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ABSTRACT

Chitosan has been shown in research to act as a plant tolerance inducer that supports natural defence mechanisms against abiotic stress factors, and its use in agriculture is steadily increasing. Recent literature reports indicate that, in various plant species, chitin and chitosan, when applied via soil or foliar application, are effective in promoting plant growth and seed germination. Peppers (*Capsicum annuum*), a warm-climate vegetable species, exhibit poor germination at low soil temperatures. This study focused on the effect of chitosan priming on germination in peppers experiencing germination problems under low-temperature (10 °C, 15 °C) and control (24 °C) conditions. Furthermore, this effect was investigated using machine learning methods. Priming treatments were applied using three different chitosan concentrations (0.050%, 0.075%, and 0.1%) and two different incubation times (4 hours and 6 hours). At the conclusion of the study, the germination rate, average germination time, germination rate index, and early seedling parameters were determined. These data were subsequently analysed using machine learning algorithms. The results of the study indicated that chitosan priming has the potential to support germination in sweet pepper seeds under low-temperature conditions; however, it was observed that the success of the treatment depends on the combination of dose, duration, and temperature. The findings indicate that, of the treatments, the 0.050% chitosan treatment produced a more balanced response in terms of germination rate; in terms of temperature, the lowest germination rate was observed at 10 °C (mean 50.91%), whilst the highest was recorded at 15 °C (mean 90.17%). About incubation times, the 6-hour treatment was found to reduce the germination time of the seeds and increase the vigour index, whilst the 4-hour treatment was observed to increase the germination rate, as well as hypocotyl and root length and weight. Therefore, rather than a fixed protocol for chitosan priming of sweet pepper seeds, it is recommended to use dose and duration combinations optimised according to the target germination temperature. With regard to machine learning models, it was found that XGBoost and MARS were the best models for predicting germination and early seedling parameters, whilst the GPC model lagged behind the other two models, particularly in the prediction of germination parameters.

Keywords: Biopriming, low-temperature stress, machine learning, seed physiology

BIOACCUMULATION MECHANISMS AND OXIDATIVE STRESS-MEDIATED TOXIC EFFECTS OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

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ABSTRACT

Per- and polyfluoroalkyl substances (PFAS), which cannot be metabolized due to their strong carbon–fluorine bonds, can stay in the human body for years because of their long biological half-lives and lead to bioaccumulation. Because of their high chemical stability and resistance to biological breakdown, they are called "forever chemicals." These compounds attach to albumin and other carrier proteins, are transported through the bloodstream, and enter cells via carrier proteins, building up in various tissues, mainly in the liver. PFAS exposure causes toxicity mainly through oxidative stress at the cellular level. By disrupting mitochondrial function, PFAS increase the production of reactive oxygen species (ROS) while suppressing antioxidant defenses such as superoxide dismutase, catalase, and the glutathione system, thereby reducing overall antioxidant capacity. As a result, cells struggle to counteract the increased ROS, disrupting redox balance and leading to oxidative stress. This stress results in DNA damage, lipid peroxidation, and changes in cell structure. Studies have shown that PFAS compounds such as PFOS, PFOA, PFNA, and PFHxS cause DNA strand breaks, elevate biomarkers of oxidative and nitrosative stress, and trigger inflammatory responses. The liver is the primary target, where PFAS accumulation disrupts lipid metabolism, promotes inflammation, and causes liver toxicity. Furthermore, the nervous system and developmental processes are negatively impacted through PFAS-induced oxidative stress. PFAS also activate PPARα and related pathways, alter fatty acid metabolism, increase peroxisomal oxidation, and enhance the internal oxidative load. This study examined the bioaccumulation mechanisms of PFAS, the processes involved in oxidative stress development, and the toxic effects resulting from these mechanisms. It assessed cellular uptake, bioaccumulation features, stages of oxidative stress, and PFAS impacts on DNA damage, lipid peroxidation, hepatotoxicity, neurotoxicity, and developmental toxicity based on current literature. The findings demonstrate that PFAS are important environmental pollutants posing a serious risk to human health due to their bioaccumulation and oxidative stress-related toxicity mechanisms. Consequently, developing strategies to reduce PFAS exposure and further exploring their toxicity mechanisms are recommended.

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Keywords: PFAS, oxidative stress, bioaccumulation, reactive oxygen species (ROS), toxicity.

A SOFTWARE THAT RETRIEVES VARIOUS DATA FROM PROTEIN DATABASES ON THE COMPUTER COMMAND LINE

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ABSTRACT

Currently, the web interfaces of protein databases, which contain diverse information about various proteins, are quite complex. Therefore, it can be difficult for researchers to retrieve information about a protein from these databases. To facilitate this, a software program has been developed that runs from the computer command line, retrieves data from various protein databases, operates using the Python programming language and the CPython programming environment, does not even require a graphical interface, and is compatible with Windows and Pardus. This software, developed within the scope of this study, can retrieve information about the desired protein from the desired database (UniProt, RCSB Protein Data Bank, Protein Data Bank in Europe, Protein Data Bank Japan, and The Human Protein Atlas databases) based on the argument input in the computer command line environment. Since this software does not use a web interface, it does not require a web browser; however, it still requires an internet connection because it retrieves data from remote servers. This software has been tested and works as intended. In conclusion, the software developed in this study differs from similar software in the literature in that it can retrieve information about the desired protein from many existing protein databases in the desired format. It has been observed that this software can be easily used by researchers working in various fields such as biophysics, bioinformatics, and bioengineering who work with proteins. It is believed that researchers using this software will be able to easily obtain information about proteins from existing databases and thus accelerate their scientific studies.

Keywords: protein, protein databases, software

EVALUATION OF THE CURATIVE AND PREVENTIVE ANTIDIABETIC EFFECTS OF HONEY IN WISTAR RATS AND ITS IN VITRO A-AMYLASE INHIBITORY ACTIVITY

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ABSTRACT

This study, conducted within the framework of apitherapy, investigates the antidiabetic potential of natural honey. Specifically, it aims to evaluate the preventive effect of honey against streptozotocin (STZ)-induced diabetes in Wistar rats and to assess its inhibitory activity toward porcine pancreatic α-amylase (PPA). Male Wistar rats aged over three months were randomly assigned to two experimental groups. The first group was administered honey orally at a daily dose of 100 mg/kg, while the control group received normal saline. After a one-month pretreatment period, diabetes was induced in both groups by a single intravenous injection of streptozotocin (STZ) at 50 mg/kg. Following diabetes induction, honey administration was continued at the same daily dose. Concurrently, the inhibitory activity of honey and its ethyl acetate and aqueous fractions against porcine pancreatic α-amylase (PPA) was investigated in vitro. The results showed that the tested dose of honey had no adverse effect on the body weight of the rats. A significant increase in blood glucose levels ($p = 0.04$) was observed in untreated rats compared with those pretreated with honey. Continuous administration of honey significantly improved fasting blood glucose levels, suggesting both preventive and therapeutic effects against STZ-induced diabetic alterations. Furthermore, the results demonstrated that crude honey effectively inhibited α-amylase activity, with an IC_{50} value of 0.68 ± 0.10 mg/mL, comparable to that of acarbose ($IC_{50} = 0.69 \pm 0.02$ mg/mL). Among the honey fractions, the organic fraction exhibited greater inhibitory activity ($IC_{50} = 3.00 \pm 0.13$ mg/mL) than the aqueous fraction ($IC_{50} = 11.34 \pm 0.60$ mg/mL) This study provides evidence of the antidiabetic potential of honey, especially in preventing STZ-induced diabetic damage, and reveals its capacity to inhibit polysaccharide digestion through α-amylase inhibition.

Keywords: Honey, diabetes mellitus, preventive activity, streptozotocin, α-amylase inhibition.

GENOME-BASED CHARACTERIZATION OF AN ENDOPHYTIC NITROGEN-FIXING BACTERIUM ASSOCIATED WITH VIGNA UNGUICULATA IN ALGERIA

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ABSTRACT

environments, where its productivity is strongly influenced by soil fertility and beneficial microbial symbioses. This study reports the whole-genome sequence and characterization of an endophytic bacterial strain isolated from efficient root nodules of Vigna unguiculata collected from Ksar Ben Aissa, Timimoun, Algeria. The strain was identified as Ensifer sp. And its phenotypic characterization showed that it is a Gram-negative bacillus and displaying oxidase, urease, and catalase activities. Biochemical profiling using API 20NE and API 50CH revealed a metabolically versatile strain with a specific biochemical signature, including positive reactions for glucose utilization and selective assimilation of several carbon sources such as D-maltose, D-lactose, D-ribose, D-glucose, D-galactose, D-turanose, D-arabinose, and inositol. The strain tolerated NaCl concentrations up to 0.4%, grew across a wide pH range from 4 to 12, and remained viable at temperatures between 25 and 37°C, indicating a high level of adaptation to environmental stress. In addition, the strain produced indole-3-acetic acid (IAA), reaching a maximum concentration of 19.09 µg/mL, which suggests plant growth-promoting potential. Whole-genome sequencing was performed to gain deeper insight into the genetic basis of nodulation, nitrogen fixation, plant growth promotion, and stress adaptation. Genome-based analysis highlighted functional traits associated with endophytic colonization, symbiotic efficiency, and survival under the harsh conditions typical of the Algerian Sahara. Overall, this work underscores the potential of indigenous symbiotic bacteria as natural bioinputs for sustainable agriculture in desert ecosystems and provides a foundation for developing inoculants adapted to arid environments to improve legume productivity under stress conditions.

Keywords: Vigna unguiculata, Ensifer sp., whole-genome sequencing, nitrogen fixation, endophytic bacteria, root nodules, desert agriculture, Algeria.

GENOMIC INSIGHTS INTO PRIESTIA MEGATERIUM STRAIN ASSOCIATED WITH COWPEA NODULES FROM ALGERIAN DESERT

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ABSTRACT

Cowpea is an important legume crop in Africa, serving as a major source of protein, improving soil fertility through nitrogen fixation, and supporting food security in arid and semi-arid regions. Nitrogen availability is a major constraint for plant growth in arid ecosystems, where microbial partners may play an important role in supporting host performance. Root nodules of cowpea (Vigna unguiculata) collected from a Saharan environment were subjected to bacterial isolation, and one isolate was selected for taxonomic and genomic characterization. The isolate was also tested in a pot experiment for plant growth-promoting traits. Although recovered from nodules, the isolate was not a symbiotic rhizobium, yet it retained the capacity to fix nitrogen independently. Whole-genome sequencing identified the isolate as Priestia megaterium, and genome annotation revealed genes associated with nitrogen fixation, nitrogen metabolism, and several plant growth-promoting traits. The in planta assay showed potential growth promotion in cowpea. The presence of this bacterium within cowpea nodules suggests that the nodule microbiome is more diverse than previously assumed and may include non-symbiotic diazotrophs that contribute to plant nutrition without establishing a classical symbiotic relationship. These findings broaden our understanding of nodule-associated bacteria in harsh Saharan conditions and highlight the potential ecological relevance of endophytic, free-living nitrogen-fixing bacteria in enhancing nitrogen availability and supporting plant adaptation in nutrient-limited environments.

Keywords: Cowpea, Sahara, Priestia megaterium, Nitrogen fixation, Plant growth promotion, Root nodules, Whole-genome sequencing

ISOLATION, CHARACTERIZATION, AND SYMBIOTIC EVALUATION OF A NATIVE BRADYRHIZOBIUM SP. ISOLATED FROM ROOT NODULES OF VIGNA UNGUICULATA (L.) WALP. IN SOUTHERN ALGERIA

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ABSTRACT

Native rhizobia are adapted to arid environments and represent valuable resources for the development of sustainable biofertilizers. This study aimed to isolate, characterize, and evaluate the symbiotic potential of a native Bradyrhizobium sp. strain named V8 that obtained from a root nodule of cowpea (Vigna unguiculata (L.) Walp.) cultivated in southern Algeria.
Apparently healthy root nodules were collected from field-grown cowpea plants, and bacterial isolation was performed under sterile conditions. The isolate was characterized based on morphological and physiological traits and identified by 16S rRNA gene sequencing. Sequence analysis confirmed its affiliation with the genus Bradyrhizobium. The symbiotic performance of the isolate was evaluated through inoculation experiments under nursery conditions using cowpea (Vigna unguiculata) and pea (Pisum sativum) as host plants. Nodulation, plant growth, and biomass production were assessed and compared with uninoculated controls. Inoculated plants showed enhanced nodulation and improved vegetative growth, indicating the ability of the isolate to establish an effective symbiosis with both legume species. These findings highlight the potential of this native Bradyrhizobium strain as a promising bioinoculant for cowpea cultivation in arid regions. Further studies on its symbiotic efficiency and agronomic performance under field conditions are needed to support the development of locally adapted biofertilizers for sustainable agriculture.

Keywords: Bradyrhizobium sp., Vigna unguiculata, Pisum sativum, biological nitrogen fixation, nodulation, southern Algeria

ENVIRONMENTAL SURVEILLANCE OF ESBL PRODUCING ESCHERICHIA COLI AND ANTIBIOTIC RESISTANCE IN THE SHKUMBINI RIVER ECOSYSTEM, ALBANIA

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ABSTRACT

Recent studies have demonstrated that ESBL-producing E. coli are globally common in aquatic environments such as lakes and rivers, detecting viable ESBL producers in a high proportion of water samples. The main objective of this study was to investigate the occurrence, diversity, and phenotypic and molecular characteristics of ESBL-producing E. coli in the aquatic environment, in the Shkumbini River Ecosystem. Antimicrobial susceptibility analysis of the ESBL producing E. coli revealed that 100 % of isolates were resistant to at least one antimicrobial agent in three or more antimicrobial categories thus characterized as multidrug resistant (MDR). Molecular characterization of ESBL producing isolates revealed the prevalence and diversity of the β-lactamase resistance genes among them. The most prevalent ESBL Genotype was blaCTX-M-1 (33.33%, 5/15). Overall, the findings of our study are worrisome, emphasizing the importance of rivers as potential reservoirs of antibiotic resistance genes (ARGs), imposing serious threats to public health as well as the necessity of a more detailed analysis of genomic features of ESBL E. coli isolates to better understand the pathogenic potential and the epidemic characteristics of them in the aquatic ecosystem. Considering the continuous interaction between aquatic ecosystems, human activities, and animal production systems, the detection of ESBL-producing E. coli in the Shkumbini River emphasizes the urgent need for coordinated One Health-based surveillance programs to identify transmission pathways and develop effective strategies for controlling the environmental dissemination of antimicrobial resistance.

Keywords: ESBL-producing E.Coli, surface water, antibiotic resistance genes

SUB-REGION CLASSIFICATION ANALYSIS WITHIN THE METROPOLITAN AREA OF ISTANBUL

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ABSTRACT

This study examines the administrative structure of Türkiye at the provincial and district levels and evaluates the spatial, demographic, and developmental characteristics of the districts of Istanbul within the context of metropolitanization and future urban settlement development. Istanbul, as Türkiye's largest metropolitan area and one of the country's most significant economic, social, and spatial centers, has experienced rapid population growth, urban expansion, migration, and infrastructural transformation. These processes have resulted in substantial differences among its districts in terms of population size, population density, urbanization, accessibility, and socioeconomic development. Accordingly, identifying spatial patterns and potential future metropolitan sub-regions is important for effective urban and administrative planning. Within the scope of the study, the historical and current criteria for provincial status in Türkiye were initially examined, together with the development disparities observed among provinces and districts. Considering that regional development differences cannot be adequately explained by a single indicator, a multidimensional approach was adopted. Population, population density, urbanization characteristics, development level, geographical location, and spatial proximity were evaluated as major parameters. A classification analysis was subsequently conducted using the R-Studio statistical programming environment in order to identify homogeneous groups of districts and determine potential metropolitan sub-regions. The analysis was based particularly on the spatial relationships and distances among districts, while demographic and developmental characteristics were considered in the interpretation of the resulting clusters. The findings indicate that Istanbul can be classified into eight major metropolitan regions according to localization, spatial proximity, and development characteristics. These regions are identified as: (1) the European Continental Center, comprising Sultangazi, Gaziosmanpaşa, Kâğıthane, Esenler, and Eyüpsultan; (2) the European Bosphorus–Marmara Region (Historical Peninsula Development Zone), comprising Şişli, Beşiktaş, Beyoğlu, Fatih, Zeytinburnu, Bayrampaşa, Güngören, Bahçelievler, and Bakırköy; (3) the European Peripheral Centralization Region, comprising Esenyurt, Avcılar, Başakşehir, Küçükçekmece, and Bağcılar; (4) the European Outer Peripheral Cluster, comprising Beylikdüzü, Arnavutköy, Çatalca, Silivri, and Büyükçekmece; (5) the Anatolian Bosphorus–Marmara Region (Historical Üsküdar Development Zone), comprising Üsküdar, Ümraniye, Kadıköy, Ataşehir, and Maltepe; (6) the Continental Bosphorus Area, comprising Beykoz and Sarıyer; (7) the Anatolian Inner Region, comprising Çekmeköy, Sancaktepe, Sultanbeyli, and Şile; and (8) the Anatolian Southern Center, comprising Kartal, Pendik, Tuzla, and Adalar. The results suggest that Istanbul's future metropolitanization is likely to develop primarily within these eight spatial regions. In addition, potential administrative restructuring is anticipated in several areas, particularly within Eyüpsultan and Şişli, as well as through possible boundary and administrative changes involving Çekmeköy, Pendik, and the Avcılar–Başakşehir area. The findings demonstrate that multidimensional and spatially based classification can provide a useful framework for understanding metropolitan development and identifying potential future

sub urban trends. The proposed regional classification may therefore contribute to urban planning, regional development policies, transportation and infrastructure planning, and future administrative organization in Istanbul. More broadly, the study emphasizes the need for comprehensive, multi-criteria analyses of metropolitan cities in Türkiye, particularly in the context of increasing population concentration, urban expansion, and regional development disparities.

Keywords: clustering, infrastructure, province status, urbanization, development

ANALYSIS OF FREE SUGARS AND SUGAR ALCOHOLS IN PISOLITHUS ARHIZUS USING HPAEC-PAD

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ABSTRACT

Pisolithus arhizus is a strong ectomycorrhizal fungus distributed globally. Unlike most of its ectomycorrhizal relatives, it forms a closed, gasteroid fruiting body protected by a thick, sturdy outer layer called a peridium. In Turkey, its fruiting bodies have been documented growing in ectomycorrhizal associations with major forest tree genera, including Abies, Betula, Eucalyptus, Pinus, and Quercus. Depending on a continuous carbon exchange with its host plant for its symbiotic life cycle, its method of breaking down carbohydrates is entirely unique. Analyses quantitatively confirm its fruiting bodies contain carbohydrates at a remarkably high proportion, measuring around 47.87 percent on a dry-weight basis. Furthermore, solvent extracts demonstrate strong antioxidant effects, cellular DNA protection, and anticancer properties against HT29 colon cancer cells. These strong bioactivities are attributed to extracts containing high levels of phenolic compounds, triterpenoids, and diverse soluble carbohydrates like sugar alcohols and glucans. To properly unravel the intricate profiles of the free sugars and sugar alcohols underlying these bioactivities, advanced High-Performance Anion Exchange Chromatography with Pulsed Amperometric Detection (HPAEC-PAD) was utilized. The analytical preparation involved pulverizing dried fruiting bodies, extracting them with boiling deionized water, and freeze-drying the extract. For the chromatographic separation, a strong anion-exchange column was maintained at 20 degrees Celsius. A borate ion-trap column was integrated into the system to prevent trace borate ions from causing peak tailing in sensitive carbohydrates. Electrochemical detection utilized a flow cell incorporating a gold working electrode at 35 degrees Celsius, applying a precise four-step potential waveform under alkaline conditions. The chromatographic results for this species exhibited a balanced and structurally diverse profile comprising exactly seven components. While its total free sugar content was remarkably high at 19.61 grams per 100 grams of dry weight, its profile was characterized by spreading the osmotic load across multiple constituents rather than relying on a single dominant molecule. The chromatogram revealed three closely spaced peaks rising sequentially within the first two minutes, representing sorbitol, mannitol, and trehalose, followed by a distinguishable glucose peak. Trehalose accounted for 7.06 grams per 100 grams of dry weight, representing 36.0 percent of the total free carbohydrate pool. Alongside trehalose, the species was characterized by substantial concentrations of sorbitol at 6.42 grams, mannitol at 3.69 grams, and glucose at 2.20 grams. Minor trace components identified included fructose at 0.12 grams, gentiobiose at 0.08 grams, and melibiose at 0.04 grams. The asymmetry coefficient calculated for the sorbitol peak was the highest in the dataset, reflecting its particularly high concentration. This multi-osmolyte buffering system, combining trehalose, sorbitol, and mannitol, strongly reflects the morphological adaptations of the fungus. Because it produces a closed, thick-walled gasteroid structure that remains in direct contact with the soil, it creates a protected microclimate favoring a diverse osmotic network over a single desiccation-resistant molecule. Similar carbohydrate patterns have been documented in phylogenetically distant truffles, such as Tuber aestivum and

Terfezia claveryi, which are also dominated by mannitol and trehalose alongside minor sugars. This cross-phylum parallel indicates that the ectomycorrhizal habit fundamentally drives a shared carbohydrate signature. Geographical support for this pattern is found in the Turkish desert truffles Terfezia olbiensis and Terfezia claveryi, where trehalose and mannitol were similarly identified among the principal sugars. The link between gasteroid architecture and trehalose reliance is further supported by the closed, soil-associated giant puffball Calvatia gigantea, where trehalose was likewise the principal sugar, though mannitol was absent, suggesting the accompanying suite of minor sugar alcohols varies by species. The metabolic divergence of this species is also evident in its trace disaccharide profile. The detection of only two trace disaccharides, gentiobiose and melibiose, aligns with its symbiotic lifestyle. Lacking the need for the active extracellular enzymatic breakdown of lignocellulose, it maintains a much narrower disaccharide repertoire. Finally, comparing the total bulk carbohydrate proportion of 47.87 percent with the measured free sugar and polyol content of 19.61 percent suggests the free fraction accounts for roughly 41 percent of the total carbohydrates. The remainder likely consists of structural macromolecules such as chitin and glucans. These distinct compositional findings illuminate the carbohydrate components from both a bulk and component-level perspective, shedding light on the molecular foundations underlying the remarkable antioxidant, antimicrobial, and immunomodulatory properties previously reported for this ecologically significant symbiotic fungus.

Keywords: Pisolithus arhizus, HPAEC-PAD, free sugars, sugar alcohols, trehalose

ANALYSIS OF FREE SUGARS AND SUGAR ALCOHOLS IN HERICIUM ERINACEUS USING HPAEC-PAD

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ABSTRACT

Hericium erinaceus, commonly known as lion's mane mushroom, is a medicinal species noted for its protective effects on the nervous and digestive systems and its ability to inhibit cancer cell proliferation. These effects are underpinned by polysaccharide-rich (HEP) fractions from the fruiting body. High-molecular-weight H. erinaceus polysaccharides resist gastrointestinal digestion and are fermented by gut microbiota, exhibiting prebiotic properties that support gut health. They are composed mainly of glucose, galactose, mannose, and fucose, and their branched beta-glucan structures (1→3 and 1→6 linkages) play an immunomodulatory role, particularly by activating macrophages. The species is part of Turkey's native macrofungal flora, recorded in the Western Black Sea Region and Sinop Province, and Turkish groups have studied its cytotoxic effects on MCF-7 breast cancer cells. However, a detailed free-sugar and sugar-alcohol profile for Turkish populations had not previously been reported, prompting this study to analyze H. erinaceus's carbohydrate content using the sensitive HPAEC-PAD method. Dried fruiting bodies were ground, extracted with hot water, freeze-dried, then reconstituted and filtered before HPAEC-PAD analysis, run on a system using an ALEXYS Carbohydrate Analyzer, a DECADE Elite electrochemical detector, and a SweetSep AEX200 anion-exchange column, with precautions against carbonate and borate interference. Eight carbohydrate components were identified. Relative to dry weight, the highest amount was sorbitol (6.737%), followed by mannitol (2.413%), trehalose (1.006%), glucose (0.435%), rhamnose (0.422%), nigerose (0.162%), fructose (0.106%), and gentiobiose (0.022%). Sorbitol and mannitol eluted at closely spaced retention times (1.683 and 1.983 min) at high concentration with partial peak overlap, giving markedly higher asymmetry values (10.4 and 2.5) than the other components (0.94–1.9). The later-eluting components; rhamnose, glucose, fructose, gentiobiose, and nigerose were clearly resolved, with good peak symmetry. The high levels of sorbitol, mannitol, and trehalose align with general knowledge of mushroom carbohydrate processing: trehalose and mannitol are the main storage carbohydrates and osmolytes transported from mycelium to fruiting body in many basidiomycetes, with trehalose serving as an energy source and stress protectant, and mannitol regulating osmotic and turgor pressure during fruiting-body development. The predominance of sugar alcohols among total free carbohydrates matches the general trend in edible medicinal mushrooms; the same comparative study found H. erinaceus contains markedly more fructose than Flammulina velutipes and Lentinula edodes, consistent with the fructose detected here. A comparable profile; rhamnose, fructose, trehalose, and mannitol were also reported in two other Turkish wild mushrooms, Terfezia olbiensis and Terfezia claveryi, suggesting this sugar combination may be a broader feature of Turkey's wild macrofungi rather than unique to H. erinaceus. The detection of free rhamnose and gentiobiose is linked to the species' known polysaccharide architecture. A cell-wall polysaccharide fraction (HEP-S) from H. erinaceus has been reported to contain fucose, mannose, glucose, galactose, and rhamnose, so the free rhamnose found here may arise from natural, partial hydrolysis of cell-wall heteropolysaccharides. Gentiobiose, a β-1,6-linked

glucobiose, is a natural degradation product expected at the branch points of H. erinaceus's branched beta-glucan backbone; its trace presence is interpreted as indirect evidence supporting this structure. Nigerose, an α-1,3-linked glucobiose, was also detected in H. erinaceus. It is a rare, digestion-resistant disaccharide with potential prebiotic benefits. A branched α-glucan fraction was recently discovered in the H. erinaceus fruiting body, showing the species contains glucan types beyond beta-glucans. Acid hydrolysis of a comparable α-1,3-glucan from another basidiomycete, Laetiporus sulphureus, yields nigerose and nigero-oligosaccharides that markedly promote growth of Lactobacillus and Bifidobacterium strains. The free nigerose found here is considered an early finding pointing to a less-studied α-glucan fraction that complements the immunomodulatory beta-glucans discussed above. **In conclusion,** the high sensitivity of HPAEC-PAD enabled reliable detection of trace-level sugars, including nigerose and gentiobiose typically overlooked by conventional HPLC-RID methods. While H. erinaceus's free sugar and polyol profile shows species-specific features, it also reflects a shared pattern of fungal carbohydrate metabolism centered on trehalose, mannitol, glucose, fructose, and nigerose. As this is a screening-type analysis based on a single sample, the authors recommend confirming these findings across multiple biological replicates and verifying trace compounds like nigerose by mass spectrometry. Nonetheless, the data offer an original quantitative and qualitative contribution to the literature on H. erinaceus's potential value in the food and nutraceutical fields.

Keywords: Hericium erinaceus, HPAEC-PAD, rare sugars, sugar alcohols, nigerose

STUDIES ON THE MICROPROPAGATION AND IN VITRO CONSERVATION OF MEDICINAL PLANT SPECIES

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ABSTRACT

Research conducted at the NIRDPSB Brasov aimed to achieve the in vitro multiplication of Arnica montana L. and the in vitro conservation of Lavandula angustifolia Mill. Regarding arnica, following surface sterilization, the seeds were inoculated on Murashige-Skoog medium (MS, 1962) without the addition of phytohormones, in order to promote germination. Seeds stored in a freezer for 24 hours exhibited a lower germination rate (31.43%) compared with those maintained at room temperature (51.43%). For multiplication, MS medium supplemented with sucrose, vitamin C, activated charcoal, phytohormones and agar was used. The culture vessels were incubated in a growth chamber at a temperature of 22 ± 2 °C under a 16/8 h photoperiod. Regarding the in vitro conservation of lavender, the main objective was to extend the interval between subcultures on fresh medium while maintaining plantlet viability. Lavender explants were cultured on Woody Plant Medium (WPM) supplemented with 0.5 mg/L IBA, with or without vitamin C, and with several concentrations of osmotic agents used individually or in different combinations. The control treatment consisted of WPM medium without the addition of auxin, vitamin C, or osmotic agents. Plantlet development was monitored by assessing the survival rate after 5, 7, 8, and 9 months from culture initiation. The best result was obtained with the medium supplemented with mannitol (20 g/L), on which the plantlet survival rate was 100% after 5 months. This rate decreased to 50% after 7 months and remained constant through the 9-month assessment.

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Keywords: Lavandula angustifolia, Arnica montana, micropropagation, in vitro conservation

DRY MATTER AND CARBOHYDRATE COMPOSITION AS INDICATORS OF QUALITY POTENTIAL IN POTATO VARIETIES

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ABSTRACT

The aim of this study was to evaluate the quality of 14 potato varieties grown in Brașov in 2025, based on dry matter and carbohydrate composition, and to identify differences among varieties relevant to their potential. Dry matter was determined by oven drying (%), while fructose, glucose and sucrose were quantified by HPLC (mg/100 g). Data were analyzed using descriptive statistics and Principal Component Analysis (PCA) was performed using Past5 soft to assess relationships among carbohydrate variables and dry matter content. Potato varieties exhibited high variability in both dry matter content and carbohydrate profile. Dry matter content ranged from 17.43 to 24.40%, while reducing sugars ranged from 115.32 to 1325.89 mg/100 g. The varieties MARVIS, AZARIA, COSIANA, and BRAȘOVIA were characterized by low levels of reducing sugars, suggesting favorable potential for frying processing. In contrast, CEZARINA, FORESTA, and POSTĂVARU showed high concentrations of reducing sugars, which are associated with a higher risk of browning during thermal processing. These results highlight substantial genetic variability and allow the varieties to be differentiated according to their technological suitability.

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Keywords: potato variety, dry matter, fructose, glucose and sucrose.

PHYSICOCHEMICAL AND CHEMICAL CHARACTERIZATION WITH ASSESSMENT OF THE ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF CITRUS ESSENTIAL OIL

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ABSTRACT

Citrus essential oils (EOs) are valued for their bioactive compounds with potential applications in food preservation, pharmaceuticals, and cosmetics. This study aimed to characterize the physicochemical and chemical properties of Citrus EOs extracted via hydrodistillation, while evaluating its antimicrobial and antioxidant potentials. Physicochemical analysis revealed a yield of 1.2 ± 0.1%, refractive index of 1.472, density of 0.845 g/mL, and acidity of 0.8 %. Gas chromatography-mass spectrometry (GC-MS) identified 42 compounds, dominated by limonene (68.5%), β-pinene (12.3%), and myrcene (8.7%). Antimicrobial activity was assessed using disk diffusion and microdilution against Gram-positive (Staphylococcus aureus, Bacillus subtilis), Gram-negative (Escherichia coli, Pseudomonas) bacteria. Citrus EO exhibited strong inhibition zones (15-28 mm) and MIC values of 0.5-2 mg/mL, outperforming some synthetic antibiotics. Antioxidant capacity was determined via DPPH (IC50 = 12.4 µg/mL), ABTS (IC50 = 9.8 µg/mL), demonstrating high radical scavenging comparable to ascorbic acid. These findings highlight Citrus EO as a potent natural antimicrobial and antioxidant agent, supporting its use in sustainable bio-preservation. Further in vivo studies are recommended.

Keywords: Citrus essential oil, GC-MS, antimicrobial activity, antioxidant activity, limonene.

COMPARISON OF PROBLEMS AND TRAINING PRIORITIES OF BUFFALO FARMERS ACCORDING TO THEIR SOCIOECONOMIC AND STRUCTURAL CHARACTERISTICS IN THE KIZILIRMAK DELTA

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ABSTRACT

The aim of this study is to identify the problems and training priorities of buffalo farmers in the Kızılırmak Delta in Samsun Province, which has hosted Türkiye's most significant buffalo population from the past to the present, based on their socio-economic and structural characteristics. The data for this study were obtained from face-to-face surveys conducted with 45 buffalo farmers in the Kızılırmak Delta. The problems faced by producers and their training needs were assessed using a 5-point Likert scale. According to the research findings, it was found that both the priorities of the problems and the training needs varied according to the socio-economic and structural characteristics of buffalo farmers. Age, level of education, experience in buffalo farming, non-agricultural income and farm size all influence both producers' perceptions of problems and their training priorities. In particular, producers with higher education levels prioritized producer organization and productivity improvement, while larger-scale farms considered branding and value-added production to be their primary training priorities. In contrast, for small-scale farms with no non-agricultural income, marketing remains a challenge, and there is a greater need for training on public support schemes. As the level of education rises, the importance of cooperatives and organisational awareness is increasingly recognised; furthermore, training on methods to increase productivity and the marketing of buffalo products is being given higher priority. It is noteworthy that young producers place a higher priority on organisation-focused issues such as cooperatives, trust in producer organisations and a culture of collective action; similarly, when it comes to their training needs, they prioritise training on methods to increase productivity and on producer organisation. Whilst farms with large herds prioritise training in branding and value-added production, small farms prioritise agricultural support and grants. The research findings indicate that planning extension, training and rural development policies for buffalo farmers using a one-size-fits-all approach will not be effective; rather, it is necessary to develop tailored training and support programmes that take socio-economic and structural characteristics into account. The findings suggest that targeted extension strategies tailored to farm size, education level, and buffalo farming experience can strengthen organizational capacity, promote value-added production, and enhance the sustainability of buffalo farming in the Kızılırmak Delta.

Keywords: Buffalo farming, problem analysis, training needs, Kızılırmak Delta

ALLİUM AMPELOPRASUM VAR. PORRUM: STUDY OF GERMİNATİON PARAMETERS AND ANTİOXİDANT POTENTİAL OF AQUEOUS EXTRACTS

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ABSTRACT

Allium ampeloprasum var. porrum, commonly known as leek, is a plant belonging to the Amaryllidaceae family. This species is of significant importance in the agri-food and biological sectors due to its nutritional value and its high content of bioactive compounds. The aim of this study is to evaluate certain germination and biometric parameters (kinetics and germination rate, radicle length, moisture content, dry matter content) in the seeds; as well as to estimate the total phenolic content and antioxidant activity using three techniques (DPPH, FRAP, CAT). Aqueous extracts were prepared by infusion and decoction from the green and white parts of the plant under study. The results obtained show that the seeds of Allium ampeloprasum var. porrum exhibit good germination capacity. Indeed, the cumulative germination rate of the seeds ranged between 72.79per cent and 94 per cent respectively during the first two weeks. Furthermore, the germination rate reached up to 24.77% over two weeks of germination, with a slight decrease in the estimated average time of 0.69 days. Monitoring of the biometric parameters highlights three key points: the growth of young roots, which is proportional to time and reached 9.18cm on the fourteenth day of germination, whilst the water content (moisture) and dry matter content of the seeds were estimated at between 66.69 % and 76.18 % and 33.30 % and 27.39 %, respectively, over the two-week period. The total phenolic content varies depending on the plant part and the extraction method used. Indeed, the extracts obtained by infusion and decoction of the green part recorded the highest levels (412.16 and 296.33 mg GAE/g DM respectively). Assessment of antioxidant activity using the DPPH, FRAP and CAT methods revealed varying levels of activity depending on the extract. Consequently, the infusion of the green part exhibited the best antioxidant activity across all the tests carried out, reflecting greater reducing power and free radical scavenging capacity compared with the other extracts (IC_{50} = 380.71 µg/ml, EC_{50} =169.33 µg/ml, CAT = 410.25 mg AAE/g DM). The results also highlight that Allium ampeloprasum var. porrum is an important natural source of nutrients and bioactive compounds, and that it warrants further study to encourage its cultivation and consumption in the future.

Keywords: Allium ampeloprasum var. porrum, Germination, Phenolic compounds, Antioxidant activity

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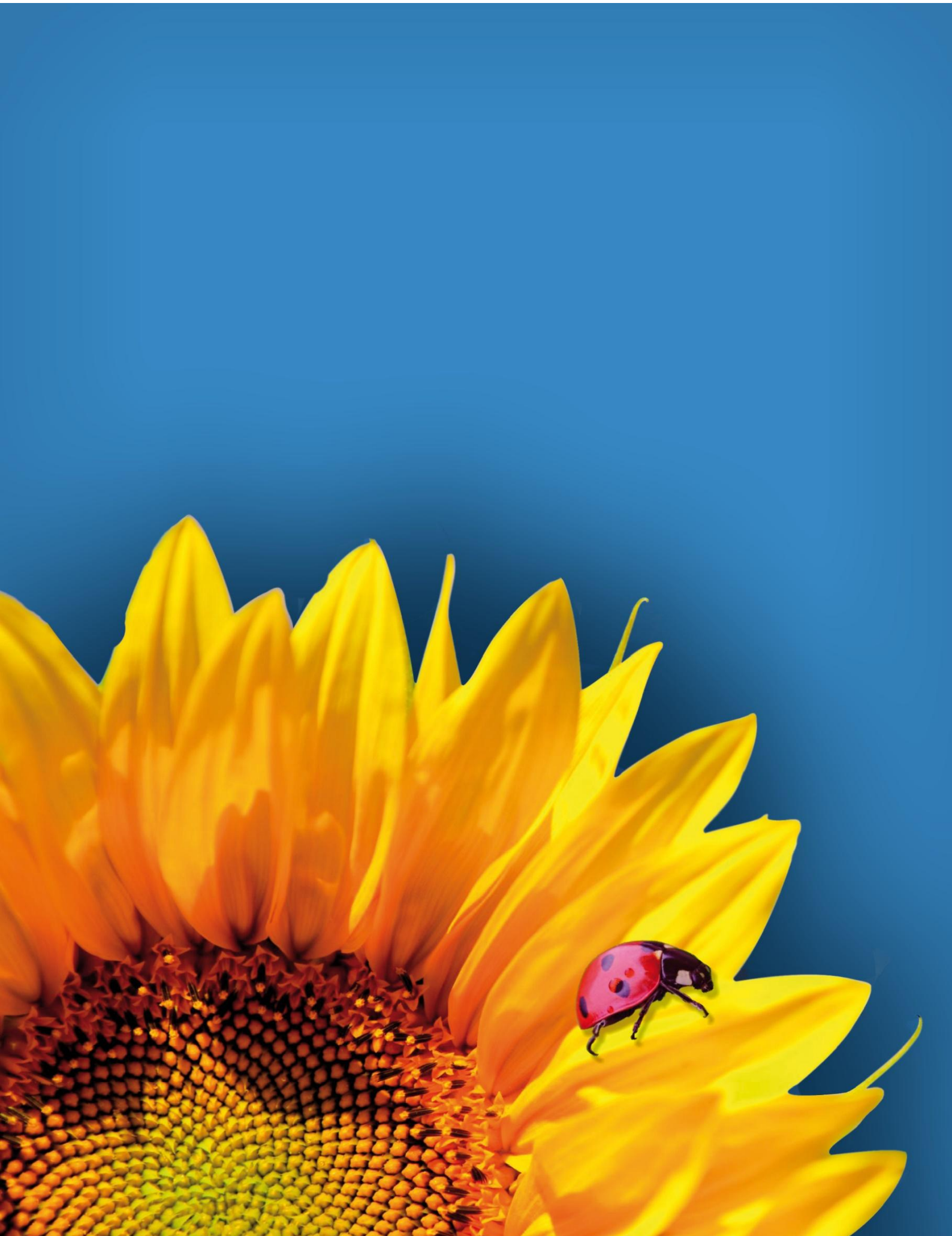
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