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INTERNATIONAL CONGRESS (ICASPSABHH-2026)

International Congress on Advanced and Sustainable Plant Sciences, Agro-Biodiversity and Human Health

DATE
May 16, 2026 (Staturday)

VENUE
Online

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International Congress on Advanced and Sustainable Plant Sciences, Agro-Biodiversity and Human Health (ICASPSABHH-2026)

Organizer

- VitaNova International Alliance for Sciences (VNIAS)
- Scientific Research Institute of Fruit and Tea Growing, Ministry of Agriculture, Azerbaijan
- Field Crop Department, Siirt University, Türkiye
- University of Swat, Pakistan

Date and Venue

Date: May 16, 2026 (Saturday)
Venue: Online Moderating System

Objectives

1. To integrate plant science innovations with sustainable agriculture to enhance global food and nutritional security.
2. To advance agro-biodiversity conservation through cutting-edge genomics, climate-resilient crops, and regenerative practices.
3. To bridge plant-based bioactive research with human health and functional nutrition development.
4. To promote climate-smart, biodiversity-driven farming systems for ecosystem restoration.
5. To foster transdisciplinary collaboration among scientists, policymakers, and industry for sustainable bioeconomy solutions.
6. To accelerate the translation of plant research into sustainable health and agricultural technologies.

Congress Sub-Themes

1. Advance research in plant biotechnology, genomics, gene editing, molecular breeding, and biodiversity.
2. Promote climate-resilient agriculture through digital agriculture, precision farming, and sustainable practices.
3. Develop science-based strategies for plant disease surveillance, early detection, and pathogen management.
4. Foster international and cross-sector collaboration to address global plant health and food security challenges.
5. Develop plant-based medicines, nutraceuticals, and functional food additives to enhance human health and well-being.
6. Conserve and characterize crop wild relatives, landraces, and underutilized species.
7. Enhance crop resilience to abiotic stresses through innovative mitigation strategies.

Collaborators

- Department of Plant Sciences, University of Manitoba, Canada
- Shaheed Benazir Bhutto University, Shaheed Benazir Abad, Pakistan
- University of Science and Technology, Bannu, Pakistan
- Journal of Biomedical and Applied Sciences, Federal University Dutse (JOBASFD)
- Science Center for Programming Education (Science Academy), Egypt
- Scholarship Mine

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The Gene Pool of Cherry Plants in Azerbaijan

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Abstract
The gene pool of sweet cherries in Azerbaijan is rich and diverse, which is due to the country's varied climatic and soil conditions. In particular, the Greater and Lesser Caucasus regions, as well as the Aran zone, provide favorable environments for the distribution of both wild and cultivated forms of cherry. Local varieties have been formed over many years through folk selection and are distinguished by high taste quality, productivity, and resistance to certain diseases. The cherry gene pool of Azerbaijan includes both local (aboriginal) varieties and introduced (imported) ones. Among the local varieties, examples such as "Gara cherry" and "White cherry" are of special importance. These varieties are valuable due to their adaptability to regional conditions and their taste characteristics. Introduced varieties are used to increase productivity and meet market demands. The conservation and study of the cherry gene pool are carried out by Azerbaijan National Academy of Sciences and relevant research institutes of the Ministry of Agriculture. These institutions play an important role in preserving genetic diversity, developing new varieties, and advancing breeding work. In recent years, due to climate change and anthropogenic impacts, some local varieties have faced the risk of extinction. Therefore, both ex-situ (in collection orchards) and in-situ (in natural conditions) conservation methods are applied to protect the gene pool. In conclusion, the cherry gene pool of Azerbaijan has great scientific and economic importance, and its preservation is essential for the future development of agriculture.
Keywords: *Cherry gene pool, genetic diversity, introduced varieties, selection (breeding), productivity.*

Sustaınable Plant-Based Bıoactıve Compounds for Fungal Skın Dısease Management and Human Health

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Abstract

The increasing prevalence of fungal skin infections, particularly in rural communities, necessitates the development of affordable, safe, and sustainable therapeutic interventions. This study explores the potential of plant-based bioactive compounds derived from locally available medicinal plants, specifically neem (Azadirachta indica) and garlic (Allium sativum), for the management of common dermatophytic and opportunistic fungal infections. These plants are widely recognized for their antimicrobial, antifungal, and immunomodulatory properties, making them suitable candidates for sustainable healthcare solutions. Crude extracts were prepared using standard extraction techniques and evaluated for antifungal efficacy against selected fungal pathogens, including Trichophyton, Microsporum, and Candida albicans. The bioactivity of the extracts was assessed using agar diffusion and broth dilution methods to determine zones of inhibition and minimum inhibitory concentrations. Preliminary findings indicate significant antifungal activity, supporting the ethnomedicinal use of these plants. This research aligns with global efforts toward advancing sustainable plant science and agro-biodiversity by promoting the utilization of indigenous plant resources. It also contributes to human health by offering eco-friendly alternatives to synthetic antifungal drugs, which are often expensive and associated with resistance and side effects. Furthermore, the integration of traditional knowledge with modern scientific approaches enhances the value of biodiversity conservation and supports local healthcare systems. The findings underscore the importance of plant-based innovations in addressing public health challenges while ensuring environmental sustainability and resource conservation.

Key words: Phytotherapy, Dermatophytosis, Bioactive compounds, Ethnomedicine, Antifungal activity

Early Cancer Detection Using Molecular Biomarkers

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Abstract

Early detection of cancer significantly improves treatment outcomes and survival rates. However, many cancers are diagnosed at advanced stages due to the lack of sensitive and reliable screening methods. Molecular biomarkers have emerged as powerful tools for early cancer diagnosis, prognosis, and personalized therapy. Biomarkers are measurable biological molecules found in blood, tissues, or other body fluids that indicate normal or abnormal processes in the body. Recent advances in biotechnology have enabled the identification of genetic, epigenetic, proteomic, and metabolomic biomarkers associated with early tumor development. Circulating tumor DNA (ctdna), micrornas (mirnas), and specific protein signatures are among the most promising non-invasive biomarkers. These markers can be detected through liquid biopsy, a minimally invasive technique that allows early screening and continuous monitoring of cancer progression. The use of early biomarkers not only improves diagnostic accuracy but also reduces the need for invasive procedures and enables timely therapeutic intervention. Furthermore, biomarker-based screening supports precision medicine by helping clinicians select targeted treatments tailored to individual patients. Despite ongoing challenges in validation and standardization, molecular biomarkers hold great potential to transform cancer diagnosis and management. Continued research in this field will contribute to improved public health and reduced global cancer burden.

Keywords:

Cancer biomarkers, Early detection, Liquid biopsy, Precision medicine, Molecular diagnostics.

Synthesıs and characterızatıon of cobaltbased nanopartıcles: ımpact on blood profıle, sex hormones and metabolıc profıle of albıno mıce

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Abstract

Cobalt is one of first and lightest element in the group 9 transition metals and isabundant in mineral deposits like oxide ores, arsenide, and sulphides etc. Cobaltcompounds pose health risks; long-term exposure of cobalt can lead to chronic respiratory issues, lung health issues and adverse effects on the cardiovascular system. We synthesize the nanoparticles of cobalt carbonate by using controlled chemical precipitation and reduction methods. The nanoparticles are characterized by FTIR, XRD, and SEM analysis and confirm the crystalline structure, chemical composition, and morphology of synthesized nps. They are tested on albino mice for potential biological applications.Blood profile evaluations assessed the hematological parameters, hormonal profile, and reproductive health of albino mice. Exposure to cobalt carbonate nps significantly influences the endocrine function in albino mice. Potential health implications like thyroid disorders and metabolic imbalances are observed due to the exposure of nps, which affect the thyroid, reproductive and insulin levels of albino mice and significant alterations were also observed in various blood parameters, including platelet count and distribution, which also indicate the potential effect on the immune system and overall health. This study contributes to understanding the biological implications of cobalt carbonate nanoparticles.

Keywords

Nanoparticles, coco3 nps, Albino male mice, blood profile, sex hormones and metabolic profile.

Synergistic Biocontrol and Induced Resistance Against Bacterial Leaf Blight of Rice by Pseudomonas and Flavobacterium species

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Abstract

Bacterial leaf blight (BLB), caused by Xanthomonas oryzae pv. Oryzae (Xoo), capable of causing up to 50% yield losses. This study aimed to isolate and characterize rhizosphere bacteria with antagonistic activity against Xoo. Rhizosphere soil samples were collected from healthy rice plants in Anhui Province, China, and 96 bacterial cultures were isolated using Beef Peptone agar. Amplified ribosomal DNA restriction analysis (ARDRA) grouped these isolates into 17 clusters, and 16S rrna gene sequencing identified them as members of 11 genera. Two strains: Flavobacterium ginsenosidimutans YTB16 and Pseudomonas chlororaphis JTB29 were selected for their strong biocontrol potential. In vitro and in vivo assays, conducted with three independent biological replicates and repeated twice, demonstrated that both strains individually reduced BLB incidence by over 60%, while their consortium achieved 75% suppression. Disease incidence was determined by scoring the symptomatic leaf area, and the percentage reduction was calculated relative to the positive control. Data were statistically analyzed using one-way ANOVA followed by Tukey's HSD test ($p < 0.05$). In pot experiments, consortium application showed significantly ($P<0.05$) increased chlorophyll (~2.26-fold), carotenoids (~2.06-fold), plant height (~2.1-fold), dry weight (~2.11-fold), and seed yield (~21-fold) compared to the positive control. It also enhanced total phenolic content (~1.95-fold) and elevated the activities of peroxidase (~2.4-fold), phenylalanine ammonia-lyase (~2.2-fold), and polyphenol oxidase (~2.3-fold) in rice plants challenged with Xoo, indicating the activation of systemic defense responses. Functional assays further revealed that P. Chlororaphis produced cellulase, contributing to pathogen cell wall degradation, while F. Ginsenosidimutans synthesized salicylic acid, hydrogen cyanide, and siderophores; key metabolites associated with induced resistance, pathogen inhibition, and iron competition. These findings highlight the potential of Pseudomonas and Flavobacterium consortia as stable, versatile, and eco-friendly biocontrol agents for sustainable management of BLB in rice.

Keywords: Bacterial Leaf Blight, Flavobacterium, Induced resistance, Pseudomonas, Synthetic consortium.

Gene Editing Approaches for Enhancing Wheat Productivity and Climate Resilience

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Abstract

Wheat is a staple crop critical for global food security, yet it faces significant challenges. Due to climate change, increasing disease pressure, and declining arable land. This study Focuses on the application of gene editing techniques, particularly CRISPR/Cas9, to Enhance wheat productivity and climate resilience. Gene editing enables precise Modification of target genes associated with drought tolerance, disease resistance, and yield İmprovement. By integrating advanced molecular tools with conventional breeding strategies, it is Possible to accelerate the development of improved wheat varieties. These approaches offer A more efficient and targeted alternative to traditional methods, reducing time and resource Requirements. Additionally, gene editing contributes to sustainable agriculture by improving Resource-use efficiency and minimizing dependence on chemical inputs. This research highlights the potential of gene editing technologies to address major Agricultural challenges and ensure food security. The findings support the development of Resilient wheat cultivars suitable for changing environmental conditions, particularly in Regions vulnerable to climate stress. Overall, this study demonstrates the importance of Combining innovation with sustainability in modern agricultural systems.

Keywords: gene editing, CRISPR technology, climate adaptation, yield enhancement,

Genome modification

Screening of Maize Genotypes for Salt Tolerance at the Seedling Stage

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Abstract

Soil salinization is a major problem worldwide and also threatens global food security. Too much salt in the soil hurts maize plants, making it harder for them to grow and germinate. Salt stress changes the way seeds work, reducing essential nutrients and water. This study looked at how salt affects maize seeds and found ways to help plants grow better in salty soil. This study investigated salinity effects on germination, growth, and biochemical parameters in three maize varieties (ILC-26, ILC-28, ILC-30). The experiment consisted of three treatments: control, T1 (8 ds/cm), and T2 (12 ds/cm). Results showed decreased germination percentage, shoot and root length, and fresh and dry weight with increasing salinity. However, ILC-28 demonstrated highest tolerance, maintaining high germination percentages and potential. Biochemical analysis revealed decreased chlorophyll, total sugar, and sucrose content, while proline content increased, indicating stress tolerance. ILC-28 exhibited increased sucrose content and moderate proline accumulation. Understanding maize's salt stress tolerance is crucial for enhancing crop resilience, mitigating yield losses, and ensuring global food security amidst rising soil salinization. Furthermore, this research informs breeding programs and agricultural practices to boost maize's salt tolerance, safeguarding farmers' livelihoods and securing the global maize supply.

Keywords: salinity tolerance, maize varieties, germination, growth, biochemical responses.

From plants to products: Sustaianable Extraction and Evaluation of natural color of industrial Applications:

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Abstract:
Certain synthetic dyes have been found to be extremely harmful, mutagenic, causing skin irritation, carcinogenic, and causing allergic effects in humans. Many industries now prefer using natural dyes over synthetic ones, due to their biodegradable and non-carcinogenic nature, natural dyes are considered safer for handling and use. This research delves into the dye-yielding chemical nature of Monotheca buxifolia by extracting and analyzing the natural colors from the fruit through UV visspectrophotometry, phytochemical screening, and FTIR, assessing antifungal and antibacterial activity. The natural color extracted via maceration demonstrates high ash content, carbohydrates, flavonoids, phenolics, antibacterial properties and high anthocyanin content. Furthermore, the application of the dye in food products (jelly candies, cream, and hard candies) was tested for color efficiencies in terms of CIE L* a* b* values. The color efficiency of the natural color in hard candies was evaluated through color analysis, ash tests, moisture content, estimation of phenolics and flavonoids, solubility time, BRIX value, antifungal, and antibacterial activity. The overall findings indicate that the Monotheca. Buxifolia's fruit extract is a safe and sustainable substitute for nonbiodegradable synthetic dyes in the production of environmentally friendly colours for a variety of industrial sectors, including food, cosmetics, and medicines.
Keywords: Monotheca buxifolia; Color analysis; FTIR; Candy; BRIX; CIE lab*

Creation of the Gene Pool of Pistachio (Pistacia vera L.) Cultivated in Absheron

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Keywords: variety, form, descriptor, productivity

Pistachio (Pistacia vera L.) İs a valuable plant with significant industrial, nutritional, and medicinal importance. It has also attracted continuous attention due to its longevity and resistance to various environmental stress factors. Although pistachio is widely cultivated in many regions of the world, its production in Azerbaijan remains relatively underdeveloped. According to research-based calculations, establishing pistachio orchards on 500 hectares using a 6×3 m planting scheme would result in approximately 264,000 trees. Assuming that each tree produces at least 5 kg of yield after 15 years, the total production would reach 1,320 tons. This level of production could fully meet the country's domestic demand for pistachios through local production, reducing dependence on imports. Currently, the expansion of pistachio cultivation is considered a priority in Azerbaijan. In this context, the creation of a pistachio gene pool and the study of its genetic diversity are among the strategic directions of both agricultural science and practice. Research in this field is aimed at developing breeding programs and obtaining high-yielding cultivars resistant to environmental stresses under conditions of climate change. The gene pool of pistachio involves the systematic conservation and maintenance of local cultivars and forms. Pistachio varieties cultivated in the Absheron region are known for their high productivity and resilience to environmental conditions. In many cases, these varieties are not inferior to globally cultivated cultivars and even possess certain advantages. Currently, these varieties are maintained in the collection fields of the Absheron Experimental Base. The primary objective is to expand the cultivation of these local varieties across larger areas and promote them in the global market. For this purpose, the genetic diversity of cultivated varieties and forms is being thoroughly studied, and their descriptors are being developed. Based on the collected data, the most perspective varieties are identified and recommended for the establishment of new pistachio orchards.

Rational Design and Computational Screening of a Novel Ganoderic Acid Derivative Targeting Human Fungal Pathogens

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Abstract

The exploration of natural bioactive compounds remains a cornerstone in the development of novel therapeutic agents to combat fungal resistance. Ganoderic acids, a class of highly oxygenated triterpenoids from the medicinal mushroom Ganoderma lucidum, have shown diverse pharmacological properties. However, their structural optimization for specific antifungal applications is less documented. This study focuses on the computational design and evaluation of a novel ganoderic acid derivative to enhance binding stability and pharmacokinetic profiles. Computational methods were employed to assess the potential of the modified molecule. Electronic properties, including frontier molecular orbital analysis, were calculated using density functional theory. To evaluate the antifungal potential, molecular docking simulations were performed against key fungal target enzymes. The results indicated that the modified derivative exhibits a significantly higher binding affinity compared to the parent ganoderic acid, suggesting stronger inhibitory potential against common fungal pathogens. Furthermore, computational profiling predicted favorable drug-likeness and low toxicity for the new molecule. This research highlights the effectiveness of structure-activity relationship-based modification and computational screening in transforming natural products into potent drug candidates. By utilizing the rich biodiversity of Ganoderma species, this study provides a sustainable approach to antifungal drug discovery, aligning with the objectives of advanced plant sciences and human health. These findings establish a solid foundation for future experimental validation and synthesis of the proposed compound.

Keywords

Mushroom, Triterpenoids, Molecular Docking, Antifungal Activity, Drug Discovery

Machine Learning applications in sustainable agriculture and crop health monitoring

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Abstract

Agriculture is facing many challenges today due to climate change, increasing population, and limited natural resources. Farmers often depend on traditional methods to monitor crops, which can be time-consuming and sometimes inaccurate. Because of this, there is a need for smarter and more efficient solutions. Machine learning is a modern technology that can help improve farming by using data to make better decisions. This study focuses on how machine learning can be used for crop monitoring and sustainable agriculture. In this approach, different types of data such as soil quality, temperature, humidity, and plant images are considered. Machine learning models can analyze this data to detect diseases in crops at an early stage and give useful predictions about crop growth. Early detection is important because it helps farmers take action on time and reduce losses. It can also help in using fertilizers and pesticides more carefully, which is better for the environment and human health. Moreover, combining machine learning with smart farming systems can make agriculture more efficient. Farmers can get useful information and suggestions based on real-time data, which helps them make better choices. This not only improves productivity but also supports sustainable use of resources. In conclusion, this study shows that machine learning can play an important role in modern agriculture. It provides a simple and effective way to improve crop monitoring, protect the environment, and support future food needs

Keywords

• Artificial Intelligence • Crop Monitoring

• Sustainable Farming • Data Analysis • Smart Agriculture

Study of the Biological Effectiveness of Essential Oil Plants Against Bacterial Canker and Brown Moniliosis Diseases in Fruit Plants with Seeds in Vitro and In Vivo Conditions

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Abstract

This study is devoted to the comprehensive investigation of the biological effectiveness of essential oil–bearing plants against bacterial canker and brown moniliosis, which are widely распространн diseases causing serious yield losses in stone fruit crops. The main objective of the research is to identify safer, environmentally friendly, and sustainable alternatives to chemical pesticides. The experiments were conducted under both in vitro (laboratory conditions) and in vivo (natural or semi-natural conditions on plants) settings. In the in vitro stage, extracts obtained from various essential oil–bearing plants, including thyme, mint, lavender, and rosemary, were evaluated for their effects on phytopathogenic microorganisms. The results demonstrated that these essential oils significantly inhibited the growth of bacterial canker pathogens and fungi responsible for moniliosis, reducing colony development. In in vivo experiments, these biological preparations were applied to fruit trees, and the spread of diseases, degree of damage, and overall physiological condition of the plants were monitored. The findings indicated that solutions prepared from essential oil–bearing plants noticeably reduced disease progression, enhanced plant immune responses, and positively affected fruit quality. Furthermore, it was determined that biologically active compounds present in essential oils, such as phenols and terpenes, possess strong antibacterial and antifungal properties. These characteristics increase their relevance in phytosanitary practices. In conclusion, the use of essential oil–bearing plants can significantly contribute to improving environmental safety in agriculture, reducing dependence on chemical inputs, and ensuring sustainable production. This approach also opens broad prospects for future research and practical applications.

Keywords: essential oil plants, bacterial canker, brown moniliosis, biological control, in vitro and in vivo studies.

Evaluating the Role of Phosphorus Application on Growth, Yield and Phosphorus Use Efficiency (PUE) of Different Pearl Millet (Pennisetum glaucum L.) Genotypes

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Abstract

Pearl millet (Pennisetum glaucum L.) İs locally known as “Bajra” which is a beneficial cereal for humans and animals. Its total production is 384 thousand tons in Pakistan which is very low as compared to other countries. Phosphorus (P) is an essential nutrient that helps plants to complete their normal life cycles. Phosphorus is ranked as the second most important limiting factor after nitrogen (N) for plant growth and yield. Phosphorus deficiency is one of the major limiting factors for the high yield of pearl millet. To solve the problem of low productivity of pearl millet in phosphorous deficit soils and to find out the most efficient pearl millet genotype regarding phosphorus efficiency. Therefore, a research trial was conducted at the Research Farm, Department of Agronomy, Bahauddin Zakariya University, Multan, during 2020. For this purpose, five (5) Pearl millet genotypes MP-24, HP-50, YBS-98, YBS93 and YBS-70 were used to check the most efficient genotype regarding phosphorus uptake potential at two different phosphorus levels, i.e. (0 kg ha-1 and 90 kg ha-1). The result of studies showed that the application of phosphorus @ of 90 kg per hectare at the sowing stage of pearl millet had a significant effect throughout all replications and enhanced leaf area index (LAI), leaf area duration (LAD), crop growth rate (CGR), plant height, ear length, number of tillers, one thousand (1000) grain weight and ear length. MP-24 expressed maximum grain yield, harvest index and chlorophyll content while YBS-70 demonstrated maximum biological yield, number of tillers, ear length and plant height. Under P deficit conditions, the YBS-70 genotype performs well, but still, its yield was less than all P-applied replications. The YBS-70 genotype performed well under phosphorus deficit conditions, while MP-24 can deliver its best on phosphorus sufficient soils.

Keywords: Nutrient management; Soil fertility; Crop productivity; Sustainable agriculture; Nutrient uptake

Neem-based bıofertılıser and cow dung enhance mıllet growth, rhızobacterıal dıversıty and populatıon dynamıcs

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Abstract

The global shift towards sustainable farming practices such as biofertilisation is necessitated by impacts of chemical fertilizers. Nonetheless, Evidence comparing how specific biofertilisers, organic fertilisers, and synthetic fertilisers shape rhizobacterial abundance and diversity in Nigeria is limited. This research evaluates the effects of neem-based biofertilizer (BF), produced at NARICT, Kaduna State, traditional cow dung (CD), and NPK synthetic fertiliser, on rhizobacterial populations and microbial diversity during millet cultivation. A randomized block design (RBD) was employed in a greenhouse at the Faculty of Agriculture Annex, Umaru Musa Yar'adua University, Katsina State, Nigeria, to test millet growth in mesocosms containing the three fertilisers (applied at standardized rates), plus a non-fertilsed control (CT). Rhizobacterial colonies were quantified on Yeast Extract Malt Agar at intervals; culturable α-diversity was assessed as colony morphotype richness on YEMA; β-diversity was reported via Simpson's Diversity Index; and γ-diversity was examined across the treatments. Within 1 week, rhizobial counts (CFU/g) were highest in CD1 ($5.40 \pm 1.41 \times 10^{11}$), followed by BF1 ($4.75 \pm 2.12 \times 10^{11}$), NPK1 ($4.45 \pm 0.71 \times 10^{11}$) and CT1 ($3.10 \pm 1.84 \times 10^{11}$). By 7 weeks, the counts increased overall, in the same trend. Simpson's indices confirmed that CD supported the most diverse rhizobacterial communities. In contrast, gamma diversity was greatest in BF and lowest in NPK. Preliminary millet growth assays indicated that CD produced the highest shoot length and stem girth, while BF generated growth responses comparable to NPK ($p = 0.58$). Overall, CD most strongly enhanced rhizobacterial abundance and diversity, whereas BF supported the highest community-level diversity. These findings suggest that organic amendments, especially cow dung and neem-based biofertiliser, may partly replace NPK and promote healthier rhizobacterial communities for sustainable millet production. Further omıcs studies are recommended to unravel the link between rhizobacterial community shifts and millet yield, towards sustainable millet production.

Keywords: Biofertilisation, diversity indices, plant growth-promoting rhizobacteria, sustainable agriculture.

Assessment of Sustainable Plant Science Strategies for Environmental Resilience and Productivity

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Abstract

Sustainable plant sciences play a critical role in addressing global environmental challenges, including climate change, soil degradation, and biodiversity loss. This study explores advanced and sustainable strategies in plant science aimed at improving crop productivity while ensuring environmental conservation. The research focuses on modern techniques such as precision agriculture, remote sensing, and the use of eco-friendly biofertilizers to enhance plant growth and resilience. Field observations and literature analysis were used to evaluate the effectiveness of these approaches in different environmental conditions. The findings suggest that integrating technological innovations with traditional agricultural practices significantly improves resource efficiency, reduces environmental impact, and supports long-term sustainability. Additionally, the role of plant adaptation mechanisms in stress tolerance, particularly under changing climatic conditions, is highlighted. The study emphasizes the importance of interdisciplinary approaches and policy support to promote sustainable agricultural systems. These insights contribute to the development of resilient plant-based solutions for food security and environmental protection. Overall, sustainable plant science offers promising pathways to balance agricultural productivity with ecological stability.

Keywords

Sustainable agriculture, Plant resilience, Precision farming, Biofertilizers, Environmental conservation

Utılısıng bıoactıve compounds from ethnomedıcınal plants as bıofılm dısruptıng agents: ımplıcatıons for the control of mdr eskape pathogens

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Abstract

Multidrug-resistant ESKAPE pathogens represent a formidable and persistent clinical challenge, largely attributable to their capacity to form biofilms that confer heightened antibiotic tolerance and facilitate prolonged survival on host tissues, implanted devices, and environmental surfaces. Addressing this challenge demands the exploration of innovative therapeutic strategies beyond conventional antimicrobial agents. Ethnomedicinal plants constitute a chemically diverse and largely untapped reservoir of bioactive compounds with demonstrated antibiofilm potential. These compounds, including phenolics, flavonoids, terpenoids, alkaloids, tannins, and glycosides, disrupt biofilm formation and integrity through multiple mechanisms, such as interference with quorum sensing signalling, impairment of microbial adhesion, suppression of extracellular polymeric substance synthesis, and resensitisation of metabolically dormant persister cells to existing antibiotics. This review synthesises current evidence from recent scientific literature on the application of plant-derived antibiofilm agents against ESKAPE pathogens, with particular emphasis on mechanistic pathways of biofilm disruption, strain-specific responses, and the translational gap between in vitro efficacy and clinical applicability. Emerging themes discussed include the utility of ethnopharmacological knowledge in guiding lead compound discovery, the role of metabolomics and molecular modelling in prioritising bioactive fractions, and the promise of plant-antibiotic combination strategies in reducing biofilm burden and resistance selection pressure. From a public health standpoint, the standardisation and clinical validation of plant-derived antibiofilm agents could meaningfully complement antimicrobial stewardship programmes by lowering effective antibiotic doses, improving outcomes in biofilm-associated infections, and broadening the therapeutic pipeline against multidrug-resistant organisms, thereby contributing to the reduction of global morbidity and mortality due to these infections.

Keywords: Antimicrobial resistance, biofilms, ethnopharmacology, quorum sensing

Comprehensıve characterızatıon of the wıld hyrcanıan fıg populatıon ın azerbaıjan

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Abstract:

The conservation of crop wild relatives and underutilized species is of great importance. The Hyrcanian wild fig, Ficus carica L. (syn. F. Hyrcana Grossh.), is a relict and endemic species listed in Azerbaijan's Red Book. Local observations indicate that, although wild fig trees were once widespread across farms and home gardens, low levels of local consumption led to extensive tree removal, resulting in a significant population decline and leaving the species endangered and largely neglected. This study provides the first comprehensive morphological characterization of 15 wild fig accessions in Hirkan National Park, based on 56 traits, revealing substantial diversity. The studied trees are tall and vigorous, with dense branching and well-developed root systems. Leaves are mainly cordate with varied lobe shapes, and their average area (460 cm^2) exceeds that of related cultivated and wild fig species. Petiole length ranges from 5.8 to 17.1 cm. Fruits are predominantly oblong, with weights ranging from 1.1 g to 12.5 g. All accessions have small ostioles (<1 mm), which is advantageous for reducing pest and disease susceptibility. The fruits are doughy in texture, with a neutral to mildly sweet flavor. Total soluble solids range from 4.2% to 13.7%, averaging 9.59%, and internal cavities are minimal or absent. The observed diversity highlights the importance of Hyrcanian wild figs as valuable genetic resources for breeding programs, particularly for improving vigor, drought tolerance, and disease resistance. Overall, Azerbaijan's forests represent rich reservoirs of plant diversity with strong potential for conservation and future agricultural development.

Keywords: wild fig, underutilized species, morphological assessment

Influence of crown architecture on growth and productivity of intensive plum cultivars

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Abstract

This study evaluates the impact of diverse crown formation techniques on the vegetative growth and yield efficiency of 'Black Amber' and 'Angelino' plum cultivars (Prunus domestica L.). Research was conducted between 2022 and 2024 at the Zardabi Experimental Base of the Scientific Research Institute of Fruit and Tea Growing, located in the Guba-Khachmaz region of Azerbaijan. Trees grafted onto Garnem rootstocks were planted at a density of 666 trees per hectare (5 × 3 m) and subjected to three treatments: standard tiered (control), vase-shaped, and open vase-shaped crowns. Comprehensive phenological observations and biometric assessments, including trunk cross-sectional area (TCSA), annual shoot length, and leaf area, were performed. The results indicated that crown architecture significantly influences productivity. The vase-shaped crown demonstrated the highest efficiency, achieving average yields of 74.79–78.98 quintals per hectare, which constitutes a 16.26–20.76% increase over the control group. Biometric data showed TCSA values between 6.53 and 7.27 cm², annual shoot growth ranging from 37.00 to 45.80 cm, and individual leaf areas of 21.72–25.53 cm², depending on the cultivar and formation method. The vegetation period remained consistent across treatments, lasting approximately 238 days. The findings suggest that optimized crown management, specifically the vase-shaped formation, enhances light interception and physiological efficiency in intensive plum orchards. This research provides critical insights for improving sustainable fruit production and maximizing yield potential under the specific agro-climatic conditions of Azerbaijan's Guba-Khachmaz economic region.

Keywords: Prunus domestica, garnem rootstock, yield efficiency, vegetative growth, Azerbaijan agriculture.

Role of Nutraceuticals in Improving Cognitive Performance and Mental Wellbeing: Exploring the Brain–Body Connection

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Abstract:

Nutraceuticals are also becoming a well-known bioactive dietary compounds that has the potential to treat cognitive performance and mental wellbeing. The brain-body relationship is a complicated two-way process between neurological activity and physiological processes involved in the regulation of mood, stress reaction and mental efficiency. Interference in this axis has been linked to cognitive impairment, anxiety, depression and stress-related disorders. Consequently, nutraceuticals are undergoing extensive research to be used as complementary interventions to support and improve brain health. The study is a review of the evidence on peer-reviewed research articles obtained in scientific databases such as pubmed, Scopus, Web of Science and Google scholar. The literature contains experimental studies, observational studies and systematic reviews on the major nutraceutical classes of adaptogen(e.g., ashwagandha, rhodiola), nootropic(e.g., bacopa monnieri, ginkgo biloba), omega-3 fatty acids, probiotics and plant-derived bioactive compounds.The results obtained in the reviewed literature show that nutraceuticals have neuroprotective and psychobiological effects with a variety of mechanisms. They are the modulation of the activity of neurotransmitters (serotonin, dopamine and acetylcholine), alleviation of oxidative stress and neuroinflammation, improvement of mitochondrial energy metabolism and control of the gut-brain axis. Together, these processes lead to memory, attention, executive, stress, mood, and mental fatigue enhancement. However, , several limitations are also mentioned in the existing literature, such as heterogeneity of the study design, heterogeneity of bioactive composition, and lack of long-term clinical evidence. Formulations should be standardized and additional large-scale evidence based research needs to be carried out to reinforce clinical applicability.In conclusion , nutraceuticals represent a promising evidence-based intervention that sustains cognitive functioning and mental health via integrated neurobiological mechanisms of the brain–body axis.

Keywords: Phytotherapy;Metabolic health;Nutritional therapy;Antioxidant activity;Anti-inflammatory agents;Dietary bioactives;Functional nutrition

Enhancing Plant Disease Surveillance and Management Using Integrated Diagnostic and Predictive Methods

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Abstract:

Plant diseases are a major threat to global agricultural productivity because they cause large crop losses and threaten food security. Because of climate change and global trade, plant pathogens are becoming more common. This means that we need to create better ways to watch for them and find them early. This study concentrates on scientifically grounded methodologies to enhance plant disease surveillance, facilitate swift diagnosis, and improve pathogen management techniques. An integrated methodology was utilized, amalgamating molecular diagnostic instruments, including polymerase chain reaction for precise pathogen identification, with remote sensing technologies for extensive disease surveillance. Geographic information systems and data-driven predictive models were also used to look at disease patterns and predict possible outbreaks. These methods make it possible to act quickly and make better decisions in farming systems. The study stresses the importance of using resistant crop varieties, biological control agents, and sustainable farming practices as part of an integrated disease management strategy for controlling pathogens. These methods work well together to control plant diseases in a way that is good for the environment. The results show that combining advanced diagnostic tools with predictive modeling makes it much easier to find diseases early and stop them from spreading. These strategies help protect crops in a way that lasts and make farming more productive. Overall, these science-based approaches improve plant disease surveillance systems and support more effective handling of pathogens in modern farming.

Keywords: Plant disease detection, Molecular diagnostics (PCR), Remote sensing, Predictive modeling, Integrated disease management

Effect of Salinity and Potassium Humate on Growth and Physiology of Soybean (Glycine max L.)

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Abstract

Soybean (Glycine max L.) İs a globally significant oilseed and protein crop contributing approximately 20% oil and 40% protein contents but it is sensitive to saline conditions. Soil salinity is among the most critical abiotic stresses limiting soybean productivity, especially in arid and semi-arid agricultural regions. This study investigated the ameliorative potential of potassium humate (KH) on the growth, physiological, and water relation parameters of soybean cultivated in salt-affected soil. A pot experiment was conducted under controlled conditions at the Department of Soil Science, Faculty of Agriculture and Environmental Sciences, The Islamia University of Bahawalpur, Pakistan. Salt-affected soil with was used as the growth medium. Four treatments were evaluated: a control (untreated saline soil) and three KH application rates (100, 200, and 300 kg ha-1). Plants were harvested 30 days after sowing, and the following parameters were recorded: fresh shoot weight (g), fresh root weight (g), dry shoot weight (g), dry root weight (g), shoot length (cm), root length (cm), leaf area (cm^2), SPAD chlorophyll index, chlorophyll a and b (mg 100 ml-1), total carotenoids (mg 100 ml-1), relative water content (%), and membrane stability index (%). Salinity stress significantly suppressed all measured growth and physiological parameters in the untreated control. However, exogenous KH application progressively alleviated the inhibitory effects of salinity. The highest KH rate (300 kg ha-1) produced the most pronounced improvements in shoot biomass and root morphology, while KH at 200 kg ha-1 optimally enhanced photosynthetic pigments and water relations. These findings demonstrate that potassium humate is an effective organic biostimulant for mitigating salinity-induced growth inhibition in soybean, with practical implications for sustainable crop production on salt-degraded agricultural soils.

Keywords: Salt stress, humic acid, biostimulant

Comparative assessment of yield components and morphological traits in cultivated barley samples over three years.

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Abstract

The present study conducts, a final comparative structural and morphological analysis of 63 cultivated barley (Hordeum vulgare L.) Samples, sown over a three-year period (2022-2024) at the Absheron Experimental Base Station of the Institute of Genetic Resources, was conducted based on phenological and morphobiological observations. Barley is the fourth most important global cereal crop. The samples selected as the research objects were stored in the genebank under the Institute of Genetic Resources. Based on numerous observations conducted across various barley populations, the biomorphological traits of the selected samples were studied, and these traits were evaluated with a comparative analysis of the obtained results. To determine the structural and morphological characteristics of two-rowed samples, productivity indicators such as plant height, number of productive tillers, spike length, number of spikelets and grains per spike, grain mass per spike, and 1000-grain weight were analyzed. According to the three-year data, Garabagh 7 (61.3 g), TYB 7412 (61.3 g), Nutans 46 (60.7 g) and AG 2632 (60.3 g) have showed the highest values for 1000 grain weight. Specifically, genotypes with plant heights ranging from 89 cm to 107.5 cm exhibited higher yield components. Statistical analysis revealed a positive correlation (r=0.40) between plant height and thousand-grain weight. Accessions that showed equivalent results to “Garabagh 7” regarding 1000-grain weight demonstrated higher parameters in terms of spike length and plant height. The study revealed that certain accessions (TYB 7412, Nutans 46, AG 2632) exhibited performance levels comparable to the control variety “Garabagh 7” in terms of thousand-grain weight (58-61 g). This indicates that these accessions possess a high adaptation potential to local soil and climatic conditions and can be utilized as alternative donor materials in breeding programs alongside the “Garabagh 7” variety.

Keywords: Genbank accessions, 1000-grain weight, Garabagh 7, Genetic resources

Impact of Organic and Inorganic Fertilization on the Growth and Yield Dynamics of Tomato (Lycopersicon esculentum) in the Young Meghna Estuarine Floodplain, Bangladesh

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Abstract

Tomato (Lycopersicon esculentum) productivity is heavily reliant on strategic nutrient management to optimize both vegetative growth and reproductive performance. Efficient nutrient application is also essential for reducing yield gaps while maintaining soil biodiversity in subtropical floodplain agroecosystems. This study evaluated the comparative effects of organic and inorganic fertilizers on the growth and yield of tomato at Noakhali Science and Technology University, Bangladesh (AEZ-18: Young Meghna Estuarine Floodplain), during the Rabi season from December 2022 to March 2023. The experiment was conducted using a Randomized Complete Block Design (RCBD) with three replications and three treatments: T_1 = control (no fertilizer), T_2 = recommended organic fertilizer (cow dung at 10 t ha^{-1}), and T_3 = recommended inorganic fertilizers (urea, TSP, MP, gypsum, zinc, and boric acid at BARI-recommended doses). Results revealed that fertilizer application significantly improved all measured growth and yield parameters. The inorganic fertilizer treatment (T_3) showed the highest performance, with maximum plant height (81.08 cm), leaf number (52.56), and enhanced flowering efficiency. Yield-contributing traits such as fruit length, diameter, and individual fruit weight were also highest under T_3, resulting in a yield of 2.61 kg per plant compared to 1.36 kg per plant in the control. Although inorganic fertilizers provided immediate yield benefits, the findings highlight the importance of integrated nutrient management for sustaining soil health and ensuring long-term productivity in the AEZ-18 region of Bangladesh. These findings provide practical insights for improving tomato productivity in coastal floodplain systems and have broader implications for sustainable intensification in similar agroecological regions worldwide.

Keywords: Tomato productivity, Inorganic fertilizer, Organic fertilizer, Yield attributes, Sustainable agriculture

Genetic Diversity Assessment of Chickpea (Cicer arietinum L.) Genotypes Using Molecular Markers for Breeding Applications

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Abstract

Chickpea (Cicer arietinum L.) İs a globally important grain legume valued for its nutritional quality and contribution to sustainable agriculture, making the assessment of genetic diversity within its germplasm essential for effective breeding and crop improvement. The present study aimed to evaluate the genetic variability among 20 chickpea genotypes, including both local and introduced materials, using inter-simple sequence repeat (ISSR) markers. A total of three ISSR primers (UBC 807, UBC 814, and UBC 815) were employed, generating 6–8 bands per primer. Each primer produced four polymorphic bands, with polymorphism levels ranging from 50.0% to 66.7% and an average polymorphism of 57.9%. The highest genetic diversity index (GDI) was observed with primer UBC 814 (0.86), while the lowest was recorded for UBC 807 (0.43), with a mean GDI of 0.66 across all primers. Similarly, polymorphic information content (PIC) values ranged from 0.17 to 0.43, with an average of 0.33, indicating moderate informativeness of the markers. Cluster analysis based on Jaccard's similarity coefficient grouped the genotypes into five distinct clusters. The closest genetic relationship was observed between breeding lines F.09-60 and F.0.3-14, while the Ukrainian variety Odisey and the USA variety Sanford were identified as the most genetically distinct genotypes. These findings demonstrate a considerable level of genetic variation within the studied germplasm. The identified diverse genotypes can serve as valuable genetic resources for breeding programs aimed at improving chickpea productivity, adaptability, and resilience.

Keywords: chickpea, ISSR, genetic diversity, genetic relationship

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Selection of Rootstocks Under In Vitro Conditions and Their Application Prospects

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Abstract

The correct selection of rootstocks is of particular importance for increasing productivity in fruit growing and enhancing plant resistance to biotic and abiotic factors. In the modern era, alongside traditional breeding methods, the use of in vitro (artificial laboratory conditions) methods allows for improving the quality of planting material and ensuring its biological stability and genetic homogeneity. In vitro cultivation methods (micrografting, meristem culture, callus induction, and somatic embryogenesis) enable the production of clean (virus- and pathogen-free), genetically stable, and rapidly propagable rootstocks. This method is widely applied, especially in apple (Malus domestica), pear (Pyrus communis), peach (Prunus persica), cherry (Prunus avium), and other fruit species. Clonal rootstocks selected by in vitro methods control plant growth vigor, shorten the time to fruiting, regulate tree size, and facilitate the implementation of intensive horticultural technologies. Research shows that rootstocks obtained under laboratory conditions can be differentiated based on selective tolerance indicators to stress factors (salinity, drought, soil reaction). This creates conditions for developing suitable rootstock-scion combinations for various ecological zones. Such an approach opens significant prospects both for adaptive breeding and the application of biotechnological innovations.

Keywords: In vitro conditions, rootstocks, micrografting method, biochemical indicators, stress tolerance.

Genetic Variability in Hazelnut for Quality Enhancement and Climate-Resilient Breeding Potential

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Abstract

Hazelnut (Corylus avellana L.) İs an economically important nut crop widely cultivated for its nutritional value and diverse applications in the food industry. The present study aimed to perform a morphobiological assessment of 36 qualitative traits in 95 hazelnut genotypes, including both local and introduced varieties. The results revealed substantial variability among genotypes for key traits. Tree vigor ranged from low to very high, with the highest vigor observed in Qabala-68 and Shish findig, while six genotypes exhibited low vigor. Most genotypes displayed an upright growth habit, whereas Haribaldi and Nahang were strongly upright, and Firavan and Nasimi showed a spreading tendency. Leaf blade shape was predominantly ovate, with 15 genotypes exhibiting round and 32 elliptical forms. Nut ground color varied considerably, with nearly white observed in Nakoniroud and Ata-baba clone, while others ranged from light brown (17 genotypes) to brown (20 genotypes) and dark brown (9 genotypes). Kernel shape also differed, including flat (4 genotypes), conical (7 genotypes), spherical (12 genotypes), and predominantly oval or cylindrical forms. In terms of taste, 17 genotypes were classified as very good, 27 as satisfactory, and 4 as unsatisfactory, including Aslan baba clone, Haribaldi, Sivri mazi, and Hybrid N1 × Qirmizi Lombard × Sivri mazi. Internal cavity was absent in 6 genotypes, while the hybrid Eshrefi × Qirmizi Lombard exhibited a large cavity, and others showed small to moderate levels. Overall, the observed diversity highlights valuable genetic resources for breeding programs aimed at quality improvement and climate-resilient crop development.

Keywords: quality traits, hazelnut, tree vigor, morphological assessment

Acknowledgements: This work was supported by the Azerbaijan Science Foundation – Grant № AEF-MGC-2024-2(50)-16/08/3-M-08.

Morphologıcal characterıstıcs of azerbaıjanı wıld blackthorn (prunus spınosa l.)

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Abstract

This study examines the morphological diversity of Prunus spinosa L. (blackthorn), a widely distributed drupe fruit species of the Rosaceae family. A total of 100 wild genotypes were evaluated using 19 morphological traits. Descriptive statistics revealed high variability, especially in vegetative traits. Trunk diameter ranged from 3.37 to 15.83 cm (CV=45.27%), canopy diameter from 1.00 to 3.70 m (CV=32.47%), and plant height from 1.40 to 5.83 m (CV=33.06%), indicating substantial phenotypic diversity. In contrast, leaf traits exhibited relatively lower variation. Fruit characteristics were more stable overall. Fruit length ranged from 13.2 to 17.2 mm (CV=8.25%) and width from 9.9 to 14.3 mm (CV=11.69%). However, fruit weight (CV=22.69%) and pulp weight (CV=7.80%) showed moderate variability. The pulp percentage varied between 52.70% and 67.50% (CV=6.47%), reflecting a consistently high proportion of edible tissue. Principal component analysis (PCA) confirmed the suitability of the dataset. The first three principal components explained 91.31% of the total variation. PC1 (73.30%) was strongly associated with fruit size, weight, stone characteristics, and flower traits, indicating that generative traits are the primary source of variation. PC2 (10.35%) was linked to plant height and leaf width, while PC3 reflected growth vigor. Analysis of variance revealed highly significant differences ($p<0.001$) among populations for all traits, with the greatest variation observed in vegetative parameters. Correlation analysis showed strong positive relationships among fruit traits, particularly between fruit length and width ($r=0.94$), and negative correlations between fruit weight and shape index ($r=-0.89$). Cluster analysis grouped the genotypes into five clusters, with Cluster 3 identified as the most promising due to larger fruit size and higher pulp percentage (58.2–64.8%). The lack of correspondence between clusters and geographic origin suggests effective gene flow. Overall, the findings highlight high morphological diversity and confirm the value of blackthorn as a genetic resource for breeding and conservation.

Key words: Prunus spinose L., genetic resources, phenotypic variation, cluster

Role of Nutritional and Genetic Factors in Health and Behavioral Outcomes in ASD

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Abstract:

The development of plant-based nutraceuticals and functional food additives is increasingly relevant, as emerging evidence suggests that processed foods may influence human health, including neurodevelopmental conditions such as Autism Spectrum Disorder (ASD). Many children with ASD experience gastrointestinal problems such as constipation, diarrhea, and food selectivity. Food selectivity may reflect the repetitive and restricted behaviors characteristic of ASD, leading to a limited range of accepted foods, with reported prevalence ranging from 51% to 89%. Recent advances in genomics have identified multiple single nucleotide polymorphisms (snps) associated with ASD, suggesting that genetic variability may also influence individual responses to dietary factors and repetitive behaviors. In the present study, SNP screening was conducted in a cohort of 103 children diagnosed with ASD to explore underlying genetic variability, alongside limited observational data on feeding behavior and other repetitive behaviors. Screening revealed a potential link between the NRP2 rs2254298 polymorphism and olfactory sensitivity ($\chi^2 = 4.917$, $p = 0.027$), suggesting that genetic variability may contribute to sensory-driven repetitive behaviors, such as olfactory stimming. Within the participant group, some children displayed a strong aversion to meat, while others avoided juicy fruits such as apricots and peaches, as well as watery vegetables and foods like tomatoes, potentially increasing their risk of micronutrient deficiencies and metabolic disturbances. Our findings indicate that food selectivity and other repetitive behavioral challenges can improve over time with targeted interventions; in a subset of our cases, weekly sessions of behavioral and sensory integration therapy combined with regular speech therapy led to reduced ASD symptoms, resolution of food selectivity, and increased peer engagement. The coexistence of genetic variability and restrictive dietary patterns highlights the importance of integrated nutritional and behavioral strategies in ASD management.

Keywords: food selectivity, autism, SNP, repetitive behavior

Genomic Tools for Plant Diversity Analysis and Sustainable Agriculture

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Abstract

The world food requirements are increasing day by day due to over increasing population. Genetic diversity is very significant for sustainable agriculture, food security and sustainability of the environment. With the privilege of various challenges in agriculture like climate change, soil degradation and loss of genetic material, there is a need of high-tech genomic tools that can be used to understand and preserve plant diversity. This paper outlines the importance of genomic tools in genetic variation analysis and their relevance in sustainable agriculture. There have been great advancements in genomics that include molecular markers, whole-genome sequencing, genotyping techniques, genome-wide association studies and bioinformatics tools. Such instruments help in the characterization of germplasm resources, understanding genetic relations, as well as finding beneficial traits related to stress resilience, increased yields and disease resistance. For example, reference genome assembly together with germplasm sequencing facilitates identification of breeding targets that could help ensure future food security. The use of genomic techniques also allows using marker-assisted selection and developing new cultivars that possess climate resilience and high performance. Moreover, the advent of next-generation sequencing and comparative genomics can increase possibilities for the study of previously unexplored plants and maintenance of plant diversity. Involving genomics into agricultural science can enhance the sustainability of crops as they promote efficient use of resources, plant biodiversity and adaptive ability to environmental changes. This review shows an increasing importance of genomics in agriculture and its great potential for improving modern food systems as well as keeping the ecosystem in balance. Thus, the incorporation of genomics is quite promising in sustainable agriculture and preservation of plant genotypes.

Key Words: Molecular breeding, Genetic variability, Next Generation Sequencing, Germplasm characterization, Climate resilience

Molecular docking and bioactive compounds from Mentha longifolia against AmpC an efflux pump protein in multi drug resistant bacteria

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Abstract

Medicinal plants have numerous phytochemicals that played an important role in development of conventional medicines. Mentha longifolia produce essential oil constituents, flavonols, ceramides, cinnamate, sesquiterpene and monoterpene. Pseudomonas aeruginosa is a gram negative, clinically significant pathogen that is responsible for various infections e.g., pulmonary and urological infections. It causes diverse infections in immunocompromised hosts. AmpC ß-lactamase group I class C enzyme commonly found among the Pseudomonas aeruginosa and those bacteria that are not able to break down sugars. Molecular docking simulation were performed against the crystallographic structure of AmpC to check the inhibitory capability of 68 phytochemicals via AutoDock Vina. The drug likeness properties such as Lipinski's five rule and pharmacokinetic analysis ADMET (absorption, distribution, metabolism, excretion and toxicity) were performed using SwissADME and ADMETlab 2.0. In the end Discovery Studio was used to check binding interaction analysis. 2D and 3D interactions were formulated using LigPlot and PyMol. Two compounds out of 68 cross the PGP+ with Blood Brain Barrier without violating the Lipiski's five rule. Both compounds Dihydro tagetone and Phenyl ethyl butanoate showed best docking score against the protein with -8.222 KJ/Mol and -6.562 KJ/Mol respectively. These findings can be used to design the potential candidate against inhibitors of efflux pump protein in multi resistant bacteria. Further research must be conducted to identify the bioactive compounds in order to increase their binding capacity and neutralize the effect of efflux protein in multidrug resistant bacteria.

Key Words: Pseudomonas aeruginosa, Molecular docking, ADMET

Harnessing Plant Genetic Diversity for Climate-Smart Agriculture and Human Health

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Abstract

Plant genetic diversity is a key resource for developing climate-smart agricultural systems and improving human health. This review synthesizes the role of diverse plant genetic resources in enhancing crop adaptability to changing environmental conditions. Studies revealed that genetic variation can identify traits related to drought tolerance, disease resistance and improved nutritional quality. This review further highlights the importance of plant-based bioactive compounds in promoting human health and preventing diseases. Integrating genetic diversity into breeding programs not only strengthens agricultural sustainability but also contributes to the development of functional foods. It also emphasizes that preserving and utilizing plant diversity is essential for addressing climate change and ensuring nutritional security. Moreover, this review is a critical review of the recent developments in molecular breeding methods, such as marker-assisted selection, genomic selection, and multi-omics methods of the effective use of genetic diversity. In addition, it discusses about the importance of protecting the germplasm stock, the importance of underutilized and indigenous crops in climate resilience. This review assesses the present challenges and next-generation collaborations of plant genetic diversity with nutritional security and human health outcomes. Overall, this study provides a sustainable framework linking plant science innovations with agriculture and human well-being.

Keywords: Genetic Diversity, Genomic Selection, Multi-omics and Molecular Markers.

CRISPRa-Mediated Improvement of Zingiber officinale via In vitro Propagation and Bioactive Compound Profiling

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Abstract

Ginger (Zingiber officinale) is a highly regarded medicinal and culinary plant. The rhizome of ginger is a rich source of phenolic compounds including gingerols and shogaols which exhibit anticancer properties. In spite of great breakthroughs in tissue culture, the targeted improvement of bioactive compounds by identifying key enzymes involved in phenylpropanoid synthesis is still unexplored. This proposal aims to formulate CRISPR (dCas-based activation) system in order to elevate the PAL gene, an important enzyme in the phenylpropanoid pathway. This study will develop an optimized tissue cultured protocol, design CRISPRa construct which will target the PAL promoter. Furthemore this study will generate CRISPRa modified ginger plant through Agrobacterium based transformation. Activation of target gene will be confirmed by using PCR and gene expression analysis. The changes in metabolites such as gingerol and shagaol content will be checked by metabolite profiling. The regenerated ginger plant is expected ro enhance the transcriptional activity of PAL gene without creating double stranded break . Hence, this work will provide a novel framework for metabolic engineering in Zingiber officinale, Furthermore, it is a suitable approach for improving anticancerous metabolites and other medicinal values in Zingiber officinale and emphasize on broader applications of CRISPRa in medicinal plant metabolites enhancement.

Keywords: Ginger, Micropropagation, Plant growth regulators, Bioactive compound extraction, CRISPR technology

PROSPECTS OF USING PAULOWNIA TREE IN THE RESTORATION OF LAND RESOURCES IN KARABAKH

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Abstract:

The degradation of soil resources in the Karabakh economic region has created serious ecological challenges stemming from long-term anthropogenic pressure, intensive agriculture, and years of military occupation. In previously uncontrolled areas, the collapse of soil structure, reduction of the humus layer, weakening of microbiological activity, and intensification of erosion have been widely recorded. These processes have significantly decreased agroecosystem productivity and slowed the region's sustainable development.

Under such conditions, the use of plant species with high adaptation potential and phyto-ameliorative capacity becomes strategically important for restoring soil health. Among these species, the Paulownia tree has attracted global scientific interest in recent decades due to its role in soil rehabilitation, carbon sequestration, and alternative bioresource production.

Paulownia's rapid growth, strong photosynthetic ability, and deep root system enable it to stabilize soil structure, enhance nutrient circulation, and increase biological productivity. Its nitrogen-rich leaves stimulate soil microflora, support microbial diversity, and strengthen the soil's natural self-recovery mechanisms.

Beyond ecological functions, Paulownia also offers socio-economic value. By forming high-quality wood and biomass in a short period, it can serve as a sustainable raw material source for industrial and energy sectors.

Therefore, establishing Paulownia plantations in the Karabakh region may contribute substantially to restoring soil fertility, improving ecosystem service sustainability, and supporting regional socio-economic development. Comprehensive scientific studies will provide a solid basis for realizing this potential.

Keywords: carbon sequestration, soil degradation, biodiversity protection, ecosystem services, green economy.

A century of Scientific Research at the Fruit and Tea Research Institute: Historical Heritage, Scientific Achievements and Future Prospects

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Abstract

Agricultural science plays a pivotal role in ensuring food security, promoting the sustainable use of soil and natural resources, and conserving plant genetic diversity under changing environmental conditions. In this context, the Fruit and Tea-growing Research Institute of Azerbaijan, with nearly a century of continuous scientific activity, has emerged as one of the country's leading research institutions in the fields of horticulture and tea science. Since its establishment, the Institute has made substantial contributions to the development of fruit growing and tea production through applied and fundamental research. The Institute's mandate encompasses a broad range of economically important crops, including pome fruits (apple, pear, quince), stone fruits (peach, apricot, cherry, plum), nut-bearing species (hazelnut, walnut, chestnut), subtropical and citrus fruits, berries, and tea. Through long-term breeding programs, extensive field evaluations, and germplasm conservation efforts, the Institute has developed and maintained rich genetic collections that serve as a critical foundation for cultivar improvement and sustainable production systems. In recent years, advances in molecular genetics, marker-assisted diversity analysis, and biotechnological techniques have significantly strengthened the Institute's research capacity. The application of molecular markers, in vitro propagation, and modern nursery technologies has facilitated the identification of valuable donor genotypes and the development of high-yielding, disease-resistant, and climate-resilient cultivars. These approaches align closely with global trends in sustainable agriculture and plant breeding. Furthermore, active participation in international initiatives, including the European Cooperative Programme for Plant Genetic Resources (ECPGR), has enhanced the Institute's integration into the global scientific community and increased the visibility of Azerbaijan's plant genetic resources. Overall, the Institute's research activities contribute strategically to sustainable agricultural development, biodiversity conservation, and the long-term resilience of horticultural systems in the Caucasus region.

Keywords: *fruit growing, tea cultivation, genetic diversity, breeding, Azerbaijan*.