



*International Conference
on*

BIORESOURCE SYNERGIES FOR SUSTAINABLE ENVIRONMENT, AGRICULTURE AND MEDICINE

BioS-SEAM - 2026

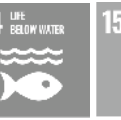
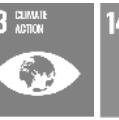
**FEBRUARY
03 & 04
2026**



Organised by

**DEPARTMENT OF BOTANY
PERIYAR UNIVERSITY**

State University - NAAC 'A++' Grade - NIRF Rank 94 - State Public University Rank 40 - SDG Institutions Rank Band : 11-50
Salem - 636 011, Tamil Nadu, India.



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ABSTRACT BOOK TITLE

International Conference on

**BIORESOURCE SYNERGIES FOR SUSTAINABLE ENVIRONMENT,
AGRICULTURE AND MEDICINE
(BioS-SEAM- 2026)**

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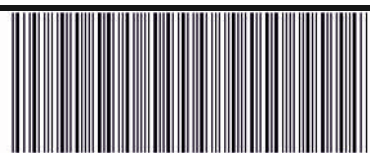
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பெரியார் பல்கலைக்கழகம்

PERIYAR UNIVERSITY

State University - NAAC A++ Grade - NIRF Rank 94
State Public University Rank 40- SDG Institutions Rank Band : 11-50
Salem - 636011, Tamil Nadu, India

Dr. V. Raj
Registrar (FAC)

Date: 29.01.2026



Message

I am very happy to know that the Department of Botany, is organizing International Conference on "Bioresource Synergies for Sustainable Environment, Agriculture, and Medicine (BioS-SEAM 2026)", scheduled on 3-4 February 2026. The conference is conceived as an interdisciplinary knowledge platform that underscores the responsible and sustainable utilization of bioresources to address pressing challenges related to environmental sustainability, agricultural resilience, and human health.

Contemporary scientific advancement increasingly relies on convergence, where environmental sciences, agricultural innovations, and biomedical research collectively contribute to holistic and sustainable solutions. In this context, BioS-SEAM 2026 has been carefully structured to facilitate meaningful interaction among scientists, academicians, industry experts, policymakers, and young researchers. The thematic focus highlights the importance of integrated, systems-oriented approaches that harmonize productivity with ecological balance and societal well-being.

The conference program, comprising plenary lectures, technical sessions, and interactive discussions, is intended to encourage critical inquiry, promote innovation, and showcase research with strong translational relevance. Such scholarly exchanges are expected to strengthen interdisciplinary networks and foster collaborations that transcend institutional and geographical boundaries.

It is anticipated that BioS-SEAM 2026 will act as a catalyst for knowledge enrichment and make a constructive contribution to sustainable development efforts. I extend my best wishes for the success of the conference.



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Prof. Dr. S. VINCENT, D.Sc., Ph.D., MNASc., FNABS., FRBS (Lon)

Member Secretary



FOREWORD

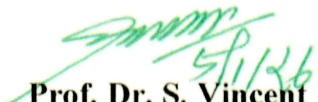
It is with great pleasure that I extend my warm greetings on the occasion of the Two-Day International Conference on "*Bioresource Synergies for Sustainable Environment, Agriculture, and Medicine (BioS-SEAM-26)*", being organized by the Department of Botany, Periyar University, Salem, during 3rd & 4th February 2026.

In the present global scenario, sustainable utilization of bio-resources has become a critical necessity for ensuring environmental balance, food security, and human health. The theme of BioS-SEAM-26 is timely and highly relevant, as it emphasizes the integration of biological resources with innovative scientific approaches to address challenges in sustainability, agriculture, and medicine. Such interdisciplinary synergies are essential for developing eco-friendly solutions and advancing knowledge for the benefit of society.

This international conference provides an excellent platform for academicians, researchers, scientists, industry professionals, and young scholars to share their research findings, exchange ideas, and foster collaborations across disciplines and geographical boundaries. The deliberations and interactions during the conference are expected to generate valuable insights, promote innovative thinking, and contribute meaningfully to the advancement of bio-resource-based research and applications.

I sincerely appreciate the efforts of the organizing committee, advisory board, and all contributors for their dedication and meticulous planning in making this conference a reality. I am confident that BioS-SEAM-26 will be a fruitful academic endeavour and will inspire future research initiatives toward sustainable development.

I wish the conference every success.


Prof. Dr. S. Vincent
Member Secretary



Dear Delegates,

On behalf of the **BioS-SEAM-2026** Organizing Committee, it is my great pleasure to welcome all speakers, presenters, and participants to the **International Conference on “Bioresource Synergies for Sustainable Environment, Agriculture, and Medicine (BioS-SEAM-2026)”** sponsored by **Tamil Nadu State Council for Science and Technology (TNSCST)**.

Last year, our department successfully conducted the **National Conference on “Current Challenges and Future Perspectives of Medicinal Plants (NCFMB-2024)”**. We hope this international conference will build on that success and achieve even greater heights. I strongly believe that this conference will be a good opportunity for scientists, researchers and students passionate about environment, agriculture and medicine have an excellent opportunity to connect and collaborate.

We hope you can leverage as much as you can from this conference with a plenty of beneficial take away. Thank you all for your support. In that regard, I extend my sincere appreciation to the organizing committee members for their dedication and hard work in making this event possible. I would like to thank **Dr. Lalitha** (Organising Secretary), who will conduct this conference with excellence. A special thanks to **Tamil Nadu State Council for Science and Technology (TNSCST)** for their generous support in making this conference possible.

I hope we will have a fruitful conferencing experience and make this conference a grand success. I pray for all the great things ahead for all of us.

Thank you with best wishes,

With warm regards,

Dr. K. Selvam,

Professor and Head,

Chairman (**BioS-SEAM-2026**)

Department of Botany,

Periyar University, Salem – 11.



Professor Dr. Kasem Soytung

Director, Research Institute of Modern Organic Agriculture
King Mongkut's Institute of Technology Ladkrabang (KMITL),
Bangkok, Thailand

President, Association of Agricultural Technology in Southeast Asia
(AATSEA)

MESSAGE

It is a great honor and pleasure to be associated with the Two-Day International Conference on “Bioresource Synergies for Sustainable Environment, Agriculture and Medicine (BioS-SEAM-2026)” organized by the Department of Botany, Periyar University, Salem, Tamil Nadu, India. The theme of this conference is timely and highly significant in the context of global challenges related to environmental degradation, food security, climate change, and human health.

Bioresources, including soil, plants, microorganisms, and bio-based products, play a pivotal role in achieving sustainable development goals. Their responsible utilization through scientific innovation and interdisciplinary collaboration is essential for maintaining ecological balance, enhancing agricultural productivity, and improving human well-being. This conference provides an excellent international platform for knowledge exchange, sharing of best practices, and fostering collaborative research among scientists across the globe.

I commend the organizing committee for their vision and dedication in bringing together researchers, academicians, and young scientists from diverse disciplines. I am confident that the deliberations and scientific interactions during this conference will generate innovative ideas, strengthen global research networks, and contribute meaningfully to sustainable solutions for the benefit of present and future generations.

I wish the organizers and participants every success and look forward to the fruitful outcomes of this important scientific gathering.

A handwritten signature in blue ink that reads "Kasem Soytung".

Professor Dr. Kasem Soytung
President, AATSEA



Valeria Bianciotto Ph.D.

Senior Scientist

Institute for Sustainable Plant Protection (IPSP) of

National Research Council of Italy (CNR)

Department of Life Science and System Biology - Turin University

Viale Mattioli 25, 10125 Turin, Italy

Email: valeria.bianciotto@cnr.it

Foreword letter

I am pleased and honored to write this foreword letter for the *International Conference on Bioresources for Sustainable Environment, Agriculture and Medicine (BIOS-SEAM 2026)*, which will take place in Salem, India, on 3–4 February 2026.

The responsible use and management of bioresources represents one of the most pressing challenges facing modern society, especially in relation to agriculture, environmental conservation, and human well-being. Through my long-standing research experience on soil microorganisms and their use as biofertilizers, I strongly believe that biological resources—when carefully studied and applied in a sustainable manner—can provide effective and eco-friendly approaches to improve crop productivity, maintain soil quality, and limit the excessive use of chemical inputs.

Microorganisms in the soil are essential for nutrient transformation, plant development, and adaptation to environmental stress conditions. Their incorporation into sustainable farming practices is a crucial pathway to ensuring food security while protecting natural ecosystems and biodiversity. Furthermore, ongoing progress in bioresource science is generating new opportunities for sustainable environmental solutions and medical applications, highlighting the growing need for interdisciplinary and global cooperation.

This conference serves as an important forum for young researchers, scientists, and professionals to share expertise, present novel findings, and discuss practical solutions at the intersection of environment, agriculture, and medicine. I warmly acknowledge the efforts of the organizers in promoting scientific exchange and collaboration across different fields and countries.

I am confident that BIOS-SEAM 2026 will encourage constructive dialogue and contribute to the advancement of sustainable approaches and bio-based innovations for the benefit of both current and future generations.

I wish all participants a successful conference and a productive exchange of ideas.

Valeria Bianciotto

Senior Scientist IPSP- CNR

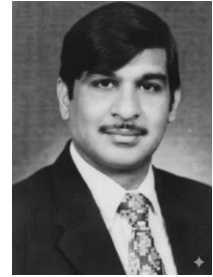
T.J. PANDIAN, FNASc, FASc, FNA, FTWAS

09.01.2026

National Professor

Madurai Kamaraj University

MADURAI 625 021



FELICITATION MESSAGE

On the eve of the International Conference on Bioresources Synergies for Sustainable Agriculture, Environment, Agriculture and Medicines (BioS-SEAM) being hosted by Dr. S. Lalitha at Periyar University, Salem during the 3rd and 4th of February 2026, I am happy to send this felicitation message.

The Conference includes Lead Lectures, Panel Discussions and Posters — all arranged interesting sessions: Animal Husbandry, Bioresources, Marine Medicines and Sustainable Agriculture. Known for her excellent organizing ability, Dr. Lalitha has ensured the participation of leading scientists from three continents: Africa (Botswana), Asia (China, Thailand) and Europe (Italy). Notably, the conference shall provide a unique opportunity for the faculty and students from affiliated colleges of Dharmapuri and Krishnakiri districts, known to be the educationally backward districts of Tamil Nadu, to update their knowledge in these vitally important areas of Biology.

I wish the Conference a great success.

(Signed)

T.J. PANDIAN



Prof. M. JOTHI BASU
Professor of Botany, CDOE



Date: 2nd January 2026


MESSAGE

I am delighted to learn that the **International Conference on Bioresource Synergies for Sustainable Environment, Agriculture and Medicine (BioS-SEAM 2026)** is being organized by Department of Botany, Periyar University, Salem on 3rd & 4th February 2026 with great scientific intension. The **BioS-SEAM 2026** is a vital forum at a time when societies worldwide are seeking scientific, ethical and sustainable pathways to address the intertwined crises of environmental degradation, food insecurity and human health challenges. By foregrounding bioresource synergies, the conference aspires to reframe biological resources not merely as commodities but as foundations for resilient ecosystems, dignified livelihoods and holistic well-being.

Bringing together leading experts, early-career researchers and practitioners, this conference spans key themes such as sustainable agriculture, biodiversity conservation, plant and animal health, marine bioresources, ethnobotany, phytochemistry, microbial and nanotechnologies, and renewable energy. Such a broad yet coherent canvas enables meaningful dialogue between traditional knowledge and frontier science, between field realities and laboratory innovations, and between local priorities and global sustainability commitments, including the Sustainable Development Goals.

It is anticipated that the deliberations, presentations and interactions over these two days will catalyse enduring collaborations, context-appropriate technologies and policy-relevant insights that can be translated into practice for the benefit of farming communities, rural and urban societies, and fragile ecosystems.

With great pleasure, this foreword is commended to the readers of the proceedings of **BioS-SEAM 2026**, with warm wishes for an intellectually stimulating and impactful conference.


Dr. M. JOTHI BASU
Professor in Botany
Centre for Distance and Online Education
Alagappa university
Karaikudi - 630 003
Tamil Nadu India



Foreword

Bioresources, ranging from soil, plants, microorganisms and agro-residues to medicinal flora and bio based products constitute the foundation of sustainable agricultural practices. Their judicious utilization and effective integration across environmental management, agricultural productivity and human health hold immense potential to enhance ecosystem resilience, improve resource efficiency and maintain ecological balance. The global initiative to foster sustainable practices aimed at enhancing soil health and safeguarding environmental quality through soil and water conservation, efficient nutrient and waste management, biodiversity preservation and the sustainable utilization of bio-resources. Recognizing these interlinkages, the present conference emphasizes a synergistic approach that transcends disciplinary boundaries and encourages holistic solutions.

It gives me immense pleasure to extend my hearty congratulations to the Department of Botany, Periyar University, Salem, Tamil Nadu for organizing the **Two days International Conference on “Bioresource Synergies for Sustainable Environment, Agriculture and Medicine (BioS-SEAM-2026)” during 3-4 February, 2026**. The deliberations and presentations scheduled during this conference will highlight recent advances in sustainable agriculture, natural resource conservation, bio-based innovations, climate-smart practices, and the role of bioresources in preventive and therapeutic medicine. By bringing together diverse perspectives and expertise, the conference seeks to stimulate knowledge exchange, inspire innovative research that reduce environmental degradation, enhance ecosystem resilience and mitigate the adverse impacts of natural disasters. Furthermore, the conference seeks to facilitate interdisciplinary research, technology transfer and active stakeholder engagement to achieve long-term environmental sustainability and socio-economic well-being. I am confident that the scientific interactions, technical sessions and discussions will not only enrich our collective understanding but also pave the way for actionable strategies that benefit both society and the environment alike. I sincerely hope that this conference will serve as a milestone in strengthening research networks and nurturing young minds toward responsible stewardship of bioresources.

A handwritten signature in green ink, appearing to read 'T.S.S.K. Patro'.

Dr. T.S.S.K. Patro
Principal Scientist and Head
Agricultural Research Station
Vizianagaram 535001



Foreword Message

In an era marked by global challenges related to environmental degradation, food security, and human health, the responsible utilization of bioresources has become increasingly vital.

International Conference on Bioresources Synergies for Sustainable Environment, Agriculture and Medicine (BioS-SEAM-2026) to be held on 3rd & 4th February 2026 at Periyar University seeks to foster meaningful dialogue and knowledge exchange across the domains of sustainable environment, agriculture, and medicine, encouraging translational research and collaborative solutions that address real-world problems.

This conference is conceived as a multidisciplinary forum to explore the transformative potential of bioresources in addressing pressing global challenges at the intersection of environment, food systems, and human health. The conference program features keynote lectures by eminent scientists, invited talks, oral and poster presentations, providing participants with valuable opportunities to share their research findings, gain insights from experts, and establish interdisciplinary collaborations. I believe that the discussions and outcomes of this conference will contribute significantly to advancing sustainable practices and bioresource-based innovations.

I express my sincere appreciation to Dr. S. Lalitha, convenor and organizing secretary, and extending a warm welcome to all delegates and participants, whose active engagement will be central to the success of this academic endeavor. I am confident that BioS-SEAM-2026 will serve as a vibrant platform for innovation, collaboration, and inspiration, and that its deliberations will contribute meaningfully to advancing sustainable solutions for global well-being. I am confident that BioS-SEAM-2026 will be a stimulating and enriching experience for all involved.

With best wishes for a successful and impactful conference.

Dr. Kathiresan Natarajan

Scientist E1
BRIC Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram,
Kerala, India.



On behalf of the organizing committee, it is my great pleasure to welcome you to the forthcoming International Conference on “**Bioresource Synergies for Sustainable Environment, Agriculture, and Medicine (BioS-SEAM 2026)**”, scheduled to be held on **3–4 February 2026** .

In the present era, the responsible utilization of bioresources and the effective integration of environmental, agricultural, and medical sciences have become critically important in addressing global challenges such as climate change, food security, ecosystem degradation, and human health. BioS-SEAM 2026 has been conceived as a timely academic initiative to bring together the global scientific community to deliberate on these interconnected issues through an interdisciplinary lens.

The conference aims to serve as a knowledge-driven platform that promotes meaningful scientific exchange and collaborative thinking. By facilitating interaction among researchers, academicians, industry experts, and policymakers, BioS-SEAM 2026 seeks to bridge the gap between research and practice, ultimately translating scientific advancements into sustainable solutions with real societal impact. The conference programme, comprising keynote lectures, technical sessions, and interactive discussions, is thoughtfully designed to strengthen the linkage between fundamental research and real-world applications. We are confident that these deliberations will inspire innovation, encourage interdisciplinary collaboration, and contribute significantly to environmental stewardship, sustainable agriculture, and health-oriented bioresource utilization.

I warmly invite you to participate in BioS-SEAM 2026 and contribute to its success through your valuable presence and scholarly contributions.

With warm regards,


Convener & Organizing Secretary
BioS - SEAM - 2026
Department of Botany
Periyar University, Salem-11.

Invited Speakers			
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2	Nanotechnology for plant disease management Jiaojiao Song ^{1,2,4*} , Kasem Soyong ^{1,3,4}		2
3	Plant-based biopolymers as performance materials for sustainable agriculture Jothi Basu Muthuramalingam ^{1,2*} , John Praveen Kumar John Kennedy ²		3
4	Revitalizing millets: An ancient grain's role in global food and climate security T.S.S.K. Patro ^{1*} , M. Divya ¹ , N. Anuradha ¹ , Y. SandhyaRani ¹ , U. Triveni ¹ , M. Swathi ¹ , M. Triveni ¹		4
5	Natural polyphenol curcumin curtails proliferation and motility in lung cancer cells Amitha Muralidharan ¹ , Anju Krishnan ² , Kathiresan Natarajan ^{2*}		5
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8	AM03	Enhancement of growth and stress tolerance in legume crops by biosurfactant-producing PGPR under arsenic stress C. Sathya ¹ , S. Lalitha ^{1*}	8
9	AM04	Indigenous plant growth-promoting rhizobacteria (PGPR) for sustainable soil and crop improvement T. Balakrishnan ¹ , S. Lalitha ^{1*}	9
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11	AM06	Potential of plant growth-promoting rhizobacteria-plant interactions in mitigating salt stress for sustainable agriculture S. Kowsik ¹ , S. Lalitha ^{1*}	11
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13	AM08	<i>Bacillus</i> sp.–Mediated improvement of salinity tolerance in Kalanamak rice (<i>Oryza sativa</i>): Effects on plant morphology and phytochemical attributes Omisha Kannaajiya ¹ , Kumari Sunita ^{1*}	13
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19	AM14	Exploration of halophilic plant growth promoting rhizobacteria (PGPR) for mitigating salt on sesame (<i>Sesamum indicum</i> L.) D. Sridhar ¹ , S. Lalitha ^{1*}	19
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21	AG02	Millet residue management approaches for sustainable soil and crop performance U. Triveni ^{1*} , T.S.S.K. Patro ¹ , N. Anuradha ¹ , Y. SandhyaRani ¹ , M. Swathi ¹ , M. Divya ¹ , and M. Triveni ¹	21
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23	BC02	Macrofungal diversity in Perumalmalai and Shembaganur regions of Western Ghats (Dindigul district) of Tamil Nadu Francis Xavier Thangaraj ¹ , Vinisha Kesavan ^{1*} , Savari vinsiya Justin ¹ , Lintu Jose ¹ , Freeda Rose Antony Kanthi ²	23
24	BC03	A Study on DNA barcoding to unveil the genetic identity of <i>Ficus</i> sp. endemic plants of Western Ghats M. Shirlin Denis ¹ , M. Geetha ¹ , C. Krishnaveni ¹ , R.K. Selvakesavan ¹ , M. Kanchana ^{1*}	24
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26	BC05	Fungal diversity and functional guild analysis of soil in Thalavadi, Sathyamangalam – A Transitional zone of Eastern and Western Ghats I. Sivaraj ^{1*} , D. Madhankumar ² , S. Bhuvaneshwari ³ , B. Sampathkumar ¹ , K.P. Kannan ⁴ , N.K. Udaya Prakash ¹	26
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32	BS04	Valorisation of agri-food waste for bioactive compounds: Recent trends and future sustainable challenges J. Roshni ¹ , K. Abirami ^{1*}	32
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36	BA03	Screening of rice landraces for salinity tolerance using morphological and molecular markers M. Karthika ^{1*} , S. Jeeviya ¹ , S. Bharathkumar ¹	36
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38	EB02	Detection of anaerobic bacteria from the soils of different altitudes of Sathyamangalam, Tamil Nadu, India N. Preethi ^{1*} , S. Bhuvanewari ² , I. Sivaraj ¹ , D. Madhankumar ³ , K.P. Kannan ⁴ , N.K. Udaya Prakash ¹	38
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41	ET02	Survey and documentation of ethnomedicinal plants used by the Malayali tribals in Sitheri Hills, Eastern Ghats, Tamil Nadu, India. G. Sekar ^{1*} , S. Muruges ²	41
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Biological technique for organic agriculture innovation and organic certified standard of AATSEA

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Abstract

Biological technique is proposed as integrating biotic and abiotic factors including digital agriculture through modern organic agriculture or organic agriculture innovation for food safety/security and sustainability to surrounding environment. This new approach is to change the concept of organic agriculture from traditional or conventional to modern organic agriculture. Modern organic agriculture has been proven effective, based on understanding the scientific principles of the natural sciences, to produce agricultural inputs that enhance crop productivity and quality, compared to chemical agriculture. Biotic factors in rhizosphere soil involve understanding all living organisms on the farm, both beneficial and non-beneficial organisms, microbial community in rhizosphere soil, bioremediation, biological pest management (weed, insect pests, and plant pathogens), etc. Moreover, biotic factors under the plant canopy and surrounding cropping production involve microbial communities, including both beneficial and pathogenic microbes and organisms, as well as insects for pollination, predators, and others. Abiotic factors in rhizosphere soil include soil fertility (organic matter, soil pH, EC, soil structure, soil moisture and temperature, soil aeration, ratio of oxygen and carbon dioxide in rhizosphere soil, toxic chemical residues in soil and water, etc.). Furthermore, abiotic factors under plant canopy and surrounding cropping areas involve temperature, wind direction, relative humidity, light intensity for physiological processes of photosynthesis, respiration, translocation of water and nutrients, evapotranspiration (water moving from soil to atmosphere by evaporating from surface of soil and transpiration from crops through stomata), water and weed management, natural plant protection etc. Digital agriculture enables precision agriculture through AI, IoTs, sensors, weather stations, drone technology, and organic smart farms. Modern techniques for organic crop production are a complex decision-making system that integrates all factors to identify problems in each organic farm, and can recommend appropriate biotechnologies to solve the problems faced in farms, thereby enabling successful organic crop production. An organic certification standard is needed for farmers and consumers to achieve an acceptable level of organic products, and the AATSEA organic certification standard is one of the leading agents in organic certification.

Keywords: Biotechnology, Rhizosphere soil, Organic Certification, Modern organic farms

Nanotechnology for plant disease management

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Abstract

Agricultural biotechnology is focused on reducing the use of toxic agrochemicals in crop production, promoting food safety, and fostering sustainable agriculture. Nano-biotechnology has been investigated and developed for safe crop production, utilizing natural product active metabolites derived from potent microorganisms engineered to form nanoparticles or nanofibers for plant disease management. Our research investigation has developed and formulated nano-elicitors from natural active metabolites of *Chaetomium globosum*, *Ch. lucknowense*, *Ch. brasiliense*, *Ch. cochliodes*, *Ch. cupreum*, *Ch. elsatum*, *Emmericella nidulans*, and *Trichoderma harzianum*. It is proven that the specific nano-elicitor such as nano-pure compound rotiorinol of *Ch. cupreum*, nano-pure compound chaetoglobosin-C of *Ch. globosum*, nano-pure compound chaetomanone of *Ch. cupreum* can be rapidly penetrated into plant cells and tissue for biological activity process to elicit the infected plants to produce phytoalexin capsidiol for disease protection at low concentration of 5 ppm which is treated to control chilli and coffee anthracnose caused by *Colletotrichum gloeosporioides*, nano-pure compound trichotoxin A50 of *T. harzianum* which acts as elicitor to induce capsidiol against anthracnose. Natural nano-pure compound chaetomanone is also expressed antifungal activity against *Fusarium oxysporum* sp *lycopersici* race 3 and induces the production of alpha-tomatiline in the infected tomato plants. Moreover, the research findings on natural products from microorganisms have been further investigated for disease management through plant immunity as plant vaccine. These research approaches can be integrated with other control measures to enhance disease management and reduce the use of toxic chemicals in agriculture.

Keywords: Natural products, Nano-elicitor, Plant immunity, Phytoalexin

Plant-based biopolymers as performance materials for sustainable agriculture

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Abstract

Plant-based biopolymers constitute a rapidly expanding class of renewable performance materials that can replace persistent petrochemical plastics in modern agriculture. Their biodegradability, bio-based origin and tunable functional properties enable applications ranging from mulch films and seed coatings to controlled-release fertilizers, hydrogels and soil conditioners, while simultaneously reducing microplastic accumulation, greenhouse gas emissions and chemical runoff. This study synthesizes recent advances in plant-derived polysaccharides (starch, cellulose, hemicelluloses, pectins) and lignocellulosic polymers (lignin, plant gums) with respect to their sources, physicochemical properties, processing routes and agricultural functionalities, and critically discusses their role in sustainability transitions and circular bioeconomy frameworks. Key challenges and future research directions are highlighted, including material optimization under field conditions, scalability, cost reduction and robust environmental assessments.

Keywords: Starch, Biopolymers, Sustainable agriculture, Fertilizers

Revitalizing millets: An ancient grain's role in global food and climate security

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Abstract

India is the largest producer of millets in the world and accounts more than 40 per cent of the global consumption. Millet cultivation is the mainstay of rainfed farming, providing livelihoods to nearly 50 percent of the total rural workforce and sustaining 60 percent of the cattle population in India. Millets are most unique among cereals. Small millets include Finger millet [*Eleusine coracana* (L.) Gaertn.], Foxtail millet [*Setaria italica* (L.) Beauv], Little millet (*Panicum sumatrense*), Kodo millet [*Paspalum scrobiculatum* (L.)], Proso millet [*Panicum miliaceum* (L.)] and Barnyard millet (*Echinochloa frumentacea*). Small millets are well known as “Nutricereals” as each of the millets is three to five times nutritionally superior to the widely promoted rice and wheat in terms of proteins, minerals and vitamins. Small millets are rich in micro- and macro-nutrients, total protein, fibre and starch. Moreover, the majority of small millets are gluten-free and therefore are of low glycemic index which can be beneficial for diabetic patients. Millets are harbingers of the evergreen revolution, and they can also be called “Miracle Grains” as they help in reducing the atmospheric CO₂ and thus contribute to mitigating climate change and produce multiple securities (food, fodder, health, nutrition, livelihood, and ecological) which make them the crops of agricultural security. Small millets are extraordinarily tolerant of drought and other abiotic stresses, such as high temperatures and poor soils. Besides all these diseases are the major production constraints causing heavy yield losses in small millets. Blast (*Pyricularia grisea*) in finger millet causing grain yield loss ranged from 6.75 to 87.5 per cent and sometimes it may range up to 80-90 per cent. However, banded blight (*Rhizoctonia solani*) causes 31.4 to 97.6 per cent yield loss in small millets. Different control strategies, viz. chemicals, botanicals, biocontrol agents, and host resistance, have been reported to reduce the level of disease to varying extents. But an integrated approach has also been advocated for effective management of these diseases. Botanicals like onion bulb extract, neem leaf extract, tulsi leaf extract, parthenium leaf extract, garlic and ginger extract were reported to inhibit the mycelial growth of these pathogens. Biocontrol agents, such as *Trichoderma asperellum* and *Pseudomonas fluorescens*, were found to be potentially effective in controlling these diseases by producing both volatile and non-volatile antibiotics. Non-conventional chemicals, such as salicylic acid and Sodium fluoride, were found to be effective in inducing disease resistance in small millets. Fungicidal spraying with tricyclazole, propiconazole, or hexaconazole was reported to control the diseases. By utilizing screening techniques, mechanisms of resistance, and employing conventional and molecular methods, including DNA markers and transgenics, a platform is provided to identify candidate genes or markers associated with disease tolerance.

Keywords: Kodo millet, Miracle Grains, *Panicum miliaceum*, *Echinochloa frumentacea*

Natural polyphenol curcumin curtails proliferation and motility in lung cancer cells

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Abstract

Lung cancer is the leading type of cancer primarily developed in tissues of lungs, usually in the cells that line the air passages (bronchi or bronchioles) or small air sacs (alveoli). Smoking is a risk factor for lung cancer development. Curcumin is a polyphenol compound derived from the turmeric plant *Curcuma longa* having promising tumor-suppressive activity. A549 lung cancer cells were treated with increasing concentrations of curcumin (10–100 μM), and cell viability was assessed using an MTT assay, while cell migration was evaluated using a wound-healing assay. Curcumin treatment resulted in a dose-dependent reduction in cell viability, with an IC_{50} value of 63.78 μM . Morphological analysis revealed apoptotic changes at higher concentrations, and migration assays demonstrated significant inhibition of wound closure at 100 μM . These findings indicate that curcumin suppresses proliferation and migration of lung cancer cells in a concentration-dependent manner, highlighting its potential as an adjuvant therapeutic agent for lung cancer management.

Keywords: Lung cancer, Tumor-suppressive, MTT assay, Proliferation

Bioprospecting of associated microbiomes for sustainable agriculture

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Abstract

Increasing demand from the world's expanding population requires increased agricultural productivity. In addition, a sustainable and healthy agricultural production utilizing advantageous microbes for increased yield is required to counteract the negative effects of current agriculture techniques on the environment, human health, and food security. Although producing biomolecules of interest from these microorganisms with rich biosynthetic repositories is quite difficult, intensive research in related fields and the development of new genetic tools for improved microbial consortia are opening up new avenues for farmers and agriculturists to meet the growing demand for sustainable food production. Associated microorganisms have become a valuable tool in the fight against threats to agricultural sustainability. However, research has had difficulty utilizing the advantageous qualities of agricultural microbiomes to enhance crop performance, despite increased interest in optimizing microbial functions for crop yield, resource efficiency, and stress resistance. Here, we provide an overview of the bacteria associated with the salt pan, earthworm cast, and insect nest that have been found to possess Plant Growth Promoting (PGP) traits. We isolated and examined the strains from salt pan and earthworm cast to determine their PGP characteristics. Finally, we suggest areas of focus for future research that take a comprehensive approach to associated microbiomes as potential resources for a range of agricultural systems.

Keywords: Agriculture, Microbes, Associated bacteria, PGP, Earthworm cast, Salt Pan

Organic waste degradation using microorganismsR. Amutha^{1*}

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Abstract

Organic waste materials are used in large quantities worldwide. It is used to improve soil health and increase crop yields. But nowadays, using many chemical fertilizers spoils the soil, preventing organic waste from being degraded and leading to some environmental pollution. Pearl millet is the world's fourth most important tropical cereal. While early maturing and well adapted to droughty, sandy, acid soils of low fertility, pearl millet is highly responsive to fertilizer and moisture on well-drained soils. Corn is also widely grown in tropical, temperate, and some cold zones. In the current study, the degradation process was studied by the enzymes –Amylase from *Bacillus spp.*, and protease from *Aspergillus spp.*, These microorganisms were isolated by inoculating them in specific media. The enzymes were produced in the production media. These enzymes from both wild strains were partially purified by the Ammonium Sulphate precipitation method and quantitatively estimated by Lowry's method. These strains were attached to the organic waste, and the degradation was confirmed by the weight loss. It can also be confirmed by tensile strength, a decrease in viscosity, in some cases, molecular weight distribution, and fragility. Based on the results, the enzyme concentration decreased gradually in the productilalion media. Corn Waste is degraded faster by the Protease enzyme when compared to the Amylase enzyme, and Pearl millet is degraded faster by the Amylase enzyme when compared to the Protease enzyme. Hence, it can be concluded that using *Bacillus* species and *Aspergillus niger* can successfully degrade organic waste within a short time.

Keywords: Organic waste, Amylase, Protease, Bio-degradation, Partial purification

Enhancement of growth and stress tolerance in legume crops by biosurfactant-producing PGPR under arsenic stress

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Abstract

Heavy metal contamination of agricultural soils poses a serious threat to soil health, crop productivity, and human well-being. The present study aimed to isolate, characterize, and evaluate multifunctional plant growth-promoting rhizobacteria (PGPR) and biosurfactant-producing bacteria from heavy metal-contaminated agricultural soils. Soil samples were collected from selected agricultural sites and analyzed for metal concentrations using inductively coupled plasma–mass spectrometry (ICP-MS). Rhizobacteria were isolated by serial dilution and spread plate techniques, and morphologically distinct isolates were screened for plant growth-promoting traits such as indole-3-acetic acid production, siderophore production, hydrogen cyanide production, ammonia production, and phosphate solubilization. The isolates were further assessed for tolerance to increasing concentrations of heavy metals. Highly efficient metal-tolerant isolates were identified by 16S rRNA gene sequencing. Among them, a biosurfactant-producing *Pseudomonas alcaliphila* strain was isolated and characterized. Biosurfactant production was confirmed through drop collapse, foaming assay, and emulsification index tests. Biochemical analyses revealed the presence of carbohydrate and lipid components, and the partially purified biosurfactant was characterized using thin-layer chromatography, Fourier transform infrared spectroscopy, and gas chromatography–mass spectrometry. Pot culture experiments were conducted under arsenic stress using *Vigna unguiculata* (L.) and *Arachis hypogaea* treated with selected PGPR and biosurfactant concentrations (100 and 200 ppm). Plant growth, biochemical parameters, antioxidant activity, and metal accumulation in roots and shoots were evaluated using ICP-MS. PGPR inoculation and biosurfactant application significantly enhanced plant growth, reduced arsenic accumulation, and improved stress tolerance. The study demonstrates the potential of biosurfactant-producing PGPR as eco-friendly agents for heavy metal remediation and sustainable agriculture.

Keywords: Biosurfactant, Arsenic stress, Heavy metal, *P. alcaliphila*, Bioremediation

Indigenous plant growth-promoting rhizobacteria (PGPR) for sustainable soil and crop improvement

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Abstract

Soil, an ever-changing fraction of terrestrial ecosystems, contains a variety of microorganisms that assume key functions in plant development and soil health. The current research was focused on the isolation and characterization of plant growth-promoting rhizobacteria (PGPR) from the rhizospheric soil. Salem, Tamil Nadu. Physicochemical properties of the soil samples such as pH, electrical conductivity, organic carbon, macronutrients (N, P, K), and micronutrients (Fe, Cu, Pb, Cd) were determined. Eleven bacterial isolates with unique morphological and biochemical features were isolated. PUBK-2, PUBK-6, and STBK-9 showed better plant growth-promoting activities like indole-3-acetic acid (IAA) production, phosphate and zinc solubilization, siderophore and hydrogen cyanide (HCN) production, and ammonia synthesis. Molecular identification by 16S rRNA sequencing revealed the isolates as *Bacillus pumilus* (PUBK-2), *Pseudomonas aeruginosa* (PUBK-6), and *Burkholderia aenigmatica* (STBK-9). These isolates exhibited multifunctional plant growth-promoting activities, pointing towards their use as potent biofertilizers and biocontrol agents. The research emphasizes the importance of indigenous PGPR in sustainable agriculture by improving soil fertility, enhancing crop productivity, and minimizing the use of chemical fertilizers.

Keywords: PGPR, *Bacillus pumilus*, *Pseudomonas aeruginosa*, *Burkholderia aenigmatica*, Siderophore

Biosurfactant production and extraction using *Pseudomonas* sp.

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Abstract

In the present study, a biosurfactant, a surface-active component produced by the *Pseudomonas alcaliphila* strain, was isolated and identified by our laboratory. Different biosurfactant screening tests, such as the drop collapse assay, foaming assay, and emulsification index, confirmed the production of biosurfactant by the isolated *P. alcaliphila* strain. The biosurfactant showed significant emulsifying index, drop collapse, and foaming activity. The biochemical assays included phenol-sulphuric acid, carbohydrate, and lipid assays, which were identified. The partially purified biosurfactant was characterized by Thin Layer Chromatography (TLC), Fourier Transform Infrared Spectroscopy (FT-IR), and Gas Chromatography-Mass Spectroscopy (GC-MS). Pot culture studies on *Arachis hypogaea* under Arsenic stress using PAS1 and BS1 at 100 ppm and 200 ppm. The biochemical tests included chlorophyll and carotenoids, shoot and root length, fresh and dry weight, protein, phenol, MDA, antioxidants, and amino acids. ICP-MS was used to identify plant roots and shoots through accumulation studies. The isolated biosurfactant showed significant tolerance against heavy metals. The future prospect of exploring the isolated biosurfactant to reduce heavy metal levels in soil and inhibit rapid agricultural growth.

Keywords: Biosurfactant, TLC, FTIR, GC-MS, Biochemical assay, ICP-MS

Potential of plant growth-promoting rhizobacteria-plant interactions in mitigating salt stress for sustainable agriculture

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Abstract

Soil salinization is one of the most serious threats to global food security. Soil salinization severely diminishes crop productivity globally, affecting 20% of the total cultivated land and 33% of all irrigated agriculture. It has been estimated that reduced crop yields due to salinization result in economic losses of approximately US\$27.3 billion annually. Conventional salinity management practices, including developing tolerant cultivars, soil scraping, flushing, leaching, and the use of gypsum and lime amendments, often yield inferior results in tackling the problem. There is an urgent need for novel approaches that use diverse microbial consortia to enhance crop performance under saline conditions without compromising soil quality. Multi-omics technologies have provided excellent insights into the composition and functional metabolism of plant-beneficial microbes. A wide array of rhizobacterial genera that mitigate both biotic and abiotic stresses have been isolated from crops like legumes, cereals, vegetables, and oilseeds inhabiting extreme alkaline and saline habitats. Recent studies on rhizosphere microbiomes support the hypothesis that plants derive greater benefits from multifaceted, synergistic microbial networks than from single strains. Recently, salt-tolerant plant growth-promoting rhizobacteria have received increased attention for improving plant growth under saline conditions and for reclamation of salt-affected farmlands. The above conclusion highlights the importance of salt-tolerant interactions between microbes and plants for improving growth under saline conditions, explores the mechanisms underlying salt tolerance, and provides a means of leveraging available microbial populations to enhance plant adaptability. Ultimately, these methodologies have the potential to improve agricultural practices and sustain high growth under saline conditions.

Keywords: Beneficial microbes, Osmo tolerance, Rhizosphere microbiome, Salt tolerance, Sustainable agriculture

Synergistic effects of compost and PGPM on crop growth and soil health under greenhouse conditions

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Abstract

This study investigates the synergistic effects of compost, plant growth-promoting rhizobacteria (PGPR), arbuscular mycorrhizal (AM) fungi, and their combined application on crop growth and soil health under greenhouse conditions. Experiments were conducted on *Capsicum annuum* (Chilli), *Solanum melongena* (Brinjal), *Vigna unguiculata* (Cowpea), *Vigna mungo* (Black gram), and *Cicer arietinum* (Bengal gram). Dairy compost prepared from agricultural residues was analysed for macro and micronutrients. Beneficial microbes, including *Pseudomonas fluorescens* and *Trichoderma* spp., isolated from rhizospheric soils of Salem District, Tamil Nadu, were screened for phosphate solubilization, siderophore production, indole-3-acetic acid synthesis, and antagonistic activity against phytopathogens. Greenhouse pot trials demonstrated that combined application of compost with PGPR and AM fungi significantly enhanced plant height, biomass, relative water content, and photosynthetic pigment content compared to the control. Root colonization by microbial inoculants was confirmed through scanning and transmission electron microscopy. Soil analyses revealed increased nutrient availability and microbial population density in treated soils. Molecular docking studies further supported the interaction of microbial metabolites with plant growth-related target proteins. Overall, the results highlight the potential of integrated compost-based bioinoculant strategies as sustainable alternatives to chemical fertilizers for improving crop productivity and soil fertility, particularly in semi-arid agro-ecosystems.

Keywords: PGPR, AM fungi, Compost, Soil health, Vegetable, Pulse crops

***Bacillus sp.*–Mediated improvement of salinity tolerance in Kalanamak rice (*Oryza sativa*): Effects on plant morphology and phytochemical attributes**

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Abstract

Agricultural systems worldwide are increasingly threatened by a range of harsh environmental factors that can drastically reduce crop performance and productivity. These stress conditions can reduce yields by up to 70%, posing a significant challenge to long-term food security. Among all environmental constraints, salinity is particularly detrimental because it damages cellular membranes, disrupts nutrient homeostasis, and suppresses both morphological growth and biochemical processes in plants. Such physiological disturbances collectively lead to significant declines in global agricultural output. Plant growth-promoting rhizobacteria (PGPR) have emerged as promising biological tools capable of enhancing plant tolerance to saline environments. In this study, the effects of *Bacillus sp.* on the growth and yield of Kalanamak rice were evaluated under graded salinity levels (100, 200, 300, and 400 mM NaCl). Higher salt concentrations consistently reduced plant morphological attributes; however, PGPR inoculation notably improved growth responses at all stress intensities. In addition, inoculated plants exhibited enhanced antioxidant defences, including elevated proline content and increased catalase activity, compared with untreated controls. Overall, these findings highlight the potential of PGPR to enhance salt tolerance, regulate key physiological and biochemical pathways, and support improved crop productivity in saline-prone agricultural systems.

Keywords: Salinity, *Oryza sativa*, *Bacillus sp.*, Proline, PGPR

Exploiting multifunctional PGPR for bioremediation of arsenic-contaminated agricultural soils

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Abstract

Heavy metal contamination of agricultural soils poses a serious threat to soil health, crop productivity, and human well-being. The present study aimed to isolate and characterize plant growth-promoting rhizobacteria (PGPR) from contaminated soils and samples were collected from selected agricultural sites and analyzed for heavy metal concentrations using inductively coupled plasma–mass spectrometry (ICP-MS). Rhizobacteria were isolated using serial dilution and spread plate techniques, and morphologically distinct isolates were screened for multiple plant growth-promoting traits, including indole-3-acetic acid (IAA) production, siderophore production, hydrogen cyanide (HCN) production, ammonia production, and phosphate solubilization. The bacterial isolates were further assessed for heavy metal tolerance using increasing concentrations of selected metals in agar media. Highly tolerant and efficient PGPR isolates were identified and molecularly characterized by 16S rRNA gene sequencing for taxonomic identification. Pot culture experiments were conducted under arsenic stress conditions using *Vigna unguiculata* (L.) to evaluate the effect of selected PGPR isolates on plant growth parameters in metal-stressed soil. The results demonstrated that PGPR inoculation significantly improved plant growth attributes, indicating their potential role in mitigating heavy metal toxicity and promoting sustainable agriculture. This study highlights the importance of multifunctional PGPR in eco-friendly bioremediation strategies and soil health restoration.

Keywords: Bioinoculant; ICP-MS; 16S rRNA; Phosphate solubilization; Bioremediation

A Survey on air mycoflora of agricultural fields of *Oryza sativa*

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Abstract

Agricultural plant diseases are caused mainly by microbes, including viruses, bacteria, and fungi. They are generally spread through soil, irrigation, and air. Among them, most fungal diseases spread through the air via spores. Hence, an investigation of the air mycoflora of different agricultural fields of *Oryza sativa* was conducted. The agricultural fields in Andarkuppam, Krishnapuram, Kodur, Ponneri, Periyapalayam, Sayanavaram, Thadaperumbakkam, Vairavan Kuppam, and Vellodai were investigated using potato dextrose agar exposed using an Andersen single-stage sampler. The developing colonies were identified after incubation using their macroscopic and microscopic characters. A total of 17 different fungal species were isolated. Among them, the maximum species belong to the genus *Aspergillus*, followed by *Penicillium*. A total average of 2316 CFU/m³ of air was recorded. Among the species, *Aspergillus niger* was dominant, followed by *Aspergillus flavus*. The results will be discussed in detail.

Keywords: Air mycoflora, Agricultural field, *Oryza sativa*, *A. niger*, *A. flavus*

Isolation and evaluation of *Chaetomium* sp. from agricultural soil: A Promising biofertilizer for enhancing Chilli (*Capsicum annuum*) crop growth

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Abstract

Soil microorganisms play a vital role in maintaining soil fertility and enhancing plant growth. Among them, filamentous fungi, such as *Chaetomium* species, are known for their plant growth-promoting and biocontrol properties. In present study focuses on the isolation and evaluation of *Chaetomium* sp. from agricultural soil and its potential use as a biofertilizer for chilli crops. Soil samples were collected from cultivated agricultural land to facilitate fungal growth. After incubation, fungal colonies were isolated and identified based on morphological characteristics, with emphasis on *Chaetomium* sp. The isolated *Chaetomium* sp. was mass-multiplied and applied at different concentrations through pot culture experiments to evaluate its effect on the growth and development of chilli plants. Growth parameters, including seed germination, plant height, root and shoot length, number of leaves, and overall biomass, were recorded. Plants treated with *Chaetomium* sp. showed significant growth improvement compared to the untreated control, indicating its biofertilizer potential. In addition, biochemical assays, including phosphate solubilization and siderophore production, were performed to assess the plant growth-promoting traits of the fungus. The results confirmed that *Chaetomium* sp. can solubilize insoluble phosphate and produce siderophores, thereby enhancing nutrient availability to plants. The study concludes that *Chaetomium* sp. isolated from agricultural soil can be effectively utilized as a biofertilizer to promote sustainable agriculture and reduce dependency on chemical fertilizers.

Keywords: *Chaetomium* sp., Biofertilizer, Chilli (*C. annuum*), PGPF, Siderophore

Application of salt-tolerant rhizobacteria to enhance Tomato (*Lycopersicon esculentum*) growth under salt stress

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Abstract

Salt stress is a worldwide challenge that affects plant growth and physiological processes. Plant growth-promoting rhizobacteria (PGPR) have potential to counteract salt stress and stimulate plant growth. In the current investigation, reports on the isolation and characterization of salt-tolerant PGPR in salinity-affected soils in Tamil Nadu, as well as their efficacy for enhancing growth and mitigating salt stress in tomato plants (*Lycopersicon esculentum*). Salt-tolerant PGPR were isolated from the affected soil. Isolates with desirable PGPR attributes were selected. One isolate was identified as *Bacillus* sp. This isolate possessed desirable attributes, including indole-3-acetic acid, siderophore production, phosphorus solubilization, ammonia production, and hydrogen cyanide production. This isolate was identified as *Bacillus* spp. This bacterium was used to inoculate the tomato. The tomato plants were grown in different concentrations of CaCl₂ solution (0 mM, 100 mM, 200 mM, 400 mM, 600 mM, 800 mM, 1000 mM) to assess the effects of salt stress over 45 days. The importance and potential benefits of inoculating tomato plants with salt-tolerant *Bacillus* spp. to improve plant growth and increase salt stress tolerance are explored extensively in this research. Notably, salinity-tolerant halo-tolerant PGPR bacterial strains such as *Bacillus* spp. are presented as valuable biofertilizer resources for this purpose.

Keywords: Salt stress, PGPR, *Bacillus* spp., Tomato, *L. esculentum*, Biofertilizer

**Application of PGPR strain PAS3 for growth promotion and arsenic stress reduction in
Cajanus cajan L.**

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Abstract

Microorganisms can solve the global problem of arsenic (As) contamination in soil and water by eliminating the hazardous metalloid from contaminated habitats. A native As-resistant PAS3 strain was isolated from the contaminated agricultural field in Mettur. In the current study, the plant growth-promoting (PGP) traits of the metal-tolerant PAS3 were examined. The strain exhibited several important plant growth-promoting traits, including indole-3-acetic acid production, hydrogen cyanide production, ammonia production, phosphate solubilization, and siderophore production and 16S rRNA sequence-based homology, both in terms of physiological and biochemical parameters of PAS3 stimulatory effect on the physiology. Various analytical techniques, such as Fourier transform infrared spectroscopy, scanning electron microscopy, and studies, revealed a positive correlation between the strain's resistance to biosorption and bioaccumulation of arsenic biomolecule content and its phytoremediation potential in *C. cajan* (L.). These traits facilitated the growth augmentation of pigeon pea seedlings under As stress, compared to uninoculated soil. The use of strain PSA3 helped to reduce As mobilization and oxidative stress in *C. cajan* (L.). Biochemical studies included the following tests: Chlorophyll & carotenoid, Shoot & Root Length, Fresh & Dry weight, Protein, phenol, MDA, antioxidant, amino acids. ICPMS plant root and shoot studies: seedlings growing in As-spiked soil. Therefore, strain PAS3 has the potential to serve as a bioremediator to restore As-contaminated agricultural lands while also promoting the growth of Pigeon pea seedlings. It could thus be utilized in the bioremediation of As-contaminated agricultural soil.

Keywords: Arsenic, *C. cajan*, Phytoremediation, Bioaccumulation

Exploration of halophilic plant growth-promoting rhizobacteria (PGPR) for mitigating salt on sesame (*Sesamum indicum* L.)D. Sridhar¹, S. Lalitha^{1*}

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***Corresponding author:** S. Lalitha (Email: lalithabot@periyaruniversity.ac.in)**Abstract**

Soil salinity poses major challenge to agriculture in coastal areas. It is adversely affecting crop productivity, including sesame (*Sesamum indicum* L.). This study aimed to isolate and characterize salt-tolerant plant growth-promoting rhizobacteria from saline rhizosphere soils and evaluate their potential to enhance sesame growth, stress tolerance, and seed quality under saline stress conditions. Sixteen soil halophyte rhizosphere samples were collected from Chennai, Cuddalore, Tuticorin, and Kanyakumari districts, with electrical conductivity (8.43 to 16.92 dS/m). Halotolerant PGPR isolates were selected and identified via 16S rRNA sequencing as *Pseudomonas toyotomiensis* (PTS2-Chennai), *Bacillus subtilis* (BSS1-Cuddalore), *Bacillus cereus* (PAS1-Tuticorin), and *Bacillus flexus* (PAS1-Kanyakumari). These isolates exhibited multifarious PGP traits (Siderophore production, IAA, phosphate solubilization, and enzyme activities under saline conditions). Pot experiments demonstrated that PGPR inoculation significantly mitigated NaCl-induced stress (0–200 mM), enhancing shoot and root length, photosynthetic pigments, primary metabolites and antioxidant enzymes, while reducing lipid peroxidation (MDA) and proline accumulation. In saline soil, PGPR improved relative water content, secondary metabolites and seed nutritional composition, minerals, fatty acids, and lignans compared to the control. Post-harvest soil analysis showed reduced EC, heavy metals, and enhanced nutrient availability. This research highlights PGPR as eco-friendly bioinoculants for sustainable agriculture in saline environments. It is the first comprehensive study to integrate the isolation of novel halotolerant PGPR strains from Tamil Nadu's coastal soils, their multi-omics characterization, and demonstration of enhanced sesame nutraceutical quality under salinity, offering innovative microbial solutions for climate-resilient crop production.

Keywords: Saline soil, Sesame, *P. toyotomiensis*, PGPR, lignans

Sustainable valorisation of medicinal and aromatic plant by-products for soil amendment applications

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Abstract

Among current environmental challenges, the management of agricultural by-products remains a critical issue, particularly when practices such as open-field burning and improper disposal are adopted. In this context, the valorisation of agricultural biomass into value-added products has become increasingly relevant. In recent years, interest in medicinal and aromatic plants (MAPs) has markedly increased due to growing concerns for human health and quality of life. The distillation of essential oils from MAPs generates large amounts of residual biomass still rich in secondary metabolites, offering opportunities for agricultural reuse. This work presents a literature review to assess the current state of research on the reuse and soil application of MAP residues as soil amendments, evaluate the level of scientific interest in this topic, and identify the plant species most frequently investigated. A clear increase in research activity was observed, particularly during the last five years. The plant families Asteraceae, Fabaceae, and Lamiaceae emerged as the most extensively studied. Four main categories of MAP waste used as soil amendments were identified: fresh biomass, biochar, compost, and solid distillation residues. Overall, the reviewed studies report positive effects of MAP-derived materials as soil conditioners, highlighting their potential for sustainable soil management, even though attention should be paid to phytotoxicity risks. Despite these promising results, significant knowledge gaps remain, indicating that further research is needed to better understand the effects of MAP residues and optimize their application in agriculture.

Keywords: Circular economy, Medicinal plant, Medicinal herb, Soil amendment, Compost, Soil.

Millet residue management approaches for sustainable soil and crop performance

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Abstract

Millet cultivation is gaining attention in India in recent years due to its resilience to climate variability and its role in promoting food and nutritional security. However, managing the residues left after millet harvest remains a key challenge for farmers. Millet residues are more than just agricultural byproducts—they are invaluable resources that can significantly enhance the sustainability of millet farming. Due to its nutritional richness, millet residues can be used as animal feed. Millet crop residues can also be used for mulching, composting, or as bioenergy sources. Residues, including straw and stubble, can be a valuable organic matter that, when properly managed, can improve soil structure, increase microbial activity, enhance nutrient cycling, reduce input costs and contribute to environmental conservation. Various machineries like millet straw shredders, mulchers and rotavators can be used to cut the millet residues into smaller pieces, which further hasten the decomposition process. Waste decomposers are the compounds that include microbes like bacteria, fungi and actinomycetes play a crucial role in millet residue management by breaking down organic materials into simpler compounds, facilitating nutrient cycling, and improving soil health in a faster and quicker manner. This not only reduces the dependency on chemical fertilizers but also mitigates soil degradation. By adopting sustainable residue management practices, millet farmers can create a closed-loop agricultural system that fosters long-term soil fertility, optimizes yields, and sustains millet-based farming.

Keywords: Millets, Residue Management, Soil Health, Sustainability

Integrated honey analytics revealing ethnobotanical diversity, agro-ecological sustainability, and microbial–soil–plant interactions in Western Maharashtra

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Abstract

Honey is a complex natural bio-product whose composition reflects the botanical origin, environmental conditions, and ecological integrity of the region from which it is derived. The present study provides an integrated analytical framework for evaluating honey as a reliable bioindicator of ethnobotanical diversity, agroecological sustainability, and microbial–soil–plant interactions in Western Maharashtra, India. A comprehensive assessment of honey samples collected across diverse agro-climatic zones was conducted using physicochemical, phytochemical, antioxidant, and microbiological parameters, supported by botanical and ecological interpretations. The analytical profiling revealed significant spatial variability in honey composition, closely associated with regional floral diversity, traditional medicinal plant usage, soil characteristics, and microbial dynamics influencing nectar sources. Phytochemical constituents and antioxidant capacity highlighted the functional and therapeutic relevance of ethnobotanically rich landscapes, while physicochemical markers provided insights into honey maturity, quality, and authenticity. Microbial analysis further reflected the influence of environmental hygiene, soil health, and sustainable agricultural practices on honey safety and stability. This integrative approach demonstrates that honey serves not only as a valuable nutritional and medicinal resource but also as a sensitive ecological indicator linking biodiversity, sustainable agriculture, and rural livelihoods. The findings underscore the potential of honey analytics as a multidisciplinary tool for monitoring agro-ecosystem health, conserving ethnobotanical knowledge, and supporting sustainable beekeeping-based livelihood systems. This study contributes a robust scientific foundation for the inclusion of honey-based indicators in environmental assessment, food quality assurance, and sustainable agricultural planning at regional and global scales.

Keywords: Honey analysis; Ethnobotany, Agro-ecological sustainability, Phytochemical profiling, Microbial–soil–plant interactions, Biodiversity, Western Maharashtra

**Macrofungal diversity in Perumalmalai and Shembaganur regions of Western Ghats
(Dindigul district) of Tamil Nadu**

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Abstract

Macrofungi play a crucial role in ecosystem functioning through decomposition, nutrient cycling, and symbiotic associations, yet their diversity remains under-documented in many parts of southern India. This study aimed to assess the diversity, distribution, and ecological significance of macrofungi across selected habitats of the Western Ghats region in Tamil Nadu, India. Field surveys were conducted across Perumalmalai and Shembaganur regions of Dindigul district during the monsoon season and specimens were identified using macro- and micro-morphological characteristics supported by standard taxonomic keys. A total of 60 macrofungal species representing 2 phyla, 7 classes and 12 orders, distributed among 43 genera and 31 families, were recorded. Among these, 60 species were assessed against the Macrofungal Red List, revealing that 3 species are Endangered, 4 species are at Lower Risk and 3 species are in the Least Concern category. The findings highlight Tamil Nadu as a region of considerable macrofungal diversity and underscore the need for systematic documentation and conservation of fungal resources to support ecosystem sustainability.

Keywords: Fungal biodiversity, Wild Mushrooms, Macrofungi, Species richness

A Study on DNA barcoding to unveil the genetic identity of *Ficus* sp. endemic plants of Western Ghats

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Abstract

The genus *Ficus* of the family Moraceae is one of the largest genera of angiosperms, with diverse pharmaceutical applications and biological activities. The traditional approaches based on morphological traits have been frequently used for taxonomic identification of different taxa of *Ficus*; however, encompassing these features is quite laborious because these phenotypic traits depend on environmental conditions. So, authenticating the taxonomical identity of the *Ficus* taxa with molecular barcoding and metabolic profiling, as relatively stable traits, could be a relevant approach for confirming the traditional phenotypic traits of this genus. This study applied DNA barcoding to authenticate and classify four species: *F. microcarpa*, L.f., *F. racemosa* L., *F. religiosa* L., and *Ficus anamalayana* J. V. Sudhakar and G.V. S. Murthy. Genomic DNA was extracted using the CTAB method, and barcode region (*rbcL*) was amplified, sequenced, and analyzed using BLAST and phylogenetic clustering. As a result, *rbcL* exhibited the highest accuracy (96.8%) and demonstrated its varying levels of efficiency in species-level identification. The results highlight the effectiveness of DNA barcoding, with *rbcL* being the most reliable marker. Overall, this study underscores the role of multiple DNA barcodes in biodiversity assessment and conservation of threatened *Ficus* species in the Western Ghats.

Keywords: *Ficus* sp, DNA Barcoding, *rbcL*, Moraceae, BLAST

Medicinal plants cultivation and alternative technologies for the production of high-value therapeutics: an overview

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Abstract

Medicinal plants are source of several valuable drugs known as natural products or secondary metabolites. The majority of medicinal plants are still gathered from the wild; only a small number are grown. Because of the high demand for these goods, overexploitation has led to species endangerment, biodiversity loss, adulteration of plant materials and products, and ecosystem impacts. Agrotechnology for a number of medicinal plants, alternative biotechnologies (micropropagation, production in cell cultures grown in shake flasks and bioreactors, transfer of genes in plants and microbes, modification of biosynthetic pathways, etc.), and microbial production systems have all been tried to meet the demand for raw plant material for direct use or industrial use. Understanding seed and floral biology, developing agrotechnology, and introducing them into new habitats may improve the availability of raw medicinal plant material, thereby affect downstream processes and lead to higher recovery. Similarly, the use of sophisticated detection methods, high-throughput screening methods, genomics, and proteomics can shed light on genes involved, types of biomolecules, and new sources of known drugs. Biotechnological methods (elicitation, immobilization, cloning of selected strains, hairy root cultures, and gene manipulation), including gene editing, can help improve the production system. With an ever-increasing population and the growing reliability of herbal medicine, demand for medicinal plants continues to rise; hence, the domestication of plants, along with new technologies, is a pressing need to meet the challenge of supplying uniform raw material. This brief overview presents state of research on medicinal plants and their products.

Keywords: Medicinal plant, Production, Agrotechnology, Biotechnological methods

Fungal diversity and functional guild analysis of soil in Thalavadi, Sathyamangalam – A Transitional zone of Eastern and Western Ghats

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Abstract

The study investigated the soil fungal communities in the Thalavadi region, a unique, high-altitude zone (above 800 meters) situated within the critical transitional area between India's Western and Eastern Ghats. Recognizing fungi's essential role as key drivers of decomposition and nutrient cycling, this research aimed to characterize their diversity across this ecologically significant landscape. Fungal ITS metabarcoding of Environmental DNA (eDNA) was performed on a total of 18 soil samples (9 from Zone 1 and 9 from Zone 2). The NGS library was sequenced using Illumina 250*2 chemistry, and the data were processed via the QIIME2 pipeline with taxonomic assignments referenced against the UNITE database. The identified sequences were deposited in the NCBI database and received accessions. The analysis confirmed exceptional fungal diversity: Zone 1 yielded 61,512 reads and identified 1095 OTUs (7 Phyla, 135 species), while Zone 2 provided 65,482 reads for 668 OTUs (5 Phyla, 98 species). Community composition varied significantly, reflecting the ecological differences between the distinct Western and Eastern Ghats ecosystems. Taxonomic annotation further indicated the potential presence of several species with no prior records in India, marking them as new records for Indian mycology. A notable fraction of reads was identified only at the Phylum level, suggesting significant novel fungal diversity new to science. Functional community analysis using the FUNGuild database revealed distinct dominant taxa: Zone 1 was dominated by *Polyschema*, *Asterostroma*, and the lichen-forming fungus *Rhizoplaca novomexicana*, while Zone 2 was characterized by *Periconia macrospinosa*, *Polyschema*, and *Bipolaris cookei*. This high-resolution inventory provides a vital baseline for the soil mycobiota of Sathyamangalam, and the observed species richness, functional guild patterns, and identification of potential novel fungal diversity underscore the ecological complexity of this transitional zone and highlight its importance for fungal biogeography and conservation.

Keywords: Sathyamangalam, Forest soil, Mycoflora, eDNA, NGS, Metabarcoding, Dark taxa

**Documentation of arboreal flora of Bharathiyar Arts and Science College for Women
Campus, Salem by random sampling method**

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Abstract

The present study was conducted at Bharathiyar Arts and Science College for Women Campus, Salem, with the objective of assessing selected academic and socio-educational parameters among undergraduate students. A random sampling method was adopted to ensure unbiased selection and adequate representation of the study population. Primary data were collected using a structured questionnaire, while secondary data were obtained from institutional records and relevant literature. The collected data were analyzed using appropriate statistical tools to interpret trends and relationships among variables. The findings of the study provide valuable insights into the current status and challenges faced by women students in higher education. The study highlights the importance of evidence-based approaches for academic planning and policy formulation. The results may serve as a useful reference for educators, administrators, and researchers aiming to improve institutional practices and student outcomes.

Keywords: Random sampling, Women's education, Higher education, Academic study, Salem

Biodiversity and conservation for sustainable ecosystem

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Abstract

Biodiversity encompasses the variety of life forms at genetic, species, and ecosystem levels and underpins ecological stability and human well-being. It provides essential ecosystem services, including food security, climate regulation, pollination, and medicinal resources. However, global biodiversity is declining at an unprecedented rate due to anthropogenic pressures, including habitat destruction, climate change, pollution, invasive species, and overexploitation of natural resources. The rapid loss of biodiversity threatens ecosystem resilience and sustainable development. Conservation of biodiversity has therefore emerged as a critical global priority. Conservation strategies include *in situ* conservation through protected areas such as national parks, wildlife sanctuaries, and biosphere reserves, and *ex situ* conservation through botanical gardens, seed banks, cryopreservation, and captive breeding programs. Recent advances in conservation biology emphasize community participation, landscape-level planning, restoration ecology, and the integration of traditional ecological knowledge with modern scientific approaches. Effective biodiversity conservation requires interdisciplinary approaches, strong governance, and public awareness to safeguard natural resources for future generations.

Keywords: Biodiversity, Conservation, Ecosystem Services, *In situ* Conservation, *Ex situ* Conservation, Sustainable Development.

Exploring the nutraceutical and pharmaceutical potential of miracle oilseeds

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Abstract

Oilseeds are one of the important crops of Indian economy. India plays an important role in the production of oilseeds, which are mainly cultivated for future extraction of their oil. Major edible oilseed crops of India are soybean, groundnut, mustard, sesame and sunflower. Oilseeds are known to be a concentrated source of energy and nutrition. The incorporation of oilseeds into food provides distinct flavour and aroma, in addition to making them nutritious. Nutraceuticals are substances in food that provide physiological benefits beyond basic nutrition. In addition to their energetic and nutritional contributions, oilseeds are rich sources of bioactive compounds (e.g., polyphenols, flavonoids, isoflavones, lignans, phytosterols, amino acids, and peptides). Oilseeds are considered to be a storehouse of such nutraceuticals and play a potent role in the prevention and management of lifestyle- and immune-related diseases. A regular and moderate dietary supplementation of oilseeds promotes health, prevents the appearance of certain diseases (e.g., cardiovascular diseases (CVDs), cancers) and delays the aging process. Due to their relevance to nutraceutical molecules, oilseeds, and some associated processing wastes, oilseeds have attracted interest in the food and pharmaceutical industries, with a focus on innovative products that provide health benefits to consumers. Furthermore, a circular economy approach could be considered for the reuse of oilseed processing waste. This research highlights the various oilseed types, the bioactive compounds derived from them, and the health benefits associated with their consumption.

Keywords: Oilseed crops, Nutraceuticals, Cancer, Immune diseases

Bioprospecting of insect nests - A new pathway for antibioticsA. Aruna¹, V. Gopikrishnan^{1*}

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Abstract

In recent years, the search for new antibiotics has increased worldwide due to the serious problem of antibiotic resistance among microbes. The need for new antibiotics has been met largely by the semi-synthetic tailoring of natural product scaffolds discovered in the middle of the twentieth century. Bioprospecting is the search for and discovery of natural products with useful pharmacological and biological applications. Chemical ecology studies are needed to better understand species interactions and how the production of secondary metabolites influences these associations. The symbiotic relationship between insects, fungi, actinobacteria and bacteria has been investigated and new findings in the area have shown how these relationships have evolved and which substances are involved in this co-operation. It is known that ants, termites, and bees have a symbiotic relationship with fungi and actinobacteria, which produce products of potential pharmacological or agricultural importance. The search for new natural products in this area is not only to find potential antibiotics, but to evaluate if these substances have other biological effects and activities, such as anticancer, antileishmanial and antichagasic. The need for new strategies to obtain antibiotics is urgent, since resistance is one of the main factors of mortality in patients treated with this type of medication. Analyzing this symbiotic relationship among living beings, it seems to be an innovative strategy to seek new medicines. Consequently, insect nest material is being investigated as a new source of novel antimicrobial-producing microbes that could be harnessed for therapeutic purposes.

Keywords: Antileishmanial, Antichagasic, Anticancer, Antibiotic

The influence of rapid global urbanization on Zoonotic and Vector-Borne Disease Emergence

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Abstract

Zoonoses, diseases that can be transmitted from animals to people, pose a threat to public health. Urbanization might change the way zoonotic diseases spread in several ways, and it is connected to zoonotic infectious diseases in several ways. Urbanization destroys natural environments, making it easier for people and animals to come into contact with one another. This tighter interaction with both domestic and wild animals might spread zoonotic illnesses. Urbanization often leads to more people living in a small area. A high population density may speed up the spread of zoonotic illnesses, especially those that may be passed from person to person. COVID-19, which probably originated in animals, spreads faster in densely populated cities. Rapid urbanization puts a lot of stress on infrastructure and makes it harder to keep things clean. This might cause mosquitoes and flies that spread dengue, chikungunya and cholera to proliferate. Cities are places where people from all over the world come together. Cities bring people and things from all over the globe, which raises the danger of zoonotic diseases. Sick animals or animal products in cities may spread disease. Rats in cities may spread hantavirus and leptospirosis. Urbanization is causing rapid population growth, which might strain infrastructure and make it harder to control diseases. Urbanization affects livestock and farming. Urban intensive farming might spread illnesses that affect both animals and humans. There are more cases of avian influenza at large poultry farms near cities. People living in cities have greater access to education and information, which may help them learn more about and avoid zoonotic diseases. However, it might leave poor communities without access to healthcare and health information. Urbanization may change how animals behave and how ecosystems work. Infections in novel host species or habitats may give rise to emergent illnesses. Monitoring, researching, and treating diseases in cities is difficult because of the large number of people, animals, and environmental changes. To stop urban zoonotic diseases, we need to monitor them, protect public health, and develop cities in ways that are environmentally friendly.

Keywords: Urbanization, Zoonotic diseases, Dengue, Rats, Influenza

Valorisation of agri-food waste for bioactive compounds: Recent trends and future sustainable challenges

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Abstract

Valorisation of agri-food waste has emerged as a sustainable strategy to address environmental concerns while recovering high-value bioactive compounds. The agri-food industry generates large amounts of waste such as fruit and vegetable peels, seeds, pomace, husks, bran, and processing residues, which are often underutilized. These wastes are rich sources of bioactive compounds including polyphenols, flavonoids, carotenoids, dietary fibers, bioactive peptides, essential oils, and polysaccharides with antioxidant, antimicrobial, anti-inflammatory, and health-promoting properties. Recent trends emphasize green and innovative technologies such as ultrasound-assisted extraction, microwave-assisted extraction, supercritical fluid extraction, enzyme-assisted extraction, and microbial fermentation, which improve efficiency while reducing solvent and energy use. Integrated biorefinery approaches further enhance economic feasibility by enabling the recovery of multiple products from a single waste stream. However, challenges such as raw material variability, seasonal availability, high processing costs, regulatory issues, and limited scalability persist. Addressing these challenges can promote sustainable growth in food, pharmaceutical, nutraceutical, and cosmetic industries.

Keywords: Agri-food waste, Bioactive compounds, Waste valorisation, Green extraction technologies, Biorefinery, Circular economy

Antibiotic resistivity of *Vibrio* isolated from biofilm and water samples from Cochin estuary

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Abstract

Antibiotic resistance among marine pathogenic bacteria has emerged as a significant public health concern, particularly in estuarine environments influenced by anthropogenic activities. The present study investigates the antibiotic resistance patterns of pathogenic *Vibrio* isolated from biofilms and water samples collected from two stations in the Cochin estuary, Kerala. Biofilm and water samples were obtained from Ernakulam boat jetty and Kakkanad sites within the estuary and processed for the isolation and identification of *Vibrio* spp. using selective media TCBS and using standard microbiological and biochemical methods like indole test, catalase test etc. Pathogenic potential was assessed, and antibiotic susceptibility testing was performed using Gentamicin, Chloramphenicol, Streptomycin, Amoxicillin, Antibiotics commonly available on the market by the disc diffusion method as well as commonly used antibiotics Taxim O (Alkem), Aziwin 500 (Bal Pharma). Bacterial density was higher in biofilm samples than in water samples. The results revealed the presence of multiple species with varying degrees of resistance, and Amoxicillin showed considerable potential to regulate the growth of gram-negative strains. The other antibiotics showed moderate activity against the microorganisms isolated from the estuarine environment. Resistance to antibiotics commonly used in aquaculture and clinical settings was observed, suggesting selective pressure from environmental contamination. The findings highlight the role of estuarine biofilms as reservoirs for antibiotic-resistant *Vibrio* pathogens and underscore the potential risk to human health through seafood consumption and water contact. Continuous monitoring and responsible antibiotic usage are essential to mitigate the spread of resistance in coastal ecosystems.

Keywords: Gentamicin, Pathogen, *Vibrio*, Amoxicillin

Overview of virulence of *Xanthomonas Oryzae* P.v. in rice (*Oryza Sativa* L.)S. Jeeviya^{1*}, M. Karthika¹, S. Bharathkumar¹

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Abstract

On a global scale, rice (*Oryza sativa* L.) is a primary food crop. Over 3.5 billion people depend on rice as their main food. However, rice production is frequently hindered by various biotic and abiotic stresses. Amongst the variety of bacterial diseases found in rice plants, bacterial leaf blight disease (BLB) caused by *Xanthomonas oryzae* pv. *Oryzae* (*Xoo*) is one of the most repressive and remarkably prevalent, particularly in the flooded and rainfed lowland ecosystems of Asian tropical countries, Australia, the United States, and many other rice-growing countries. This disease causes yield loss of about 20-80% based on location, season and variety. Implementation of rice varieties resistant to bacterial blight is the worthwhile approach for controlling the disease. So far, 48 BB resistance genes (Xa genes) have been encountered worldwide. In China, it is reported that the *Xoo* strain LA 20 overcome the resistance given by xa5, xa13, Xa7 and Xa1 gene. The *Xoo* strain IX- 280 from India, SK 2-3 from Thailand also break the resistance given by xa5 gene. It was reported that some Indonesian, Nepalese, Japanese and Korean isolates were efficient in overcoming Xa 21 resistance. Several studies have proved that the rice lines containing two, three and four gene combinations show robust resistance to *Xoo* strains. So, introgression of multiple *Xoo* resistance genes is recommended to develop disease-resistant rice lines.

Keywords: *Oryza sativa*, *Xanthomonas oryzae* pv. *oryzae*, Bacterial leaf blight, Implementation, Resistant genes, Introgression

Evaluation of proso millet (*Panicum miliaceum* L.) breeding lines for grain yield and yield contributing traits under kharif conditions

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Abstract

An experiment was conducted to evaluate proso millet (*Panicum miliaceum* L.) breeding lines for grain yield and associated traits during the Kharif 2024–25 season at the Agricultural Research Station, Vizianagaram. The trial comprised 14 breeding lines along with one check variety (CO 5) and was laid out in a Randomized Block Design (RBD) with three replications. The crop was sown on 24 June 2024 at a spacing of 22.5 × 10 cm using a gross plot size of 3.6 m², and a fertilizer dose of 40:20:20 kg NPK ha⁻¹ was applied uniformly. Observations were recorded on days to 50% flowering, days to maturity, plant height, number of productive tillers per plant, panicle length, grain yield, fodder yield, and thousand seed weight. Analysis of variance revealed significant differences among genotypes for most of the characters studied, indicating substantial genetic variability. Grain yield varied from 1305.56 to 1925.93 kg ha⁻¹ with a mean of 1609.26 kg ha⁻¹ while fodder yield ranged from 3250.00 to 4814.81 kg ha⁻¹. Moderate to high genotypic and phenotypic coefficients of variation were observed for grain yield, fodder yield and thousand seed weight, suggesting greater scope for selection. Heritability estimates were moderate for days to maturity, thousand seed weight, and grain yield, indicating a reasonable contribution of genetic factors to phenotypic expression. High genetic advance as percent of mean was recorded for grain yield and fodder yield, signifying the predominance of additive gene action and effectiveness of selection for yield improvement. Overall, the study identified promising proso millet breeding lines with superior grain and fodder yield potential, which can be further exploited in varietal development programs to enhance productivity under rainfed conditions.

Keywords: Millet, *P. miliaceum*, Kharif, Yield, Rainfed

Screening of rice landraces for salinity tolerance using morphological and molecular markers

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Abstract

Salinity stress poses a significant threat to global rice production and agricultural sustainability, a challenge that is intensifying due to climate change. Identifying salinity-tolerant rice genotypes is therefore essential for developing climate-resilient agriculture. A good solution would be to develop an efficient screening methodology to identify genotypes carrying genes for salt tolerance. In the present study, 42 landraces were screened for salinity tolerance at the seedling stage, both phenotypically and genotypically. Phenotypic screening was conducted under sodium chloride (NaCl)-induced salinity stress at a concentration of 2500 ppm and stress-related traits such as root length, shoot length, leaf length, leaf width, number of leaves, number of dry leaves, and leaf drying percentage were recorded. In the phenotypic screening, salinity tolerance was observed from highly tolerant to highly susceptible level among genotypes. In molecular characterization using SSR marker, RM 3412 produced polymorphic alleles among genotypes. In the study, some genotypes are highly tolerant under treatment conditions. The molecular results were consistent with the phenotypic observations, providing insights into the genetic basis of salinity tolerance. This tolerance level is associated with traits such as vigorous seedling growth and minimal reduction in growth under salinity stress. These findings highlight the potential of rice landraces as valuable genetic resources for salinity tolerance. This study provides a foundation for developing mapping populations and precision-breeding strategies to improve salt tolerance in rice.

Keywords: Landraces, Salinity, Shoot length, Leaf dry percentage, Sodium chloride, Climate change, Marker, Polymorphic alleles.

Isolation and characterisation of antibiotic-sensitive coliforms from biofilm and water samples from Cochin estuary

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Abstract

Estuarine system is a dynamic zone that limits the survival potential of organisms by its periodic fluctuations in physiochemical characteristics and can lead to the development of various survival strategies by its inhabitants. Coliforms are Gram-negative non-spore-forming bacteria that include *Citrobacter*, *Enterobacter*, *Escherichia*, *Klebsiella*, and *Aeromonas*. Their presence can indicate the potential contamination by disease-causing pathogens. The present study aims to find the antibiotic resistance of coliforms isolated from biofilm and water samples from two stations along Cochin estuary. The two stations are Ernakulam boat jetty and Kakkanad. For the isolation of coliforms, MacConkey agar was used followed by suitable biochemical tests like indole, citrate, IMViC etc for identification. Antibiotic resistance was assessed against Gentamicin, Chloramphenicol, Streptomycin and Amoxicillin employing disc diffusion method. Susceptibility to commercially available antibiotics, such as Taxim O (Alkem) and Aziwin 500 (Bal Pharma), was also determined. The bacterial density was higher in biofilm samples than in water. Amoxicillin was found to be the most effective against coliforms followed by Gentamycin. The disc diffusion method showed that the bacteria isolated from the estuarine environment exhibited moderate resistance. Since coliforms can be considered as an indicator for pathogenic organisms their ability to develop resistance against common antibiotics can be a matter of concern. The estuarine environment acts as a reservoir for microorganisms and it may further lead to development of more potent resistant strains that may be threatening to both humans and aquatic organisms. The effects of anthropogenic activities that drive the development of AMR should be properly monitored to prevent future risks.

Keywords: Estuarine system, Coliforms, disease, Taxim O

Detection of anaerobic bacteria from the soils of different altitudes of Sathyamangalam, Tamil Nadu, India

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Abstract

Anaerobic bacteria, in general, are defined as bacteria that grow in the absence of oxygen. Although they are widely studied for their clinical significance, their role in the environment is less well documented. The anaerobic bacteria are found to play a major role in Metal degradation, Sulfur reduction, Organic material degradation, Bioremediation, Dechlorination, and degradation of other Pollutants. Hence studying the presence of anaerobic bacteria in any environment is important. Thus, the study on the presence of Anaerobic bacteria in 15 soil samples from different altitudes ranging from 624m to 1395m was conducted and examined using the Metabarcoding approach. The soil eDNA was extracted, amplified with bacterial primers, and sequenced. The sequences were subjected to QIIME 2 and SILVA and the species of anaerobic bacteria were identified. The study revealed the presence of 16 different species of anaerobic bacteria, which include *Anaerolinea*, *Sedimentibacter*, *Clostridium*, *Desulfosporosinus meridiei*, *Desulfotomaculum*, *Tepidibacter*, *Desulfobulbus*, *Desulfomicrobium baculatum*, *Geobacter*, *Geobacter lovleyi*, *Desulfosporosinus*, *Acidaminobacter*, *Desulfosporosinus meridiei*, *Opitutus terrae*, *Ardenscatena*, and *Anaeromyxobacter*. It is observed that only a few bacteria are more prevalent, while others are rare, with their presence recorded in only a few of the samples studied.

Keywords: Anaerobic Bacteria, Metabarcoding, SILVA, Altitudinal Difference, Sathyamangalam forest range

**Diversity patterns of arbuscular mycorrhizal fungi in the Bhavani Sagar Range,
Sathyamangalam, India**

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Abstract

Arbuscular mycorrhizal fungi (AMF) are vital soil microorganisms that support plant growth, nutrient uptake, soil health, carbon storage, and plant resilience to stress, playing a crucial role in maintaining the stability of forest ecosystems. This study investigates AMF diversity and community composition in soils from three sites: samples 1 and 2 from the buffer zone and sample 3 from the core zone of the Bhavani Sagar range of Sathyamangalam Forest, Tamil Nadu, India. Using high-throughput sequencing and QIIME2-based bioinformatics, we found that AMF communities were dominated by the phylum *Mucoromycota*, with *Glomus* as the most widespread genus, followed by *Paraglomus*, while *Claroideoglomus* and *Scutellospora* were less abundant. Analysis of AMF groups showed that one main group was dominant across all sites, along with several other abundant groups, while some sequences could not be assigned to known taxa. Alpha diversity was highest in sample 3 (core zone), suggesting a more balanced and richer AMF community compared with the buffer zones (samples 1 and 2). Beta diversity revealed clear differences in community composition between sites, indicating that local environmental conditions and zone-specific factors shape AMF assemblages. Some AMF taxa were found at all sites, indicating broad ecological tolerance, while others were restricted to particular zone, reflecting site-specific preferences. These results reveal that AMF communities in the Sathyamangalam Forest vary across sites and are structured by local environmental conditions. Protecting both core and buffer zone habitats is essential to maintaining AMF diversity, which, in turn, supports soil fertility, plant growth, and the overall health of the ecosystem. This study provides baseline molecular data on tropical forest AMF and highlights the critical role of mycorrhizal fungi in sustaining the functions of forest ecosystem.

Keywords: Glomeromycotina, Tropical Forest soil, α diversity, Beta diversity, Soil microbial ecology

Ethnomedicinal plants used by Santhal community of India – A Review

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Abstract

Many health problems are observed worldwide; among them, antimicrobial resistance (AMR) is the most serious. Urgent formulations of antimicrobial agents from natural sources and Indigenous Traditional Knowledge (ITK) are needed. The ITK belongs to different tribal communities for their day-to-day traditional practices. Those communities are storehouses of traditional therapeutic values that need to be explored. The Santhal, a tribal community in India, is more developed and has sound knowledge of forest foods, forest products, sustainable agriculture, and medicinal plants. They use local plants for food, nutraceuticals, medicinal agents, and as a source of livelihood, which should be documented to inform the formulation of new antimicrobial agents to mitigate global health problems. Therefore, in the present study, the Santhal community was selected, and 120 medicinal plants were enumerated along with their uses and local names. The active constituents of 31 medicinal plants and their pharmacological activities are also documented. 34 nutraceuticals and 10 economically important plants were enumerated through a field survey and presented. Since less documentation is available on the plants used by the Santhal community, the present study focuses on their medicinal uses, pharmacological activities, and nutraceutical potential, aiming to identify sources of future medicinal foods and antimicrobial agents to address global health problems.

Keywords: Antimicrobial resistance, Medicinal agents, Tribal communities, Indigenous Traditional knowledge

Survey and documentation of ethnomedicinal plants used by the Malayali tribals in Sitheri Hills, Eastern Ghats, Tamil Nadu, India.

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Abstract

The Sitheri Hills of the Eastern Ghats represent one of the ecologically and culturally rich landscapes of Tamil Nadu, inhabited predominantly by the Malayali tribal community whose traditional medicinal knowledge forms a vital component of primary healthcare. The present study systematically documents the ethnomedicinal plants used by the Malayalis through extensive field surveys conducted in ten representative villages. Standard ethnobotanical methods, including semi-structured interviews, guided field walks, and participant observation, were employed with 25 knowledgeable informants, comprising traditional healers, elders, and experienced community members. A total of 115 medicinal plant species belonging to 60 families were recorded. Fabaceae emerged as the most dominant family, followed by Acanthaceae, Apocynaceae, Euphorbiaceae, and Asteraceae. Herbs constituted the largest life-form category, indicating easy accessibility and frequent use. Leaves were the most commonly utilized plant part, reflecting their availability and rich phytochemical potential. The documented plants were used to treat 60 categories of ailments, with gastrointestinal disorders, skin diseases, fever, respiratory ailments, and musculoskeletal problems being the most prevalent. Quantitative indices such as RFC, CII, FL, and RCF were used to understand cultural significance and knowledge consensus. Cross-cultural comparison with Bhil, Gond, Santal, Irula, Kannikar, and Palliyar tribes revealed notable similarities, especially with Irulas (80%), indicating strong regional knowledge continuity. The study highlights the rich ethnomedicinal heritage of the Malayalis and underscores the need to conserve, validate, and sustainably utilize traditional knowledge and medicinal plant resources.

Keywords: Malayali, Tribals, Ethnobotany, Indigenous Knowledge, Medicinal plants

Quantitative ethnobotanical assessment of traditional medicinal plants used by the Muthuvan tribe of Vattavada Kovilur, Munnar, Kerala, India

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Abstract

Quantitative ethnobotany focuses on assessing the significance and utilization of plants and vegetation by local communities, enabling the quantification of qualitative data in biological and social sciences. Traditional medicinal plants continue to serve as an essential source of primary healthcare for rural populations. An ethnobotanical survey was conducted among the Muthuvan (Muthuva) tribal community in Vattavada Kovilur, Munnar Forest Division, Idukki District, Kerala, India. The present study documented 40 ethnomedicinal plant species belonging to 35 genera and 22 families, traditionally used to treat various ailments. Based on growth habit, the recorded species included 12 herbs, 13 shrubs, 12 trees, and one species each of climbing shrub, twining shrub, prostrate shrub, and climber. The conservation status of the documented plants revealed 26 common, 14 rare, 5 common and cultivated, and 2 sporadic species. Ethnomedicinal information obtained from rural inhabitants was critically compared with existing literature. Data were collected randomly from 85 informants, including traditional healers, and statistically analyzed using quantitative ethnobotanical indices, such as Use Value (UV), Informant Consensus Factor (ICF), and Fidelity Level (FL), as well as various ranking methods.

Keywords: Ethnobotany, Muthuva Tribes, Vattavada Koilur, Munnar, Traditional knowledge

Numerical taxonomy of *Tectona grandis* clones based on leaf morphometrics for DUS evaluation

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Abstract

Commercial plantations of *Tectona grandis* (teak) play a vital role in meeting the growing demand for high-quality timber and supporting sustainable livelihoods in tropical regions, particularly in India. With increasing reliance on clonal forestry, accurate identification, registration, and protection of superior teak varieties have become essential to ensure genetic purity, uniform productivity, and farmer confidence. Under the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2011, systematic documentation of plant varieties is mandatory to safeguard breeders' rights while ensuring the supply of quality planting material to society. In this context, the present study was undertaken to classify 122 *Tectona grandis* (L.f.) germplasm accessions/clones from Chandrapur, Maharashtra, India, using leaf morphological variability and numerical taxonomy to develop robust Distinctness, Uniformity, and Stability (DUS) descriptors. A total of 35 morphological characters, including qualitative and quantitative traits, were analysed, revealing significant phenotypic variation among accessions. The observed diversity highlights the usefulness of morphometric-based numerical taxonomy for reliable clone identification, DUS testing, and the promotion of sustainable teak production benefiting farmers, industry, and forest ecosystems.

Keywords: *Tectona grandis*, Plant protection variety, Germplasm collections, Clones, Taxonomy, Chandrapur, Maharashtra

Ethnomedicinal relevance, phytochemistry, and pharmacological potential of the genus *Sida*: A Comprehensive review

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Abstract

The genus *Sida* comprises nearly 200 species distributed across tropical and subtropical regions and has a long history of use in traditional medicine for the treatment of inflammation, pain, nervous disorders, and related ailments. Ethnomedicinal practices have inspired scientific investigations into this genus, leading to the identification of several pharmacological activities. Preclinical studies have demonstrated antioxidant, anti-inflammatory, analgesic, and sedative properties in various *Sida* species, which are mainly attributed to bioactive phytochemicals, including alkaloids, flavonoids, and coumarins. Despite the wide diversity of the genus, pharmacological evidence is currently available for only 17 *Sida* species, indicating a considerable gap between traditional use and scientific validation. Among these, *Sida cordifolia* is the only species to have advanced to clinical trials, particularly for the management of arthritis, while other promising species, including *Sida rhombifolia*, remain underexplored. The present review examines the phytochemical composition and pharmacological activities of the 17 reported *Sida* species. By consolidating existing knowledge, this review highlights the therapeutic relevance and untapped potential of the genus *Sida*, emphasizing the need for sustainable utilization of plant resources and well-designed clinical studies to facilitate the development of *Sida*-based pharmaceutical formulations.

Keywords: *Sida*, Ethnomedicine, Phytochemistry, Pharmacological activity, Medicinal plants

Medicinal botany of prophetic medicine

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Abstract

Prophetic Medicine embodies a significant and dynamic research endeavor, spearheaded by the Central Ministry of Health and the Ministry of AYUSH, Government of India. This program aims to scientifically investigate the botanical knowledge inherent in Prophetic traditions, reinterpreting it through modern lenses of biomedicine, ecology, and public health. As part of this initiative, a diverse array of medicinal plant species referenced in Prophetic Medicine—such as *Ficus carica* (fig) and *Olea europaea* (olive) have been meticulously cultivated on the tranquil slopes of Payambra (Wisdom Park) in Kerala. Currently, approximately forty key medicinal plants are being preserved and researched. These species are renowned for their therapeutic, nutritional, immunomodulatory, and preventive health benefits. Particular attention is devoted to photolytic and biophotonic medicinal plants, establishing a specialized botanical niche within this medicinal framework. These botanicals exhibit potent antioxidant, anti-inflammatory, antimicrobial, metabolic-regulatory, and neuroprotective effects. Many influence the gut microbiota, bolster immune resilience, promote wound healing, and help prevent chronic diseases, thus paving the way for advancements in phytopharmacology and integrative medicine. Viewing these plants as an interconnected botanical ecosystem rather than mere isolated compounds could yield groundbreaking insights that revolutionize preventive and regenerative healthcare strategies. This endeavor forms a cornerstone of the nascent discipline of photopharmacology within Prophetic Medicine. It urges the international scientific community to prioritize medicinal botany as a fundamental aspect of biophotonic medicine, leveraging light energy captured by plants through photosynthesis and channeled through their water systems for therapeutic purposes.

Keywords: Prophetic Medicine, Medicinal Plants, Phytopharmacology, Biophotonic Medicine, Integrative Medicine

Ethnobotanical knowledge and phytochemical profiling of medicinal plants for therapeutic applications

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Abstract

Ethnobotanical knowledge represents a rich source of information on the traditional use of medicinal plants for healthcare, particularly among indigenous and rural communities. The present study focuses on documenting ethnobotanical knowledge and evaluating the phytochemical profile of selected medicinal plants used for therapeutic applications. Ethnobotanical data were collected through field surveys, interviews, and literature to record plant species, parts used, preparation methods, and ailments treated. Phytochemical screening was performed to identify major secondary metabolites, including alkaloids, flavonoids, tannins, phenolics, terpenoids, and glycosides. The results revealed a strong correlation between traditional medicinal uses and the presence of bioactive phytoconstituents responsible for therapeutic efficacy. Integrating ethnobotanical knowledge with phytochemical profiling provides scientific validation of traditional medicine and highlights the potential of medicinal plants as sources of novel drug candidates. This interdisciplinary approach supports the conservation of traditional knowledge and promotes sustainable utilization of medicinal plant resources.

Keywords: Ethnobotany, Phytochemical, Traditional Knowledge, Therapeutic application, Phytoconstituents

Efficient adsorptive removal of Congo red dye using Zn-activated carbon prepared from *Hyophorbe lagenicaulis* fruits

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Abstract

The present investigation presents an efficient activated carbon derived from *Hyophorbe lagenicaulis* fruits by thermal (HAC) and chemical activation (zinc chloride, Zn-HAC) methods, and utilized for the adsorption of the CR dye via batch adsorption. The XRD patterns indicated that the HAC and Zn-HAC have mostly an amorphous structure and presence of Zn in Zn-HAC. SEM images revealed that the outer surface was uneven and various shapes and sizes with porous nature for both adsorbents. The EDX spectrum shows the existence of carbon, oxygen and silica in HAC with weight percentages of 61.18, 23.84 and 14.98%, respectively. Whereas, in the Zn-HAC spectrum, carbon, oxygen, zinc, and chloride were detected with weight percentages of 64.71%, 11.48%, 7.46%, and 16.34%, respectively. The maximum adsorption efficacies are 49% and 90 % were achieved for HAC and Zn-HAC adsorbents, respectively, with an adsorbent dose of 50 mg/50mL at pH 9. Further, the experimental data were analysed using linear and nonlinear kinetic and isotherm models. The pseudo-second order and Langmuir models were better fitted compared with other models. Based on the outcomes of the models, the adsorption was chemisorption and the highest monolayer adsorption capabilities were 9.33 and 161.21 mg/g for HAC and Zn-HAC. The present results revealed that Zn-HAC, which can be prepared easily, is a great eco-friendly adsorbent for removing dyes from wastewater.

Keywords: Adsorption, Zinc Activated Carbon, Congo red, Dye removal, Wastewater treatment

Effect of cultivation mode on Docosahexaenoic acid production by double mutant *Neodesmus pupukensis* DMA5 using ultrasonically pretreated municipal wastewater

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Abstract

Docosahexaenoic acid (DHA) is a highly valued omega-3 polyunsaturated fatty acid owing to its significant nutritional and therapeutic benefits, particularly for cardiovascular, neurological, and visual health. The present study investigated the potential of a double mutant strain of *Neodesmus pupukensis* DMA5 for enhanced DHA production using ultrasonically pretreated municipal wastewater (UPMWW) under different trophic cultivation strategies. Mixotrophic and heterotrophic cultivation modes were evaluated, with autotrophic growth serving as the control. The results demonstrated that the double mutant *N. pupukensis* DMA5 efficiently utilized UPMWW under mixotrophic conditions, indicating metabolic flexibility and suitability for wastewater-based cultivation systems. Mixotrophic cultivation resulted in a slight increase in DHA content on a dry-weight basis and significantly enhanced overall DHA production, reaching a maximum of $35.81 \pm 0.12\%$ after 15 days of cultivation. This represented an approximately 1.59-fold increase compared with autotrophic cultivation ($22.53 \pm 0.38\%$) and a 4.96-fold increase compared with heterotrophic cultivation ($7.21 \pm 0.06\%$). In contrast, autotrophic cultivation produced 3.12-fold higher DHA levels than heterotrophic growth, highlighting the importance of light-driven metabolism for DHA biosynthesis. Mixotrophic cultivation significantly enhanced DHA accumulation compared with autotrophic and heterotrophic modes, achieving the highest yield in UPMWW. These results demonstrate the effectiveness of mixotrophy as a sustainable strategy for maximizing DHA production while enabling efficient wastewater valorization.

Keywords: Docosahexaenoic acid, *Neodesmus pupukensis* DMA5, Mixotrophic cultivation, Municipal Wastewater, Ultrasonic pretreatment

Biotechnology sustainable application of natural dyes on textile fabric pretreated with chitosan / propolis and citral nano composite and its bacterial characteristicNagia Farag Aly^{1*}

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***Corresponding author:** Nagia Farag Aly**Abstract**

Wool fibers were dyed using a natural dye made from madder root extract that was heated in a microwave. Wool fibers were treated with a chitosan/propolis and citral nano-composite before being dyed with natural dyes, such as olive leaf extract and curcumin, using microwave and ultrasonic techniques. Investigations were conducted to examine the fastness characteristics, color strength, color data, and dye concentration and pH variables of the dyed wool fibers. According to the data, wool fibers pretreated with the tested nanomaterials performed better than those that were not. Additionally, bio mordents and synthetic mordents were used in treatments, including tannic acid and Alum. Nanocomposites exhibit antibacterial properties against certain harmful bacteria. The results indicated that the natural dyes under investigation exhibited good antimicrobial activity, which was enhanced by the composite, thereby improving their antibacterial activity. Scanning electron microscopy (SEM) was used to analyze the morphologies and structures of processed and unprocessed wool fibers. The untreated wool fibers have a rough surface. In contrast to the untreated fibers, the processed wool fibers were swollen. As the fibers' diameter increased, the dyed wool fabrics were evaluated for their antibacterial properties against various Gram-positive and Gram-negative bacteria, as well as yeast, including *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Candida epidermidis*, and *Candida albicans*. The aim of this work is the manufacture of eco-friendly handmade carpets

Keywords: Nano composite, Madder, Natural dye, Antibacterial activity

Effects of *P. aeruginosa* AV 311222 lipases on high-fat diets in Pangasius fish treatment

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Abstract

The present study aims to determine the effects of isolated lipase from *P. aeruginosa* AV311222 on the growth parameters of *Pangasius pangasius*. The fish in the control tank were fed only with supplementary fish feed without lipase, and the fish in the experimental tank were fed with supplementary fish feed mixed with isolated lipase from *P. aeruginosa* AV311222. Fish in both tanks were fed regularly twice a day (3% body weight of fish). Two groups of fish with a mean weight of 5.5 ± 0.22 g were used in the study: Group 0 (control), Group 1 (feed + 2 g/kg), and Group 2 (feed + 4 g/kg). The experiment was carried out for 96 days, and the samples were taken from control and experimental fish on the 15th, 30th, 45th, 60th, 75th and 90th day of the experimental period. The present study shows that Group 1 (2 g/kg) had the highest growth and improved water quality compared with other groups ($p < 0.05$). The present results suggest that lipase could be used as a potential fat diet additive and maximum body weight for *P. pangasius*.

Keywords: Lipase, *P. aeruginosa* AV311222, *Pangasius pangasius*, maximum growth

Microbial degradation of pharmaceutical and disinfectant contaminants from hospital wastewater using indigenous bacterial isolates

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Abstract

Hospital wastewater is a major source of pharmaceutical and disinfectant residues that pose serious risks to environmental and agricultural sustainability. In the present study, hospital wastewater samples were collected from a Medical Hospital and explored as a source of indigenous microorganisms capable of degrading commonly used pharmaceutical compounds. Five bacterial isolates were obtained using serial dilution followed by spread plate, quadrant streaking, and broth culture techniques. Degradation studies were carried out using five selected pharmaceutical compounds representing different pharmaceutical classes: antibiotics (ciprofloxacin), analgesics (paracetamol), and a disinfectant (phenol). Qualitative biodegradation potential was initially assessed using the redox indicator 2,6-dichlorophenol indophenol (DCPIP), where colour reduction indicated microbial metabolic activity and compound transformation. Further confirmation of degradation was performed using UV–Visible spectrophotometry, monitoring changes in absorbance over time. Biochemical characterization of the bacterial isolates was conducted using IMViC tests along with enzyme and metabolic assays, including catalase, oxidase, urease, citrate utilization, and triple sugar iron (TSI) agar tests. The results demonstrated that the isolated bacterial cultures possess diverse metabolic capabilities and showed promising degradation potential toward pharmaceutical and disinfectant compounds. This study highlights the potential of indigenous hospital wastewater bacteria as eco-friendly, sustainable biological agents for treating pharmaceutical-polluted wastewater. The findings support the application of microbial biotechnology as an effective alternative to conventional physicochemical treatment methods, contributing to environmental protection and sustainable agricultural water reuse.

Keywords: Hospital wastewater, Biodegradation, Pharmaceuticals, DCPIP assay, UV–Visible analysis, Microbial biotechnology, Sustainability

Biodegradation and mycoremediation of plastic pollution using *Hypsizygus ulmarius* mushroom

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Abstract

The persistent accumulation of plastic waste in natural environments has become a critical ecological concern due to the slow degradation of synthetic polymers. Traditional recycling and conventional waste-management strategies are insufficient to address the rapidly increasing volume of plastic pollution. Fungi can produce a diverse array of extracellular enzymes, including laccases, peroxidases, hydrolases, and other oxidative enzymes that can interact with complex polymers and initiate breakdown processes. Research on fungal biodegradation of plastics has demonstrated that certain species can attach to polymer surfaces, secrete enzymes that catalyze bond cleavage, and partially depolymerize materials such as polyethylene, polystyrene, and polyurethane. This study investigates the capacity of *Hypsizygus ulmarius*, an edible basidiomycete with broad enzymatic activity, to contribute to the biodegradation and mycoremediation of plastic materials. By assessing fungal growth on plastic substrates, measuring enzymatic responses, and analyzing changes in polymer integrity, the evidence suggests that *H. ulmarius* mycelium interacts with and alters the structure of plastic under controlled conditions. The study demonstrates that fungal biotechnological methods could play a key role in developing environmentally sustainable ways to manage enduring plastic waste.

Keywords: Biodegradation, Mycoremediation, Plastic wastes, *Hypsizygus ulmarius*

Effect of indole-3-acetic acid mediated green synthesis of silver nanoparticles on seed germination, morpho physiology, biochemical and antioxidant alteration in blackgram

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Abstract

Indole-3-acetic acid (IAA), regulator of plant growth, can also serve as an effective reducing agent for nanoparticle synthesis. In this study, IAA-mediated silver nanoparticles (AgNPs) were synthesized, characterized, and evaluated for their effects on seed germination, morphophysiological traits, biochemical constituents, and non-enzymatic antioxidants of blackgram. The synthesis of AgNPs was confirmed by a visible colour change and further validated through UV–Visible spectroscopy, FT-IR, X-ray diffraction and SEM–EDX analyses, revealing spherical, crystalline AgNPs with a face-centered cubic structure. Seeds were treated with different concentrations of IAA and IAA-synthesized AgNPs (30, 60, 90, 120, and 150 µg) and assessed for germination and early seedling growth. Results indicated that IAA significantly enhanced seed germination and growth parameters, with 30 µg IAA showing the most improvement in shoot length, root length and overall seedling vigor. AgNPs exerted a positive influence on germination and growth at lower concentrations, whereas higher concentrations (120 and 150 µg) exerted inhibitory effects due to phytotoxicity. Photosynthetic pigments, including chlorophyll a, chlorophyll b and carotenoids, were notably increased in IAA-treated seedlings, particularly at 30 µg. Biochemical analyses revealed elevated levels of carbohydrates, proteins, amino acids, and malondialdehyde, whereas proline content remained highest in control plants. Non-enzymatic antioxidants, such as phenols and flavonoids, were differentially regulated: IAA treatments promoted phenolic accumulation, and AgNPs enhanced flavonoid content at specific concentrations. Overall, the study shows that low concentrations of IAA and IAA-mediated AgNPs enhance early growth and metabolic activity in blackgram, indicating their potential for sustainable agriculture.

Keywords: Indole-3-acetic acid, Blackgram, AgNPs, Biochemical, Antioxidant activity

Foliar application of abscisic acid mediated drought stress regulation in rice

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Abstract

Agriculture is essential for the livelihoods of many people worldwide, particularly in regions where farming is a primary economic activity. A key phytohormone, abscisic acid, plays a crucial role in how plants respond to water stress. ABA helps plants adapt to varying environmental conditions, making it a vital tool for improving crop resilience. Rice, a staple food for nearly half of the global population, is especially significant in Asian and developing countries, with Asia producing about 95% of the world's rice. In our study, we applied different concentrations of ABA (30 μM , 60 μM , 90 μM , and 120 μM) to rice plants under drought conditions (35 DAS). The research evaluated the effects on various traits including morpho-physiological, biochemical, and secondary metabolites. Results indicated that drought decreased growth and physiological characteristics, yet increased photosynthetic activity, biochemical content, and secondary metabolites, except phenol. Notably, plants treated with 90 μM ABA exhibited significant enhancements in biochemical activity compared to those treated with ABA alone. Additionally, secondary metabolite levels were notably higher at 120 μM compared to 60 μM . FTIR and gene expression analyses further detailed the molecular changes and functional groups affected by ABA treatment.

Keywords: Abscisic acid, Drought stress, Biochemicals, FTIR, Gene expression

Comparative green synthesis of carbon nanoparticles from *Gomphrena globosa* and *Ixora coccinea* using an eco-friendly biosoot method

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Abstract

Carbon nanoparticles (CNPs) synthesized from plant-based biomass have gained significant attention due to their eco-friendly nature and potential biomedical applications. The biosoot technique, which uses carbon compounds derived from combustion rather than hazardous chemical reagents, provides a sustainable approach to green synthesis. The physicochemical properties of biosoot-derived CNPs are influenced by the nature of the biomass and associated phytochemicals, which can regulate nanoparticle formation and stability. The present study aimed to synthesize and compare carbon nanoparticles derived from the floral biomass of *Gomphrena globosa* and *I. coccinea* using an eco-friendly biosoot method in a closed environment. To produce biosoot, dried flower petals from *Gomphrena globosa* and *I. coccinea* were subjected to controlled thermal carbonization in a closed system. Without using any chemical reducing or stabilizing agents, the collected biosoot was treated to produce stable aqueous dispersions of carbon nanoparticles. Particle size distribution and dispersion characteristics were analyzed using DLS to evaluate nanoparticle size and uniformity. Particle size analysis revealed that CNPs synthesized from *Gomphrena globosa* exhibited relatively larger particle sizes with moderate polydispersity. In contrast, *I. coccinea*-derived CNPs exhibited smaller average particle sizes in the nanoscale range, greater uniformity, and a lower polydispersity index, indicating enhanced dispersion and stability. These findings suggest that phytochemicals present in the floral biomass play a significant role in modulating nanoparticle formation during biosoot-mediated synthesis. The greater size, uniformity, and stability observed in *I. coccinea*-derived CNPs highlight the influence of plant-specific components on nanoparticle characteristics. Further investigations are ongoing to explore the detailed physicochemical properties and potential biomedical and cosmeceutical applications of the synthesized carbon nanoparticles.

Keywords: Carbon nanoparticles, Biosoot method, Green synthesis, *G. globosa*, *I. coccinea*

Green synthesis of zinc acetate–copper sulphate coated alginate for sustainable soil remediation

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Abstract

Soil contamination caused by heavy metals and toxic pollutants is a growing environmental concern that adversely affects ecosystem health and agricultural productivity. Conventional remediation techniques often involve high costs and secondary environmental risks, highlighting the need for sustainable alternatives. In this study, a green synthesis approach was employed to develop zinc acetate and copper sulphate-coated alginate composites using *Martynia annua* L. plant extract as a natural reducing and stabilizing agent. The phytochemicals present in *Martynia annua* L., including phenolics and flavonoids, enable eco-friendly synthesis without hazardous chemicals. Alginate, a biodegradable and biocompatible polymer, was used as a coating material to enhance structural stability, metal-ion immobilization, and controlled release. The synthesized composite was designed to enhance soil remediation efficiency by reducing the mobility and bioavailability of heavy metals in contaminated soils. The synergistic effect of zinc and copper ions provides antimicrobial properties while also supplying essential micronutrients required for plant growth. The alginate coating minimizes metal leaching, ensuring environmental safety and prolonged effectiveness. Preliminary observations indicate that the green-synthesized composite improves soil quality and reduces toxicity levels. Overall, this study demonstrates that *Martynia annua* L. mediated zinc acetate–copper sulphate coated alginate composites offer a cost-effective, environmentally benign, and sustainable solution for soil remediation. The developed material shows promising potential for application in agricultural soil management and environmental restoration practices

Keywords: Biopolymer-based remediation, Metal ion adsorption, Sustainable environmental remediation, Zinc-copper composite, Biodegradable adsorbent.

Biosynthesized of zinc–silver nanocomposite (Ag–ZnO NCs) using *Lycopus europaeus* L. leaf extract; Their biological approaches and Photocatalytic degradation of methylene blue dye

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Abstract

The present study reports the green synthesis of Ag-ZnO nanocomposites via a simple, eco-friendly precipitation method using *Lycopus europaeus* plant leaf extract as a reducing and stabilizing agent. The eco-friendly synthesized NPs and NCs were systematically characterized to evaluate their structural, morphological, optical, electrical, and chemical properties using X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDX), UV-visible spectroscopy, Fourier transform infrared spectroscopy (FTIR), and techniques. XRD analysis confirmed the successful incorporation of Ag into the ZnO green method, It was shown that the Ag–ZnO NCs had strong antibacterial activity against both Gram-positive (*Staphylococcus aureus*, *Bacillus subtilis*) and Gram-negative (*Escherichia coli*, *Klebsiella pneumonia*) bacterial stains. They also had great antioxidant and anti-inflammatory activity. The cytotoxicity of Ag–ZnO NCs against the MCF-7 cell line increased with different concentrations. Ag–ZnO NCs have been produced and shown to be effective biocatalysts, degrading methylene blue by 90% in tests. Overall, this study demonstrates a simple, cost-effective, and environmentally benign approach for synthesizing multifunctional Ag–ZnO nanocomposites with promising applications in photocatalysis, antimicrobial treatment, and future anticancer therapy.

Keywords: Synthesis Silver–Zinc Nanocomposite, Antibacterial, Antioxidant, Anticancer, Dye degradation.

Green synthesis of Ag–ZnO nanocomposite using *Merremia quinquefolia* (L.) Hallier f. leaf extract and potential biological in applications and photocatalytic dye degradationA. Bharathi¹, S. Murugesan^{1*}

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***Corresponding author:** S. Murugesan (Email: drsmbtjas@periyaruniversity.ac.in)**Abstract**

In the present study, Ag–ZnO nanocomposites were synthesized using the leaf extract of *Merremia quinquefolia*. The synthesized nanocomposites were characterized by UV–Vis spectroscopy, FTIR, XRD, and SEM–EDAX analyses. Nanocomposites possess unique mechanical, thermal, electrical, and optical properties, attracting considerable interest from both academic and industrial sectors. The incorporation of silver resulted in UV absorption at 302 nm, while zinc contributed to the absorption peak at 438 nm. XRD analysis confirmed the crystalline structure and phase composition. Antibacterial activity assessed by the disc diffusion method showed the greatest inhibition against *Bacillus subtilis*. The nanocomposites also exhibited strong antioxidant activity against DPPH and ABTS radicals, as well as notable anti-inflammatory effects. Additionally, significant anticancer activity was observed against a skin cancer cell line. The Ag–ZnO nanocomposites further demonstrated excellent photocatalytic efficiency with effective dye degradation. Overall, the synthesized nanocomposites show promising potential for biomedical and environmental applications.

Keywords: Synthesis Silver–Zinc Nanocomposite, Antibacterial, Antioxidant, Anti-inflammation, Anticancer, Dye degradation.

Development of herbal mosquito repellent sticks *Acorus calamus* (Vasambu) rhizome oil- A community-based approach in Salem.

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Abstract

Mosquito-borne diseases such as dengue, chikungunya, malaria, and filariasis remain major public health concerns in tropical regions of India, including the Salem district of Tamil Nadu. The extensive use of synthetic mosquito control agents has led to insecticide resistance, environmental contamination, and potential health risks, emphasizing the need for eco-friendly alternatives. The present study focuses on the chemical profiling of the essential oil extracted from the rhizomes of *Acorus calamus* L. (Vasambu), a medicinal plant traditionally used in Siddha medicine for insecticidal and repellent purposes, as a preliminary step toward the development of herbal mosquito repellent formulations. Fresh rhizomes collected from wetland habitats of Salem district were botanically authenticated, shade-dried, and subjected to hydrodistillation for essential oil extraction. The chemical composition of the essential oil was characterized exclusively using gas chromatography–mass spectrometry (GC–MS). The analysis revealed a diverse array of bioactive compounds, including neophytadiene, phytol, β -asarone, isoelemicin, squalene, fatty acid esters, aliphatic hydrocarbons, and phthalate derivatives. Many of these compounds have been previously reported in the literature for their mosquito-repellent, insecticidal, larvicidal, and oviposition-deterrent activities. Based on the predominance of these bioactive phytochemicals, the essential oil of *A. calamus* shows promising potential for mosquito control applications. The formulation of herbal mosquito repellent sticks, along with evaluation of repellent efficacy against major vector species, shelf-life stability, and user safety, is currently under process and will be addressed in future studies. The present GC–MS profiling provides a scientific basis for the continued development of *A. calamus*-based, biodegradable mosquito repellent products for sustainable vector management.

Keywords: *Acorus calamus*, Fatty acid esters, Vasambu, Mosquito-borne diseases

Green-synthesized silver–chitosan nanocomposite from *Ecbolium viride* and its anticancer potential

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Abstract

This study will investigate the eco-friendly green synthesis of a silver–chitosan (Ag–Ch) nanocomposite using the aqueous leaf extract of *E. viride*. The plant extract will act as a natural reducing and stabilizing agent, enabling a sustainable synthesis approach. The synthesized nanocomposite is expected to exhibit bioactive properties, particularly against cervical cancer. Nanocomposite formation will be confirmed using UV–visible spectroscopy. Structural and crystalline characteristics will be analyzed by X-ray diffraction (XRD), while functional groups involved in the synthesis will be identified by Fourier transform infrared spectroscopy (FTIR). Surface morphology will be examined using scanning electron microscopy (SEM), and particle size and shape will be determined using transmission electron microscopy (TEM). Dynamic light scattering (DLS) and zeta potential analyses will be performed to evaluate particle size distribution, surface charge, and stability of the Ag–Ch nanocomposite. Biological activities will be assessed through *in-vitro* assays. Antioxidant potential will be evaluated using DPPH, ABTS, and metal chelating assays. Antibacterial and anticancer activities will be examined, with anticancer efficacy tested against human cervical cancer cell lines (HeLa). Antidiabetic activity will be evaluated using albumin denaturation and membrane stabilization assays. The findings are expected to demonstrate that the green-synthesized silver–chitosan nanocomposite possesses significant biomedical potential, especially as an anticancer agent.

Keywords: *E. viride*, Antioxidant, Antidiabetic, Antibacterial, Anticancer.

Green synthesis of zinc–chitosan nanoparticles using *Pentatropis capensis* (L.f) Bullock leaf extract: Characterization and biological applications

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Abstract

Zinc–chitosan nanoparticles (Zn–Ch NPs) were synthesized using *Pentatropis capensis* leaf extract and characterized through SEM coupled with EDAX, XRD, FTIR, and UV–Visible spectroscopy. UV–Visible spectral analysis confirmed a characteristic absorption peak at 373 nm, while SEM micrographs indicated that the synthesized nanoparticles were predominantly spherical, and EDAX analysis further confirmed the elemental composition of zinc and chitosan. The Zn–Ch NPs exhibited strong antibacterial activity against *Staphylococcus aureus*, with a maximum zone of inhibition at 75 µg/mL. The nanoparticles also demonstrated notable antioxidant potential, with IC₅₀ values of 159.31 µg/mL and 143.67 µg/mL in ABTS and DPPH radical scavenging assays, respectively. In addition, appreciable anti-inflammatory activity was observed, as evidenced by IC₅₀ values of 94.55 µg/mL for human red blood cell membrane stabilization and 97.29 µg/mL for inhibition of albumin denaturation. Collectively, these findings demonstrate the significant therapeutic potential of *Pentatropis capensis*-derived zinc chitosan nanoparticles and support their promising application in biomedical and nanomedicine-related fields.

Keywords: *Pentatropis capensis*, Green synthesis, Antibacterial, Antioxidant, Anti-inflammation

Characterization and biological activity of *Endostemon viscosus* leaf extract-based green synthesis of silver and chitosan-silver nanoparticles

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Abstract

A green, eco-friendly approach was employed to synthesize silver nanoparticles (Ag NPs) and chitosan–silver nanoparticles (Chi-Ag NPs) using the leaf extract of *Endostemon viscosus* (Roth) M.R. Ashby as a natural reducing and stabilizing agent. Formation was confirmed by UV–Vis, XRD, FTIR, and FE-SEM–EDX analyses. Ag NPs showed an SPR peak at 439 nm, while Chi-Ag NPs shifted to 445 nm due to chitosan interaction. Both were crystalline, exhibiting rod- and spherical-shaped morphologies and some aggregation. PDI values were 1.0 (Ag NPs) and 0.5 (Chi-Ag NPs). Both nanoparticles exhibited strong antibacterial, antioxidant, and anticancer activities, with notable IC₅₀ values in DPPH, ABTS, and MCF-7 assays. Apoptotic features, including nuclear shrinkage and membrane blebbing, were observed. These results indicate that green-synthesized Ag and Chi-Ag NPs are stable, bioactive, and promising for sustainable biomedical applications.

Keywords: Green synthesis, Silver nanoparticles, Chitosan–silver nanoparticles, *Endostemon viscosus*, Antibacterial activity

Green fabrication of zinc- magnesium- manganese nanocomposites and their antibacterial activity against pathogenic bacteria

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Abstract

Nanotechnology has emerged as a promising approach for developing advanced antimicrobial agents to combat bacterial diseases and the growing threat of antibiotic resistance. In the present study, green-synthesized nanocomposites using zinc acetate, magnesium sulphate, and manganese sulphate were evaluated for their antibacterial efficacy against clinically significant pathogenic bacteria. The nanocomposites were tested against *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Bacillus subtilis*, and *Staphylococcus aureus* using the agar disc diffusion method. Chloramphenicol was used as the positive control, while DMSO served as the negative control. The results demonstrated a clear concentration-dependent antibacterial activity of the synthesized nanocomposites. At 10, 20 and 30 µg/mL concentrations, the zones of inhibition increased progressively for all tested microorganisms. *Pseudomonas aeruginosa* showed inhibition zones of 9, 11 and 15 mm, while *Klebsiella pneumoniae* exhibited 7, 10, and 14 mm at respective concentrations. Notably, *Bacillus subtilis* showed greater sensitivity, with inhibition zones of 6, 12, and 16 mm, comparable to the positive control (20 mm). *Staphylococcus aureus* also showed significant susceptibility with zones of 8, 12, and 15 mm. The negative control exhibited minimal inhibition (6 mm), confirming the antimicrobial role of the nanocomposites. The synthesized zinc acetate–magnesium sulphate–manganese sulphate nanocomposite demonstrated effective antibacterial activity against both Gram-positive and Gram-negative bacteria. These findings highlight the potential of such nanocomposites for nanotechnology-based antimicrobial formulations to manage bacterial diseases.

Keywords: Nanotechnology, Nanocomposites, Antibacterial, Pathogens

Green synthesis and physicochemical characterization of metal oxide nanoparticles using *Lantana camara* leaf extract

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Abstract

This study explores the eco-friendly synthesis of metal oxide nanoparticles (MONPs) using *Lantana camara* leaf extract as a sustainable biogenic precursor. The aqueous extract acts as a dual-function reducing and stabilizing agent, enabling controlled nucleation, growth, and surface stabilization of nanoparticles through phytochemical-mediated pathways. Phytochemical analysis revealed a rich profile of flavonoids, polyphenols, alkaloids, and terpenoids, which contribute to surface charge modulation and enhanced colloidal stability. The synthesized MONPs were systematically characterized using X-ray diffraction (XRD) for crystallographic phase analysis, Fourier-transform infrared spectroscopy (FTIR) for functional group identification, and scanning electron microscopy (SEM) for morphological evaluation. Dynamic light scattering (DLS) and zeta potential measurements confirmed narrow particle size distribution and high colloidal stability, while ultraviolet-visible (UV-Vis) spectroscopy exhibited characteristic surface plasmon resonance (SPR) peaks, validating nanoparticle formation. Photocatalytic experiments demonstrated substantial degradation of organic dyes under visible-light irradiation, indicating potential for environmental remediation. The integration of green chemistry principles with nanoparticle fabrication ensures biocompatibility, cost-effectiveness, and sustainability. These MONPs show promise for diverse applications, including antimicrobial therapy, biosensing, and catalysis. The study highlights the direct correlation between phytochemical composition and nanoparticle physicochemical properties, positioning *Lantana camara* as a versatile bioresource for next-generation functional nanomaterials. This framework supports the development of plant-mediated strategies to engineer MONPs with tunable optical, surface, and catalytic features, advancing sustainable nanotechnology.

Keywords: Green synthesis, Metal oxide nanoparticles, *Lantana camara*, Phytochemical-mediated synthesis, Sustainable nanotechnology

Evaluation of anticancer and antioxidant potential of green-synthesized ZnO-Cu-TiO₂ nanocomposites using ethnomedicinal plants *Alstonia venenata* R.Br.

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Abstract

Alstonia venenata R.Br. is an important medicinal plant traditionally used to treat various ailments and is rich in bioactive phytochemicals, including alkaloids, flavonoids, phenolics, and terpenoids. In the present study, a green and sustainable approach was employed to synthesize a ZnO-Cu-TiO₂ nanocomposite using *Alstonia venenata* plant extract as a natural reducing, capping, and stabilizing agent. This method eliminates the use of toxic chemicals and provides an environmentally friendly route for nanocomposite fabrication. The synthesized ZnO-Cu-TiO₂ nanocomposite was characterized using UV-Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Transmission Electron Microscopy (TEM) to confirm nanocomposite formation, crystalline structure, surface morphology, and functional group interactions between the metal oxides and plant phytochemicals. The antioxidant activity of the synthesized nanocomposite was evaluated using standard *in vitro* assays, including DPPH, ABTS, and FRAP, which demonstrated significant free-radical scavenging activity in a concentration-dependent manner. The anticancer potential of the *Alstonia venenata*-mediated ZnO-Cu-TiO₂ nanocomposite was assessed against selected human cancer cell lines using the MTT assay. The results revealed substantial cytotoxicity against cancer cells, with comparatively lower toxicity toward normal cells. The enhanced antioxidant and anticancer activities of the nanocomposite can be attributed to the synergistic effects of ZnO, Cu, and TiO₂, nanoscale dimensions, increased surface area, and the presence of bioactive phytochemicals from *Alstonia venenata*. Overall, this study suggests that *Alstonia venenata*-mediated ZnO-Cu-TiO₂ nanocomposite holds strong potential as a multifunctional nanotherapeutic agent for cancer treatment and oxidative stress-related disorders.

Keywords: *Alstonia venenata*, Green synthesis, ZnO-Cu-TiO₂ nanocomposite, MTT assay

Sustainable water purification using green-synthesized copper–Alginate nanocomposite membranes

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Abstract

Future research should focus on advancing the development and application of biodegradable copper–alginate (Cu–Alg) nanocomposite membranes synthesized using *Martynia annua* L. leaf extract for water purification. Further studies are required to optimize membrane composition, thickness, and porosity to enhance heavy metal removal efficiency and water flux under real environmental conditions. Long-term stability, reusability, and regeneration performance of the membranes should also be systematically evaluated to assess their practical feasibility in large-scale water treatment systems. In addition, future investigations may explore the effectiveness of Cu–Alg nanocomposite membranes against a broader range of contaminants, including organic pollutants, dyes, pesticides, and emerging contaminants such as pharmaceuticals and personal care products. Antimicrobial performance should be validated in continuous-flow systems and in real wastewater matrices to better simulate field conditions. Toxicological and environmental impact assessments are essential to ensure the safe deployment of these membranes, particularly concerning copper ion leaching and their effects on aquatic ecosystems. Scaling up the green synthesis process using plant-based extracts and evaluating economic viability will further support industrial adoption. Overall, future studies should aim to integrate Cu–Alg nanocomposite membranes into multifunctional, sustainable water treatment technologies that address both chemical and biological contaminants, thereby advancing safer, more efficient water purification strategies.

Keywords: Antimicrobial activity, Copper- Alginate nanocomposite (NCs), Green synthesis, Water pollution, Nano purification.

Chitosan-encapsulated *Syzygium cumini* leaf extract nanoparticles: Phytochemical profiling and evaluation of antioxidant, anti-inflammatory and antimicrobial activitiesDeepa Subramanian^{1*}

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Abstract

This study investigated the extraction, phytochemical profiling, and bioactivities of *Syzygium cumini* leaf extracts, with a focus on their potential in antimicrobial dental formulations. Leaves were shade-dried, powdered, and extracted via ultrasound-assisted maceration and Soxhlet methods, yielding superior recovery and bioactive content (e.g., gallic acid: 120.85 mg/g; EGCG: 79.43 mg/g) with the ultrasound method, as confirmed by HPLC and FTIR. Qualitative screening verified phenols, flavonoids, and tannins, quantified as total phenolics (gallic acid equivalents), flavonoids (rutin equivalents), and tannins (tannic acid equivalents). Ultrasound extracts exhibited potent antioxidant activity (e.g., 77.53% DPPH inhibition at 50 µg/mL), anti-inflammatory effects (64.54% membrane stabilization; 58.42% protein denaturation inhibition at 200 µg/mL, nearing diclofenac standards), and broad-spectrum antimicrobial action against oral pathogens (*S. aureus*, *S. mutans*, *C. albicans*) via agar well diffusion, often surpassing gentamicin/amphotericin B controls. Chitosan-encapsulated *Syzygium cumini* nanoparticles were synthesized via ionic gelation (0.25% chitosan, 3 mg/mL extract, TPP crosslinker; pH 5), confirmed by UV-Vis (λ max ~250 nm) and FTIR (O-H/N-H shifts indicating encapsulation). These findings position ultrasound-assisted *S. cumini* extract-loaded chitosan nanoparticles as promising candidates for enhancing oral health with anti-inflammatory and antimicrobial properties.

Keywords: *Syzygium cumini*, Encapsulation, Antioxidant, Anti-inflammatory, Anti-microbial

Functional and mutational characterization of the PAX5 transcription factor in multiple malignancies

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Abstract

Comprehensive genomic profiling has significantly advanced cancer diagnosis, prognosis, and therapeutic decision-making. Among the key molecular regulators implicated in tumorigenesis, the paired box 5 (PAX5) transcription factor has emerged as a critical player across multiple cancer types. PAX5, a member of the developmentally regulated PAX gene family, is essential for B-cell lineage commitment and differentiation and is increasingly recognized for its role in both haematological malignancies and solid tumors. Aberrant PAX5 signaling cascades, including copy number alterations and somatic mutations, contribute to cancer initiation and progression by disrupting fundamental biological processes such as receptor-mediated signaling, cell adhesion, migration, transcriptional regulation, and cellular metabolism. In this meta-analysis, we investigated the functional expression patterns and mutational landscape of PAX5 across a wide range of cancer types. Large-scale genomic and clinical datasets were retrieved and analysed from publicly available resources, including cBioPortal, COSMIC, and PubMed. The analysis revealed a high prevalence of copy number variations and recurrent amino acid and nucleotide substitutions within functionally critical regions of the human PAX5 protein. Several mutation hotspots were consistently observed across different tumor types, suggesting their potential utility as diagnostic or prognostic biomarkers. Furthermore, the study highlights cancer-type-specific mutation profiles of PAX5, emphasizing its dual role as a tumor suppressor and oncogenic regulator depending on cellular context. These findings provide valuable insights into the molecular mechanisms underlying PAX5-driven tumorigenesis. Importantly, the identification of unique and recurrent PAX5 mutations offers promising opportunities for the development of targeted therapeutic strategies. Overall, this bioinformatic meta-analysis underscores the clinical relevance of PAX5 as a molecular target and supports its potential application in precision oncology for solid tumor and haematological cancer therapy.

Keywords: PAX5; Cancer, Transcription factor, Tumor suppressor, Genomic profiling.

Biogenic synthesis of Ag-ZnO-Fe₂O₃ nanocomposites using *Helminthosporium* spp and evaluation of its antioxidant and antimicrobial potentialR. Sibiraj¹, S. Saipraba¹, S. Murugesan^{1*}

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Abstract

The present study explores the biosynthesis and characterization of *Helminthosporium* spp.-mediated Ag-ZnO-Fe₂O₃ nanocomposites, emphasizing their antibacterial and antioxidant activities. The nanocomposites were synthesized via a green synthesis route using fungal filtrate as a bio-reducing and stabilizing agent, offering an eco-friendly alternative to chemical synthesis methods. The formation of Ag-ZnO-Fe₂O₃ nanocomposites was confirmed through UV-Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), and Scanning Electron Microscopy (SEM) analyses, which revealed crystalline, well-dispersed particles with uniform morphology. The biological efficacy of the nanocomposites was assessed against selected Gram-positive and Gram-negative bacterial strains. The Ag-ZnO-Fe₂O₃ nanocomposites exhibited strong antibacterial activity, with notable inhibition zones resulting from the synergistic effects of silver, zinc oxide, and ferric oxide, which enhance membrane disruption and reactive oxygen species (ROS) generation. Antioxidant assays, including DPPH and ABTS radical scavenging tests, demonstrated significant free radical scavenging activity, confirming their capability to reduce oxidative stress. These results indicate that *Helminthosporium* spp.-based Ag-ZnO-Fe₂O₃ nanocomposites exhibit multifunctional bioactivities and have potential applications in biomedical, pharmaceutical, and environmental sectors. Thus, this study provides a sustainable approach to developing metal oxide-based nanocomposites with enhanced biological activity via fungal-mediated synthesis.

Keywords: *Helminthosporium* spp., Ag-ZnO-Fe₂O₃ nanocomposites, Green synthesis, Antibacterial activity, Antioxidant activity

Green synthesis of iron nanoparticles using *Ipomoea hederifolia* leaf extract: Synthesis mechanism, characterization and biological activitiesK. Sri Kalpana¹, Maruthupandian Arumugam^{1*}

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Abstract

The synthesis of iron oxide nanoparticles (FeONPs) using a recently developed green approach is highly promising, given their non-toxic, environmentally friendly properties. The *Ipomoea hederifolia* plant's leaf extract and ferric chloride solution were used in this investigation to create the biosynthesis of FeONPs. The presence of FeONPs was confirmed by their UV–vis spectrum, which showed a peak at 293 nm. X-ray diffraction (XRD) research revealed that the particles were of excellent purity with crystalline cubic structure phases in nature, and Fourier-transform infrared (FTIR) study of FeONPs shows identical functional groups. Analysis using scanning electron microscopy (SEM) revealed spherical morphology with particle sizes ranging from 40 nm to more. The presence of Fe elements at 3 keV was verified using energy-dispersive X-ray spectroscopy (EDAX). At a dosage of 75 µg/mL, the FeONPs demonstrated potent antibacterial activity against Gram-positive pathogens, with *Bacillus subtilis* exhibiting an inhibitory zone of 18 ± 0.15 mm. In tests for DPPH and ABTS radical scavenging, antioxidant activity was found to be more effective. The IC₅₀ values for human red blood cells (55.50 µg/mL) and albumin denaturation (51.43 µg/mL) were less significant than the anti-inflammatory activity. Furthermore, methylene blue (MB) was degraded by 88.83% after 60 minutes under sunlight, as determined by photocatalytic degradation. Thus, these findings suggest that the synthesized FeONPs may be environmentally safe and cost-effective for dye removal, and that they may find successful applications in biological fields in the future.

Keywords: Green synthesis, Iron nanoparticles, Anti-inflammation, Photocatalytic activity

α -amylase and α -glucosidase enzyme inhibitory potential of ethyl acetate leaf extract of *Phyllanthus rhamnoides* Retz.

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Abstract

Phyllanthus rhamnoides Retz. It is used in traditional Chinese medicine to treat chronic lung disease and promote wound healing. This study aimed to identify the chemical constituents of *Phyllanthus rhamnoides* having biological properties by *in vitro* methods. The ethyl acetate leaf extract of *Phyllanthus rhamnoides* leaf extract was screened for the presence of phenol, flavonoid contents, antibacterial, antioxidant, and antidiabetic activities. The antibacterial activity of ethyl acetate leaf extract of *Phyllanthus rhamnoides* was evaluated against *Escherichia coli*, *Klebsiella pneumoniae*, *Bacillus subtilis*, and *Staphylococcus aureus*. The free radical scavenging activity of the ethyl acetate leaf extract of *Phyllanthus rhamnoides* was determined by DPPH, ABTS, and phosphomolybdenum assays. An enzyme inhibition assay for α -amylase and α -glucosidase was used to evaluate the antidiabetic activity of *Phyllanthus rhamnoides*.

Keywords: *Phyllanthus rhamnoides*, Free radicals, Antibacterial, Antidiabetic

Eco-friendly fabrication and characterization of selenium oxide (SeNPs) using *Breynia vitis-idaea* leaf extract and their biological activity

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Abstract

Plant-mediated synthesis of nanoparticles has attracted considerable attention because it offers several advantages, including cost-effectiveness, rapid processing, and environmental compatibility. In this regard, this work focuses on the biological production of selenium nanoparticles (Se NPs) using aqueous leaf extracts of *Breynia vitis-idaea* (Burm.f.). C.E.C. Fisch. The formation of the synthesized Se NPs was confirmed by UV-Vis spectroscopy, X-ray diffraction, Fourier transform infrared spectroscopy, Zeta potential analysis, Scanning electron microscopy with Energy dispersive X-ray, and atomic force microscopic studies. The antibacterial activity of the synthesized Se NPs was determined using the bacterial species such as *Staphylococcus aureus*, *Bacillus subtilis*, *Klebsiella pneumoniae* and *Escherichia coli*. The highest zone of inhibition was observed against *K. pneumoniae* (16 mm) and *Bacillus subtilis* (15 mm) at the higher concentration of 30 µg/mL. Additionally, the antioxidant and antidiabetic activities of the Se NPs were assessed *in vitro*. This demonstrated potent activity against α -amylase and α -glucosidase enzymes.

Keywords: Green synthesis, *Breynia vitis-idaea*, Physiochemical study, Antibacterial, Enzyme inhibition

Green fabrication and multifunctional bioactivity of CuO-ZnO nanocomposite using *Dolichandrone falcata* leaf extract

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Abstract

The rapid development of eco-friendly nanomaterials has gained significant attention in nanotechnology owing to their sustainable synthesis and versatile uses. In this study, an eco-friendly green synthesis of a CuO-ZnO nanocomposite was carried out utilizing *Dolichandrone falcata* leaf extract as a natural reducing and stabilizing agent. The synthesized nanocomposite was characterized using UV-Visible spectroscopy, XRD, FTIR, and SEM-EDAX. UV-Visible analysis confirmed nanocomposite formation and XRD measurements showed clear crystalline structure, SEM-EDAX analysis validated the surface shape and elemental composition. The antibacterial efficacy of the CuO-ZnO nanocomposite was evaluated using the disc diffusion method against selected pathogenic bacterial strains. The nanocomposite exhibited significant antibacterial activity, with the highest zone of inhibition observed against *Bacillus subtilis*, indicating its strong bactericidal potential. The enhanced antibacterial performance can be attributed to the synergistic interaction between CuO and ZnO at the nanoscale, which improves surface reactivity and disrupts microbial membranes. The strong antioxidant activities in the DPPH (62.9%) and ABTS (69%) tests, as well as strong metal chelating activity (62.5%). In addition, *in vitro* cytotoxicity against the human skin cancer cell line A431 demonstrated good anticancer activity, with an IC₅₀ of 57.8 µg/mL. These findings highlight the successful green synthesis of a multifunctional CuO-ZnO nanocomposite with its biomedical applications.

Keywords: CuO-ZnO, *Bacillus subtilis*, DPPH, Nanocomposite

Comparative phytochemical profile and antioxidant potential of different solvent extracts of *Pleurotus ostreatus*

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Abstract

Reactive oxygen species (ROS) interact with various biomolecules in the body, leading to oxidative damage that requires antioxidants for protection. *Pleurotus ostreatus*, a highly nutritious edible mushroom, is known to be rich in bioactive compounds with potential antioxidant properties. The present study evaluated and compared the phytochemical composition and in-vitro antioxidant activities of five solvent extracts of *P. ostreatus*: aqueous (AE), chloroform (CE), ethanol (EE), methanol (ME), and n-hexane (HE). Phytochemical screening revealed the presence of alkaloids, tannins, saponins, flavonoids, terpenoids, phenolics, cardiac glycosides, carbohydrates, anthocyanins, and betacyanins in varying concentrations across the extracts. CE exhibited the highest flavonoid content (104.83 ± 29.46 mg/100 g), while AE showed the maximum phenolic content (24.14 ± 0.02 mg/100 g). Tannin content was highest in EE (25.12 ± 0.06 mg/100 g), whereas HE contained the highest levels of alkaloids (187.60 ± 0.28 mg/100 g) and saponins (0.16 ± 0.00 mg/100 g). Antioxidant assays demonstrated that CE exhibited superior hydroxyl radical scavenging activity and ferric-reducing power. ME showed the highest DPPH and hydrogen peroxide scavenging activities, while EE exhibited maximum nitric oxide inhibition and ascorbate peroxidase activity. AE recorded the highest total antioxidant capacity and ferrous ion chelating activity, whereas HE showed the greatest guaiacol peroxidase activity. Overall antioxidant effectiveness followed the order: CE > AE > EE > ME > HE. The findings indicate that chloroform is the most effective extraction solvent for *P. ostreatus*, highlighting its potential as a rich natural source of antioxidants for the management of oxidative stress-related disorders.

Keywords: *Pleurotus ostreatus*, Antioxidants, Phytochemicals, Solvent extracts, Oxidative stress

Plant-mediated green synthesis of nanoparticles using *Grewia bracteata*. Roth and their therapeutic potentialGanapathi Monisha¹, Kuppusamy Selvam^{1*}

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Abstract

Future research on the green synthesis of nanoparticles using *Grewia bracteata* should expand the range of nanoparticles beyond predominantly silver nanoparticles, including gold, copper, zinc oxide, and iron oxide, to explore their diverse functional applications. Detailed investigations into the molecular mechanisms of phytochemical-mediated bioreduction and stabilization are required to identify the specific bioactive compounds responsible for nanoparticle formation and to achieve better control over particle size, morphology, and surface properties. Standardization of extraction protocols, synthesis parameters, and characterization methods will be essential to ensure reproducibility and scalability of *G. bracteata*-mediated nanoparticle synthesis. Future studies should also emphasize *in vivo* pharmacological evaluations and comprehensive toxicity assessments to establish the safety and biocompatibility of these phytonanoparticles for biomedical applications. Additionally, exploring targeted drug delivery systems, bioimaging, wound healing, and anticancer therapeutics using *G. bracteata*-based nanoparticles may significantly enhance their translational potential. From an environmental perspective, future research may investigate their applicability in antimicrobial coatings, water purification, and agricultural disease management. Overall, *G. bracteata* holds considerable promise as a sustainable bioresource in phytonanotechnology, and future studies should aim to bridge the gap between laboratory-scale synthesis and real-world biomedical and industrial applications.

Keywords: Green Synthesis, Nanoparticles, Characterization, Biomedical applications

**Evaluation of bioactive and pharmacological activities of methanolic extract of
Ecbolium viride (Acanthaceae)**

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Abstract

Traditional medical systems like Ayurveda and Siddha have long regarded *Ecbolium viride* (Forssk.), a medicinal plant in the Acanthaceae family. Numerous illnesses, such as fever, jaundice, asthma, inflammatory diseases, rheumatism, and liver-related problems, are frequently treated with it. This paper summarizes the taxonomy, morphological characteristics, phytochemical composition, and pharmacological characteristics of the plant. *E. viride* is rich in bioactive components, including ecbolin A and B, alkaloids, glycosides, and other phenolic elements, as well as flavonoids like orientin, isoorientin, vitexin, and isovitexin, according to phytochemical investigations. In experiments, extracts from plant parts, such as leaves, have shown notable cytotoxic, antibacterial, antioxidant, and antidiabetic properties. Despite a solid ethnomedical base and encouraging biological activity, there are currently few thorough, organized pharmacological studies on *E. viride*. To fully understand its mechanisms of action, safety, and therapeutic potential, further scientific evidence is required. All things considered, *E. viride* is a potential natural source of bioactive compounds with significant room for further study and drug development.

Keywords: *Ecbolium viride*, Characterization, Antioxidant, Antimicrobial, Anticancer

Phytochemical characterization and antimicrobial evaluation of *Calotropis gigantea* methanolic extract

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Abstract

Antimicrobial resistance poses a significant threat to global public health, driving the search for novel bioactive compounds from natural sources. Accordingly, the present study investigates the antibacterial and antifungal properties of the traditionally important medicinal plant *Calotropis gigantea*, as well as its potential anticancer relevance, using molecular docking analysis. Methanolic crude extracts were prepared from the plant's aerial parts using the cold maceration method. Antimicrobial activity was evaluated against selected clinical bacterial isolates (*Staphylococcus aureus* and *Escherichia coli*) and pathogenic fungal strains (*Aspergillus flavus* and *Aspergillus terreus*) using the agar well diffusion technique. The methanolic extract exhibited significant concentration-dependent antimicrobial activity. Strong inhibitory effects were observed, particularly against Gram-positive bacteria and pathogenic fungi. Among the tested microorganisms, *Staphylococcus aureus* and *Aspergillus flavus* showed the highest susceptibility, as indicated by larger zones of inhibition. The observed antimicrobial efficacy is attributed to the synergistic action of various phytochemical constituents present in the extract. Furthermore, molecular docking studies were performed to assess the interactions between bioactive compounds identified from *C. gigantea*, particularly digitoxin, and the epidermal growth factor receptor (EGFR), a key molecular target implicated in cancer progression. Docking results revealed favourable binding affinities, indicating stable ligand-protein interactions and supporting the potential of digitoxin as a lead compound for targeted cancer therapy. Overall, this study provides scientific validation for the ethnopharmacological use of *Calotropis gigantea* and highlights its promise as a source of novel antimicrobial agents with additional anticancer potential. Further investigations, including compound purification, structural characterization, and *in vivo* studies, are required to confirm its therapeutic potential.

Keywords: *C. gigantea*, Methanolic extract, Anti-microbial activity, Natural therapeutic

Eco-engineered Ag-Cu nanoparticles from *Delonix regia* bloom waste: Impact on biological properties

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Abstract

Silver-copper nanoparticles (Ag-Cu NPs) exhibit distinctive physicochemical properties that make bimetallic systems highly attractive for biomedical applications. Green synthesis of Ag-Cu NPs has gained increasing attention as an economical, eco-friendly, and energy-efficient alternative to conventional chemical and physical methods. In this study, Ag-Cu NPs were synthesized using an environmentally benign plant-based approach with an extract derived from the floral waste of *Delonix regia*, serving as a natural reducing and stabilizing agent. The formation and characteristics of the synthesized NPs were confirmed using multiple analytical techniques. UV–Visible spectroscopy revealed characteristic surface plasmon resonance peaks, indicating successful NPs synthesis. FT-IR analysis identified functional groups responsible for reduction and stabilization. The crystalline structure and phase composition were determined by XRD. Elemental composition was verified through EDX, while SEM and TEM studies provided detailed information on morphology, particle size, and nanoscale features. Biological assessments demonstrated that the Ag-Cu NPs exhibited strong antibacterial and antifungal activities. Significant anti-inflammatory potential was observed through inhibition of BSA protein denaturation. Additionally, the NPs demonstrated notable, dose-dependent antidiabetic activity by inhibiting α -amylase and α -glucosidase, highlighting their therapeutic potential.

Keywords: α -amylase inhibition, α -glucosidase inhibition, Green synthesis, Phytomedicine, Protein denaturation assay

Eco-friendly synthesis of silver nanoparticles from *Swietenia macrophylla* king aqueous leaf extract

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Abstract

Nowadays, sustainable practices are gaining increasing importance due to the extensive exploitation of various resources. India is rich reservoir of medicinal plants that help in curing various diseases, which may be due to the presence of phytochemicals. Plant-mediated synthesis of Nanoparticles is eco-friendly, cost-effective, and can be recovered quickly. *Swietenia macrophylla* King belongs to the Meliaceae family. The plant is used to treat diverse ailments like antimicrobial, anti-inflammatory, antioxidant, antimutagenic, anticancer, antitumor and antidiabetic activities. In the present study, aqueous leaf extracts of *S. macrophylla* were used to attempt to synthesize silver nanoparticles. The formation of silver nanoparticles was confirmed by a visible color change from pale yellow to dark brown and confirmed using UV, XRD, FT-IR, SEM and TEM. The time taken for the synthesis of silver nanoparticles is 1 hour. Thus, the medicinal plant *S. macrophylla* proved to be a promising one for the eco-friendly synthesis of silver nanoparticles.

Keywords: Medicinal plants, *S. macrophylla*, Aqueous leaf extract, Silver nanoparticles, Eco-friendly synthesis

Eco-friendly synthesis of selenium nanoparticles using *Lycopus europaeus* L. leaf extract and their biological applications and degradation of methylene blue dyeS. Nisha¹, A. Bharathi¹, S. Murugesan^{1*}

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***Corresponding author:** S. Murugesan (Email: drsmbtjas@periyaruniversity.ac.in)**Abstract**

Green synthesis of selenium nanoparticles (SeNPs) has gained significant attention due to its eco-friendly nature, low cost, and avoidance of toxic chemicals. In the present study, selenium nanoparticles were synthesized using *Lycopus europaeus* leaf extract as a natural reducing and stabilizing agent. The formation of SeNPs was confirmed by UV–visible spectroscopy, which showed a characteristic absorption peak. Fourier transform infrared (FTIR) analysis revealed the presence of bioactive functional groups that contribute to the reduction and stabilization of SeNPs. X-ray diffraction (XRD) analysis confirmed the crystalline nature of the nanoparticles, while energy-dispersive X-ray spectroscopy (EDAX) demonstrated a strong elemental selenium signal. Transmission electron microscopy (TEM) and scanning electron microscopy (SEM) analyses revealed predominantly spherical SeNPs with an average particle size of approximately 14 nm. The biosynthesized SeNPs exhibited remarkable biological activities. Antibacterial studies using the disk diffusion method showed strong inhibition of *Staphylococcus aureus*. Antioxidant activity evaluated by DPPH and ABTS assays revealed significant free radical scavenging potential, along with notable anti-inflammatory activity assessed by albumin denaturation. Cytotoxicity studies demonstrated potent anticancer activity against MCF-7 breast cancer cells, indicating the therapeutic potential of SeNPs. In addition, SeNPs exhibited excellent photocatalytic efficiency in the degradation of methylene blue under sunlight irradiation. Overall, *Lycopus europaeus* -mediated SeNPs represent a promising green nanomaterial for biomedical and environmental applications.

Keywords: *Euphorbia hirta*, Synthesis Selenium, Antibacterial, Antioxidant, Anticancer, Photocatalysis

In silico anticancer potential of *Alangium salviifolium* (L.f.) Wangerin leaf, fruit, and seed extracts against liver cancer cell linesS. Karunya^{1*}, V. Balakrishnan¹

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Abstract

Alangium salviifolium (Cornaceae), a medicinal plant traditionally used in Ayurveda for its hepatoprotective and anticancer properties, was investigated for its phytochemical profile and potential against liver cancer. Methanol extracts from leaves, fruits, and seeds underwent comprehensive GC-MS and LC-MS analyses to identify bioactive metabolites. GC-MS revealed 28 compounds in leaf extract (dominated by phytol [22.45%], squalene [15.32%]), 24 in fruit (neophytadiene [18.67%], hexadecanoic acid [14.21%]), and 20 in seed (lupeol [19.88%], β -sitosterol [12.45%]). LC-MS profiling identified flavonoids (quercetin-3-O-glucoside, kaempferol), phenolics (gallic acid, ellagic acid), and terpenoids (ursolic acid) across extracts, with fruits showing highest phenolic content (145.2 mg GAE/g). For anticancer validation, 15 major phytochemicals were subjected to *in silico* molecular docking against hepatocellular carcinoma targets: EGFR (PDB: 1M17), VEGFR-2 (PDB: 4ASD), and AKT-1 (PDB: 3MV5) using AutoDock Vina. Lupeol exhibited strongest binding to EGFR (-9.2 kcal/mol), forming H-bonds with Met769 and π - π stacking with Phe723. Ursolic acid docked optimally to VEGFR-2 (-8.9 kcal/mol), while quercetin targeted AKT-1 (-8.5 kcal/mol), outperforming standards like erlotinib (-7.8 kcal/mol). ADMET predictions indicated favorable drug-likeness (Lipinski's rule compliance) and low toxicity. These findings demonstrate that *A. salviifolium* extracts are rich sources of anticancer phytochemicals with promising liver cancer-inhibitory potential, warranting *in-vitro/in-vivo* studies. This study bridges ethnopharmacology with computational validation, supporting its therapeutic development.

Keywords: *A. salviifolium*, LCMS, GCMS, Bio compounds, Phytochemicals

Cosmopolitan view on lichen secondary metabolites, culture-based extraction and their applications

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Abstract

Lichens represent stable symbiotic systems formed through the association of a fungal component with a photosynthetic partner, and they are recognized as prolific sources of chemically diverse secondary metabolites. These substances, largely produced by the fungal symbiont, encompass several major chemical groups such as depsides, depsidones, dibenzofurans, anthraquinones, xanthonones, and terpenoids, many of which have attracted attention for their pharmaceutical relevance. Lichen-derived metabolites exhibit a wide spectrum of biological activities, including antibacterial, antioxidant, anti-inflammatory, anticancer, antiviral, and cytotoxic properties, underscoring their promise for drug discovery. Despite this potential, practical exploitation of lichen metabolites is constrained by the inherently slow growth of lichens, their sensitivity to environmental disturbance, and the scarcity of harvestable biomass in nature. In response to these challenges, a range of cultivation-based approaches has been explored, including axenic growth of fungal partners, re-association of lichen symbionts, *in vitro* tissue and cell culture techniques, and fermentation-driven production systems designed to improve metabolite yield under controlled conditions. This review offers a worldwide overview of pharmaceutical applications associated with lichen secondary metabolites, with particular emphasis on recent progress in culturing methodologies that support sustainable extraction. Furthermore, existing bottlenecks, technical challenges, and future research opportunities for incorporating lichen-derived compounds into pharmaceutical development pipelines are critically examined.

Keywords: Lichen, Symbiont, Secondary metabolites, Drug discovery, Pharmaceutical applications

***Pleurotus tuber-regium*: Nutritional composition and therapeutic potential**M. Samayadevi¹, R. Meena¹, Subban Murugesan^{1*}

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Abstract

Pleurotus tuber-regium (PTR) is an edible specialty mushroom that has gained considerable scientific and commercial interest due to its unique sensory qualities, high nutritional value, and diverse medicinal properties. Traditionally consumed in various regions, PTR is now increasingly recognized as a valuable functional food and Nutraceutical. It is rich in bioactive polysaccharides, high-quality proteins containing essential amino acids, essential fatty acids, dietary fiber, and a wide range of minerals and vitamins, all of which contribute to its health-promoting potential. Recent research has demonstrated that the bioactive compounds present in PTR exhibit multiple biological activities, including antitumor, antihypercholesterolemic, antihypertensive, antiobesity, hepatoprotective, antimicrobial, antioxidant, and prebiotic effects. These properties suggest that PTR plays a significant role in the prevention and management of various chronic diseases, particularly those related to metabolic disorders, oxidative stress, and microbial infections. Furthermore, the polysaccharides and phenolic compounds of PTR are considered key contributors to its immunomodulatory and antioxidant functions. This review provides a comprehensive summary of the chemical composition and physiological functions of *Pleurotus tuber-regium*, highlighting its nutritional significance and therapeutic potential. The compiled evidence provides a scientific foundation for further research and supports the development of PTR-based products in the food, pharmaceutical, and nutraceutical industries, underscoring its potential as a sustainable, natural, and health-promoting resource.

Keywords: *Pleurotus tuber-regium*, Phytochemicals, Chemical composition, Biological activity, Tiger milk mushroom

Antimicrobial activity of an ethnomedicinal orchid *Eulophia graminea* bulb extractA. Madhu¹, N. Karmegam^{1*}

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Abstract

Orchids are widely recognized for their medicinal value, which is largely due to the presence of several bioactive phytochemicals. Their therapeutic applications have been deeply rooted in traditional folklore medicine and are commonly accepted across indigenous communities. The present investigation was undertaken to document the ethnobotanical importance of orchid species distributed in the southern region of the Shervaroyan Hills of Salem District, Tamil Nadu. Several medicinally important orchid species belong to the genera *Dendrobium*, *Cymbidium*, *Eulophia*, *Habenaria*, and *Vanda*. These orchids are traditionally used to treat various ailments, including boils, rheumatism, piles, and fever. The study revealed that bulbs and rhizomes are the most frequently utilized plant parts for ethnomedicinal purposes, followed by leaves and stems. In addition to documenting ethnomedicinal orchids, the present study also focused on the antimicrobial activities of the selective ethnomedicinal orchid *Eulophia graminea* using the methanolic extract of the bulb. The extract exhibited significant inhibitory activity against selected Gram-positive and Gram-negative bacteria and fungal pathogens. These findings suggest that the phytochemicals present in *Eulophia graminea* bulbs possess strong antimicrobial properties, highlighting their potential for pharmaceutical and therapeutic applications.

Keywords: Antimicrobial activity, Ethnomedicine, Orchids, Phytochemicals, Rhizome.

The multifaceted role of Protein Kinase C Beta (PKC β) in cancer: Mechanisms, pathways, and therapeutic prospects

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Abstract

Protein kinase C beta (PKC β), a member of the protein kinase C family, has emerged as a multifunctional regulator within the complex landscape of cancer biology. Increasing evidence indicates that dysregulation of PKC β is frequently observed across multiple cancer types and plays a significant role in tumor initiation, progression, and therapeutic resistance. PKC β is involved in a wide range of fundamental cellular processes, including cell proliferation, differentiation, apoptosis, angiogenesis, and immune regulation, exerting context-dependent effects that influence cancer development. This review comprehensively examines the multifaceted roles of PKC β in various malignancies, with particular emphasis on its involvement in key oncogenic signaling pathways such as PI3K/Akt, MAPK, and NF- κ B. Aberrant activation of PKC β has been strongly associated with enhanced tumor cell survival, epithelial–mesenchymal transition (EMT), invasion, and metastatic dissemination. In addition, PKC β contributes to modulation of the tumor microenvironment by regulating inflammatory mediators, angiogenic factors, and immune cell signaling, thereby further promoting tumor progression. This review summarizes current insights into PKC β -mediated signaling mechanisms and discusses its potential utility as a diagnostic, prognostic, and therapeutic biomarker in cancer. Recent advances in the development of PKC β -targeted therapeutic strategies are also highlighted, including small-molecule inhibitors and selective modulators designed to suppress PKC β -driven oncogenic signaling. Despite promising preclinical and clinical findings, challenges such as pathway complexity, isoform specificity, and off-target effects remain. Overall, this review consolidates existing evidence supporting the critical role of PKC β in cancer biology and underscores the need for continued research to fully exploit its therapeutic potential and advance precision-based cancer treatment strategies.

Keywords: Protein kinase C beta (PKC β), Cancer signalling, Tumor progression, Targeted therapy

Antioxidant activity of leaf and bark extract of *Cassine glauca* (Rottb.) KuntzeV. Balakrishnan^{1*}, K. Dhanasekaran¹, S. Karunya¹

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Abstract

The scientific documentation of herbal remedies has greatly supported multidisciplinary research and continuous achievements. Natural plant resources have been the main source of contemporary medications for thousands of years, with medicinal and herbal plants providing a wealth of phytochemicals. Many different plants have been used to treat a wide range of illnesses in traditional health care systems. *C. glauca* leaf and bark extracts have been reported to contain numerous phytochemicals. The plant belongs to the family x. The leaf and bark extracts of *C. glauca* were used to assess antioxidant activity. The present study showed that the subsequent section of the analysis was the antioxidant capacity of *C. glauca*. leaf and bark extracts. The antioxidants such as DPPH, Molybdenum scavenging assay, reducing power assay, nitric oxide assay and hydrogen peroxide assay were analysed. The experiment's performance supports the standard in terms of the percentage of inhibition in all experiments. The above antioxidants demonstrate strong radical-scavenging capacity, with ethanol extracts showing superior efficiency. The results confirm the presence of efficient phytocompounds in the *C. glauca* plant.

Keywords: *C. glauca*, Antioxidant activity, Molybdenum scavenging assay, Nitric oxide

Anti-arthritic activity of luteolin from the coconut haustorium- an *in vitro* assessmentS. Abiraami Valli¹ and S. Uma Gowrie^{2*}

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Abstract

In present scenario, functional foods, nutraceuticals and dietary supplements are considered as major categories of food in which different types of quality research are being carried out. In the recent past, natural products with these nutritive and bioactive phenolic compounds, flavonoids and terpenoids are widely used for the development of nutraceuticals or dietary supplements without any side effects. A symmetrical, inflammatory, chronic autoimmune disease - rheumatoid arthritis first affects tiny joints before moving on to larger joints; tendons and ligaments get weakened, followed by damage to the cartilage of bone joints. Interest in plant-based foods has developed a realistic approach as these contain enormous bioactive metabolites. On germination of coconut, the basal part of the embryo, which is embedded in solid endosperm near the germinating pore, enlarges to form a cotyledonary structure called sprout/haustorium, one of the edible parts of coconut. Luteolin or 3',4',5,7-Tetrahydroxyflavone, a potent flavone was isolated and purified for the first time from coconut haustorium. The objective of the present study is to analyze, validate and confirm the functional role of luteolin through *in silico* molecular docking against the target protein molecule- Crystal structures of T-cell receptor beta chains related to rheumatoid arthritis, retrieved from the Protein Data Bank. The Ramachandran plot validated the stereochemical quality of the target protein. Non-bonded interactions between the atoms of the target protein were computed using ERRAT, yielding an overall quality factor of 96.4. Target protein and the ligand molecules were prepared in AutoDock 4.2.6 MGL tools, grid maps were prepared, and AutoGrid4 was launched. Molecular docking using AutoDock 4.2.6 with the rigid docking method of genetic algorithm (GA) was followed with a population size of 150. The docking results were analyzed and visualized using BIOVIA Discovery Studio 2020 Visualizer. Aromatic edges, faces, charges, hydrogen bonds, hydrophobic interactions, and ionizability were analyzed. These interactions confirmed, for the first time, the functional role of luteolin as a lead molecule in *C. nucifera* haustorium for the treatment of rheumatoid arthritis. Thus, a coconut haustorium containing luteolin is a natural, cost-effective food source for overall well-being against rheumatoid arthritis.

Keywords: Luteolin, coconut haustorium, rheumatoid arthritis, molecular docking, *in silico*.

Green synthesis of chitosan-coated ZnO nanoparticles using *Scutia myrtina* extractV. Eswaran¹, K. Selvam^{1*}

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Abstract

The development of sustainable, biocompatible nanomaterials has heightened interest in green synthesis approaches that utilize biological resources. In the present study, zinc oxide nanoparticles (ZnO NPs) were synthesized using *Scutia myrtina* leaf extract as a natural reducing and stabilizing agent, followed by surface functionalization with chitosan to enhance stability and biological compatibility. The phytochemicals present in *S. myrtina*, including polyphenols and flavonoids, played a crucial role in reducing zinc ions and controlling nanoparticle formation. Chitosan coating was achieved via electrostatic interactions, yielding stable chitosan-coated ZnO nanoparticles (CS-ZnO NPs). The synthesized nanoparticles were characterized using UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and particle size analysis to confirm their optical properties, functional groups, crystalline structure, morphology, and size distribution. UV–Visible analysis showed characteristic absorption peaks confirming ZnO nanoparticle formation, while XRD patterns indicated a hexagonal wurtzite crystal structure. FTIR spectra confirmed the involvement of plant-derived biomolecules and the successful coating of chitosan on the ZnO surface. SEM analysis revealed predominantly spherical nanoparticles with reduced aggregation after chitosan functionalization. The green-synthesized CS-ZnO nanoparticles exhibited enhanced stability and potential suitability for biomedical and environmental applications. This study demonstrates that *Scutia myrtina* extract serves as an efficient, eco-friendly bioresource for nanoparticle synthesis, offering a scalable, sustainable route to the development of functional ZnO-based nanomaterials.

Keywords: Green synthesis, ZnO nanoparticles, Chitosan coating, *S. myrtina*, Biogenic nanomaterials

Isolation and characterization of flavonoids from the flowers of *Spermacoce hispida* L. using HPLC

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Abstract

Flavonoids are important secondary metabolites widely recognized for their antioxidant, anti-inflammatory, and pharmacological properties. The present study focuses on the isolation and characterization of flavonoids from the flowers of *Spermacoce hispida* using High-Performance Liquid Chromatography (HPLC). Fresh flowers were shade-dried, powdered, and subjected to solvent extraction using methanol through Soxhlet extraction. The crude extract was concentrated and fractionated using liquid-liquid partitioning with solvents of increasing polarity. Preliminary phytochemical screening confirmed the presence of flavonoids in the methanolic fraction. The extract was further purified using column chromatography, and the fractions were analyzed by HPLC equipped with a C18 reverse-phase column. A gradient mobile phase consisting of acetonitrile and water with 0.1% formic acid was employed for effective separation. Detection was carried out at 254 nm and 365 nm. Distinct peaks corresponding to flavonoid compounds were observed, and their retention times were compared with standard references, indicating the presence of quercetin, kaempferol, and rutin derivatives. The study demonstrates that HPLC is a reliable and precise technique for flavonoid profiling and isolation from *Spermacoce hispida* flowers, highlighting its potential as a valuable source of bioactive phytoconstituents for pharmaceutical and nutraceutical applications.

Keywords: *Spermacoce hispida*, Flavonoids, HPLC, Quercetin, Kaempferol, Rutin.

Biosynthesis of rutin through cell suspension culture derived from root callus of *Ruta graveolensis* L.K. Palanisamy¹, P. Srinivasan¹

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Abstract

Rutin, a pharmacologically important flavonoid glycoside with strong antioxidant, anti-inflammatory, and vasoprotective properties, is traditionally extracted from whole plants, which leads to variability in yield and quality. The present study investigates the biosynthesis of rutin through cell suspension culture derived from root callus of *Ruta graveolensis* as a sustainable and controlled alternative production system. Root explants were cultured on Murashige and Skoog (MS) medium supplemented with suitable plant growth regulators to induce friable callus, which was subsequently transferred to liquid medium to establish cell suspension cultures. Growth kinetics of the suspension cells were monitored, and rutin production was quantified at different culture intervals using chromatographic analysis. The results demonstrated that actively dividing cells in the exponential growth phase showed enhanced rutin accumulation. Optimization of factors such as hormone concentration, sucrose level, and elicitor treatment further improved flavonoid biosynthesis. The *in vitro* system produced significant levels of rutin compared to field-grown plants, indicating the potential of callus-derived suspension cultures as a reliable source of secondary metabolites. This approach offers advantages such as year-round production, independence from environmental constraints, and scope for metabolic manipulation. The study highlights plant tissue culture as an efficient biotechnological strategy for large-scale rutin production in *Ruta graveolensis*.

Keywords: *Ruta graveolensis*, Rutin, Cell suspension Culture, Flavonoid, Elicitors.

Green synthesis of silver nanoparticles from *Plectranthus amboinicus* leaf extract and evaluation of antimicrobial activities

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Abstract

Green synthesis of silver metal nanoparticles is currently growing research due to different medical applications. In nations with abundant biodiversity, nanobiotechnology can be used to extract essential natural components that safeguard human health. Numerous biological uses, including antibacterial, anticancer and antidiabetic properties, have been demonstrated by silver nanoparticles. Thus, the production and antibacterial activity of silver nanoparticles made from several solvent extracts of *Plectranthus amboinicus* leaf, such as methanol, ethanol, chloroform and water were investigated in this work. Absorption and vibrational spectra were used to characterize the produced silver nanoparticles of different extracts. A scanning electron microscope was used to examine the surface morphology of high yield silver nanoparticles from the four extracts. On the basis of the findings, the crude exposed silver nanoparticles yielded 68%, whereas the methanolic leaf extract yielded 36%. Due to the varying quantities of phytochemicals, the methanol crude silver nanoparticles exhibited strong antibacterial activity in comparison to the other extract nanoparticles.

Keywords: Silver nanoparticles; *P. amboinicus*; characterization; antimicrobial activity.

Biosynthesis of rod-shaped CuO NPs using *Secamone emetica* leaf extract and their biological and environmental applicationsMadhavan Sowmiya¹, Kuppusamy Selvam^{1*}

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Abstract

Copper oxide nanoparticles (CuO NPs) have been recognized as potential nanomaterials due to their unique physicochemical properties and wide range of uses. In this study, *Secamone emetica* leaves were used for the green synthesis of CuO NPs and characterized using UV, FTIR, XRD, FE-SEM with EDX and Zeta potential analysis. The biosynthesized CuO NPs revealed UV absorption maximum at 391nm. FTIR study demonstrated the existence of functional groups such as alcohols, alkanes, nitro compounds and carboxyl groups, indicating their role in the synthesis and stabilization of CuO NPs. XRD analysis confirmed the crystallinity of the biosynthesized CuO NPs. FE-SEM analysis revealed that the biosynthesized CuO NPs exhibited rod-shaped morphology with an average width of 25.24 nm. Zeta potential study revealed the surface charge of -9.07 mV. The biosynthesized CuO NPs showed significant antibacterial, antioxidant and anti-inflammatory activities, highlighting their therapeutic potential. In addition, they showed efficient photocatalytic degradation of methylene blue, suggesting potentially beneficial applications in environmental remediation. Overall, this study emphasizes the multifunctional capacity of CuO NPs in both clinical and environmental fields.

Keywords: Green synthesis, Antibacterial, Antioxidant, Anti-inflammatory, Photocatalytic activity

Antidiabetic and anticancer efficacy of aqueous leaf extract of mountain coffee bushMaadhu Sridhar¹, Kuppusamy Selvam^{1*}

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Abstract

In the 21st century, diabetes mellitus (DM) is recognized as one of the most prevalent metabolic disorders worldwide. Therefore, there is a growing need to explore plant-based botanicals and their metabolites for the management of DM. The present study aimed to evaluate the preliminary phytochemical profile of the aqueous leaf extract of Mountain Coffee Bush. In addition, its functional groups and bioactive compounds were characterized using Fourier Transform Infrared (FT-IR) spectroscopy and Liquid Chromatography–Mass Spectrometry (LC-MS), respectively. The biological potential of the extract was assessed through antibacterial activity against pathogenic bacteria. Antioxidant activity was evaluated using total antioxidant capacity (TAC), hydrogen peroxide (H₂O₂), and nitric oxide scavenging assays. Furthermore, the antidiabetic and anticancer activities were investigated through *in vitro* α -amylase, α -glucosidase inhibition assays and pancreatic cancer cell line studies, respectively.

Keywords: Diabetes mellitus, Aqueous extract, α -amylase, α -glucosidase, Pancreatic cancer cell line

Green synthesized iron oxide nanoparticles from *Daphniphyllum neilgherrense* leaves for antimicrobial and breast cancer therapeutics

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Abstract

Medicinal plants represent rich reservoirs of bioactive compounds with a wide range of therapeutic properties and growing significance in contemporary biomedical research. In recent years, plant-derived phytochemicals have attracted considerable interest for their ability to mediate the green synthesis of metal and metal oxide nanomaterials, providing eco-friendly and sustainable alternatives to traditional chemical synthesis approaches. This study presents a green approach to the synthesis of iron oxide nanoparticles (Fe₂O₃-NPs) using the ethanolic leaf extract of *Daphniphyllum neilgherrense* (Daphniphyllaceae), a plant known for its rich phytochemical composition and traditional medicinal properties. The biosynthesized Fe₂O₃-NPs were characterized using UV–Visible spectroscopy, Fourier-Transform Infrared Spectroscopy, X-ray diffraction, and scanning electron microscopy, which confirmed their crystalline structure and predominantly spherical morphology. The biofunctionalized Fe₂O₃-NPs demonstrated notable antimicrobial activity against selected Gram-positive and Gram-negative bacteria, as well as fungal species. In addition, cytotoxic evaluation using MTT assay revealed a dose-dependent inhibitory effect on human breast cancer (MCF-7) cells. Overall, the findings highlight the potential of *D. neilgherrense*-mediated Fe₂O₃-NPs as eco-friendly nanomaterials with promising applications in antimicrobial, and anticancer therapeutics.

Keywords: Antimicrobial activity, Cytotoxicity, Medicinal plants, MCF-7 cell lines, Phyto nanotechnology

Evaluation of the antidiabetic potential of microbial extracts from double mutant *Chlorococcum humicola* MCH4 using *in vitro* enzyme inhibition assays

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Abstract

Microalgae are gaining pharmaceutical interest due to their diverse bioactive compounds with therapeutic potential. Given the limitations and side effects of synthetic antidiabetic drugs, microalgae-derived metabolites represent a sustainable and promising natural alternative for diabetes management. The present study evaluated the antidiabetic potential of microbial extracts from a double-mutant strain of *C. humicola* MCH4, produced under optimized submerged fermentation with *Bacillus subtilis*, using *in vitro* enzyme inhibition assays. The inhibitory activities against α -amylase and α -glucosidase were assessed at different concentrations (0 to 1500 $\mu\text{g/mL}$). The microbial extract exhibited a pronounced concentration-dependent inhibition of both enzymes. α -Amylase inhibition increased from 22.43% at 100 $\mu\text{g/mL}$ to 92.31% at 1500 $\mu\text{g/mL}$, while α -glucosidase inhibition rose from 29.43% to 94.32% across the same concentration range. The estimated inhibitory concentration 50% (IC_{50}) values were approximately 620 $\mu\text{g/mL}$ for α -amylase and 520 $\mu\text{g/mL}$ for α -glucosidase, indicating a stronger inhibitory effect on α -glucosidase. Notably, these IC_{50} values were comparable to those of acarbose, a standard antidiabetic drug, which showed IC_{50} values of 525 $\mu\text{g/mL}$ for α -amylase and 450 $\mu\text{g/mL}$ for α -glucosidase. Overall, the findings suggest that microbial extracts of *C. humicola* MCH4 possess significant antidiabetic potential and may serve as a promising natural source of enzyme inhibitors for the management of type 2 diabetes.

Keywords: *Chlorococcum humicola*, Microbial extract, Antidiabetic activity, α -Amylase inhibition, α -Glucosidase inhibition

Characterization of carbon bio-nano aerosol of *Clerodendrum inerme*, Linn.S. Priyanka¹, S. Bhuvaneshwari², N.K. Udaya Prakash^{1*}

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Abstract

Nano aerosol is defined as any nanoparticles or nanomaterials suspended in the atmosphere. When these nanoparticles or nanomaterials are of biological origin, they are termed Bio-nano aerosol. This includes viruses, nucleic acids, proteins, and non-metallic organic nanoparticles or nanomaterials. Forest fires, bush fires, and woodstoves are examples that generate carbon nanoparticles into the atmosphere. Plants are among the components of these forest fires and bush fires, as well as the fuel used in woodstoves. It is the component they use to generate bio-nano aerosols during burning. In this study, the shade-dried leaves of the plant *C. inerme* were burnt in an open flame to generate a carbon Bio-nano aerosol. The developed Bio-nano aerosols are characterized for their nanomaterial properties using SEM, DLS, and XRD; phytochemistry by evaluating total phenol, total flavonoid, and total antioxidant content; and anticancer activity using an in-silico method against 3LCT. The particle sizes were recorded as 144.5nm to 486 nm, 818nm to 972nm, and 2312nm to 3270nm using DLS; 40nm to 95nm using SEM; and, using the Scherrer equation, 2.5nm to 15.7nm using XRD. The EDAX revealed the presence of Carbon in a major amount (85%), followed by Oxygen (14%). The presence of phytochemicals, Saponins, Terpenoids, Cardiac Glycosides, Quinones, and Coumarins was recorded in the *Bio-nano aerosol* of *C. inerme*. A total phenolic content of 14.44 ± 0.66 mg TAE/g DW and flavonoid content of $16.71 \pm 0\mu\text{g}$ QE/g DW. The *Bio-nano aerosol* from the leaves of *C. inerme* recorded a total antioxidant content of 10.78 ± 0.20 mg TAE/g DW. The antioxidant activity of $230\mu\text{g}$ is its EC₅₀ value. The study revealed that the Bio-nano aerosol of *C. inerme* can be potentially used for pharmaceutical and cosmetic applications.

Keywords: Bio-nano aerosol, Nanoparticles, Phytochemistry, Antioxidant activity, Anticancer activity, Cosmetics, Pharmaceuticals

Understanding the mutational spectrum of KIF14 in cancer development and precision medicine approaches

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Abstract

Advances in comprehensive genetic profiling are expected to significantly reshape current approaches to cancer diagnosis and treatment. Among the emerging molecular regulators, Kinesin family member 14 (KIF14) signaling has gained attention for its involvement in carcinogenesis across a wide range of human malignancies. This study focuses on the prevalence and pattern of KIF14 gene mutations and copy number alterations in different solid tumors. To obtain detailed information on KIF14 alterations, publicly available and well-established databases such as cBioPortal, PubMed, and COSMIC were systematically analyzed. Our findings summarize both molecular and clinical data for cancers harbouring KIF14 gene alterations. Analysis of mutation hotspots within key functional regions of the KIF14 protein revealed that many alterations are concentrated in biologically significant domains, suggesting a potential role in malignant transformation. The study identified a wide range of amino acid substitutions and nucleotide changes occurring across multiple cancer types, indicating the diverse mutational landscape of KIF14. Among the various mutational types observed, missense mutations were found to be the most frequent across nearly all known cancers. These mutations may disrupt normal protein function and contribute to tumor initiation and progression. Overall, this study highlights the importance of KIF14 genetic alterations in cancer development and emphasizes their potential utility as molecular markers for diagnosis, prognosis, and targeted therapeutic strategies. Understanding the mutational spectrum of KIF14 may support the development of precision medicine approaches in multiple types of cancer.

Keywords: Receptor threonine kinase; KIF14; protein regulating cytokinesis; motor protein; lung cancer.

Experimental and in silico characterization of phenolics from *Ziziphus jujuba* and *Nephrolepis cordifolia*: Antioxidant and antidiabetic insights through PCA, docking, DFT, ADME, toxicity and PASS predictions

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Abstract

Medicinal plants are renowned for being rich sources of bioactive compounds with a wide range of therapeutic potential. In this context, the current study delves into the phenolic composition and antioxidant activities of *Z. jujuba* Mill. (ZJ) and *Nephrolepis cordifolia* L. (NC), extends to explore the anti-diabetic capacity, using *in vitro* and *in silico* assays supported by multivariate data analysis. Ethanolic extracts obtained from ZJ leaves and NC fronds, leading to the identification of six phenolic compounds, with rutin emerging as the most abundant, particularly in ZJ (17.01 ± 0.01 mg/g DW) compared to NC (7.13 ± 0.67 mg/g DW). Quantitative analysis revealed that ZJ exhibited significantly higher TPC of 109.23 ± 1.91 mg GAE/g DW compared to 73.77 ± 1.10 mg GAE/g DW in NC. Concurrently, ZJ exhibited superior antioxidant efficacy, as evidenced by lower IC₅₀ values in radical scavenging and ion chelation activities. Correlation analysis confirmed a strong positive relationship between total phenolics and compounds with antioxidant effectiveness which was substantiated by Principal Component Analysis, which distinguished based on its enriched phenolic profile and potent bioactivities, heat map visualization provided compelling support for these findings. These properties make it an ideal candidate for use in therapeutic formulations aimed at combating oxidative stress. Additionally, the statistical analysis of the α -amylase and α -glucosidase inhibitory effects positions ZJ as a valuable candidate for managing hyperglycemia and diabetes-related complications. In silico evaluation of phenolic compounds revealed distinct differences in their pharmacokinetic suitability, safety, and predicted bioactivities. All the compounds emerged as the most promising drug-like candidates, supported by optimal ADME properties, favourable bioavailability profiles, high gastrointestinal absorption, and low toxicity predictions, and strong predicted antioxidant, anti-inflammatory, cytoprotective, and chemopreventive activities. Collectively, the experimental and computational findings underscore *Z. jujuba* as a potent natural source of promising phenolic compounds, supporting its strong potential for future pharmacological development and for the formulation of health-promoting, antioxidant, and anti-diabetic therapeutics.

Keywords: *Z. jujuba*, *Nephrolepis cordifolia*, Phenolic compounds, Antioxidant activity, Antidiabetic potential.

***Tridax procumbens* Linn.: Phytochemistry, pharmacological potential and therapeutic relevance**

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Abstract

Tridax procumbens Linn. is a widely distributed herbaceous weed found throughout India, commonly known as coat buttons and traditionally referred to as Bhringraj in Ayurvedic medicine. The plant is an annual or perennial species frequently occurring in croplands, lawns, roadsides, and other disturbed habitats. Ethnomedicinally, it has been used to manage liver disorders, promote wound healing, and promote hair growth. Phytochemical investigations have revealed the presence of diverse bioactive compounds, including alkaloids, flavonoids, carotenoids, saponins, tannins, fumaric acid, β -sitosterol, and oleanolic acid, along with appreciable levels of sodium and potassium. The flowers are reported to contain flavonoids such as luteolin, glucoluteolin, quercetin, and isoquercetin, while leaves are rich in primary pigments like chlorophyll and carotenoids. These constituents exhibit a wide range of pharmacological activities, including antimicrobial, antioxidant, wound-healing, hepatoprotective, antidiabetic, immunomodulatory, anticancer, anti-inflammatory, insecticidal, anti-dysentery, and anti-hair-fall effects. The present review comprehensively summarizes the natural habitat, taxonomy, phytochemistry, pharmacological properties, and toxicological aspects of *Tridax procumbens*. This consolidated profile may aid in its proper identification and encourage further research for its potential therapeutic applications.

Keywords: *Tridax procumbens*, Phytochemical constituents, Pharmacological activities, Traditional medicine, Therapeutic potential

Integrated disease management of mungbean yellow mosaic virus (MYMV) in Greengram

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Abstract

Greengram is a vital crop grown throughout world. India accounts for about half of the world production with around 60-65 per cent of the world acreage. The crop has been found to be suffering from many diseases, including fungal and viral diseases. Among them, whitefly transmitted mungbean Yellow Mosaic Virus (MYMV) is the most destructive in Indian subcontinent and adjacent areas of South-East Asia, causing upto 100 per cent yield losses. During *Kharif* 2024-25, a study was conducted in 40 farmers' fields, where those who followed the integrated disease management IDM of MYMD, *viz.*, seed treatment combination of foliar sprays of insecticide and yellow sticky trap @ 8/ha. The greengram variety BGS 9 treated with imidacloprid 60 FS @ 5 ml/kg was sown immediately with the receipt of early rains and early crop growth was good. Seed treatment with imidacloprid 5ml/kg seeds given control of disease and vector upto 25 days. The crop was sprayed with diafenthiuron 50 WP @ 1 gm/l at 20 DAS. The disease incidence of MYMV was noticed on trifoliolate leaf during 20-25th day after sowing. The incidence recorded upto 5.50 per cent during two-week gap of rainy period. The further spread of the disease was reducing spraying with neem oil @ 2 ml/l, followed by spraying of imidacloprid @ 0.3 ml/l with multi-nutrient liquid @ 2 ml/l water. The timely and immediate management at the early notice of the disease was the most effective technique for managing MYMV which has given higher yield of 11.2 qt/ha compared to check field (yield and disease incidence of 7.9 qtl/ha and 14.8%, respectively).

Keywords: Greengram, IDM, MYMV, Mungbean, Yellow Mosaic Virus

Integrated nematode management in Brinjal

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Abstract

Brinjal is an important solanaceous vegetable crops of tropics and subtropics and its production is being increasingly hampered by the unfavourable soil and environmental conditions that include abiotic constraints, as well as biotic ones as soil-borne pests and diseases. Among them Root knot nematode *Meloidogyne* spp. is one of the most important yield limiting constraints causing damage to crop from nursery, transplanting to harvesting stage and an estimated yield loss of 5-43 per cent in the tropics and subtropics. During *Kharif* 2024-25, study was conducted by visiting 50 farmers field in Kalyana Karnataka area. The integrated nematode management (INM) of brinjal can generally be considered as the best option for nematode management to get better yield and complete management of brinjal crop. This needs good cultivation practices from seed to fruit stage activities with special emphasis on availability of basically cost-effective resistant sources, plant protection measures. INM is not isolated approach from Integrated Pest Management (IPM), rather a component of it. INM includes Cultural methods, Physical methods, Bio management methods and Chemical methods. Bio management is effective antagonists in management of Root knot nematodes. The soil solarization, plastic mulch practiced by 20 per cent farmers, the nematicide application *viz.*, carbofuran, chloropyriphos granules practiced by 32 per cent farmers, the new nematicide Nimitz used by 8 per cent farmers and liquid nematicide Velum prime used by only 6 per cent of farmers. The integrated nematode management with marigold as trap crop, use of bioagents *viz.*, *Paecilomyces* and *Trichoderma* along with vermicompost enrichment practiced by 6 per cent farmers.

Keywords: Brinjal, Integrated, Management, Nematode

Blast disease of finger millet caused by *Pyricularia grisea*: A major constraint to productivity

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Abstract

India is the largest producer of millets, with finger millet (*Eleusine coracana*) contributing nearly 85% of the total minor millet production. Despite its nutritional importance and adaptability to marginal environments, finger millet productivity is significantly affected by several diseases and pests, posing major challenges to sustainable crop production. Among the diseases, blast caused by the filamentous ascomycetous fungus *Pyricularia grisea* is one of the most destructive constraints, resulting in severe yield losses across all finger millet-growing regions. The pathogen infects the crop at all growth stages, and the use of infected seeds often leads to seedling mortality. The frequent breakdown of host resistance due to the emergence of virulent pathogen strains further complicates effective disease management. In addition to blast, *Cercospora* leaf spot is a major foliar disease of finger millet, particularly in certain agro-climatic regions, with infection occurring from the seedling stage through grain filling. Disease incidence is strongly influenced by environmental conditions and crop phenology, with natural infections commonly initiating during mid-June in early-sown crops. Effective plant disease and pest management strategies, including the use of resistant varieties, clean seed, cultural practices, and integrated management approaches, are essential for minimizing yield losses. A comprehensive understanding of disease epidemiology and management options is critical for enhancing finger millet productivity and ensuring sustainable crop protection.

Keywords: Agroclimatic regions, Disease epidemiology, Crop phenology

Seasonal incidence of insect pests and natural enemies in finger millet

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Abstract

Finger millet, *Eleusine coracana* (L.) is an important climate-resilient small millet crop, forming staple nourishment for many African and Asian countries of the world, including India. It harbors nearly a dozen insect pests, resulting in significant yield losses. In this context, a field experiment was conducted to study the “Seasonal incidence of insect pests and their natural enemies in finger millet” during *kharif*, 2024 at the Agricultural Research Station, Vizianagaram. The trial was laid out in a 300 m² area with three different dates of sowing. Observations were recorded on major insect pests *viz.*, fall armyworm (*Spodoptera frugiperda*) and aphids along with natural enemies such as spiders and coccinellid beetles. The incidence of fall armyworm commenced from 30th Standard Meteorological Week (SMW) and persisted up to 44th SMW across all sowing dates. Peak plant damage was recorded during 33rd SMW (32.0%) in the first sowing and during 37th SMW in the second (36.0%) and third sowings (32.0%). Larval population ranged from 0.02 to 0.16 larvae per plant. Aphid incidence began at the 34th SMW and continued until the 44th SMW. The highest population of 6.20 aphids per plant was observed during 40th SMW in the third sowing. Natural enemies were active from 33rd to 45th SMW (spiders) and 34th to 44th SMW (Coccinellids). Population of natural enemies showed a significant positive correlation with aphids. Fall armyworm larval population exhibited a significant positive correlation with maximum and minimum temperatures, while aphid population showed a significant negative correlation with evening relative humidity.

Keywords: Finger millet, Aphids, Fall armyworm, Spiders, Coccinellid beetles

Temporal dynamics and disease measurements using multispectral imagery

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Abstract

Crop yields were reduced due to devastation caused by phytopathogens. It is hard to take control measures beforehand i.e., much before the visible symptoms. By the time the symptoms appear, the plant is severely affected. So, to increase yield and reduce costs, identifying diseases early is essential. These challenges can be faced by spectral imaging. The reflected light from the plant surface can be trapped and converted into images. Even single or multiple desired character(s) that change over time can be detected using multispectral imaging. Image preprocessing is essential because it reduces classification time. Essential tools for plant disease identification are retrieved from these photos. Then disease classification is derived from the collected attributes, such as water, nitrogen content etc. These images thus obtained will be processed by using several algorithms. A machine learning classifier is employed to categorise the plants as either healthy or diseased. Spectral bands, along with machine learning or deep learning using vegetative indices, help detect diseases with high accuracy. Farmers can use this disease map to pinpoint their treatment efforts in fields where the illness is most prevalent by identifying the most affected areas. It is crucial to detect the disease much before the symptoms are visible. Many Spectral vegetation indices (SVIs) were used to review the crop health. It is done using deep learning together with multispectral imaging. This makes it feasible to treat diseases early and more effectively, helping farmers save money and maximise yields. This not only helps detect symptoms but also supports breeding techniques to improve resistant varieties.

Keywords: Convolutional neural networks, Random Forest, Spectral Angle Mapper, Spectral vegetation indices, Unmanned aerial vehicles

Transgenic technology for disease resistance in different crops

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Abstract

Transgenic plants are those in which one or more genes from different species have been introduced through genetic engineering to confer superior traits, such as disease resistance. With the growing global population and rising food demand, crop yield losses from pests and pathogens pose a major challenge to sustainable agriculture. The emergence of recombinant DNA technology, transgene expression systems, and RNA interference has transformed crop improvement programs, enabling the creation of transgenic plants with durable disease resistance, many of which have been successfully commercialized. Traditionally, resistant varieties were developed through hybridization with wild relatives, using phenotypic selection. However, the advent of genetic engineering allowed the direct introduction of specific genes from diverse organisms, marking a breakthrough in plant breeding. Initially, experiments were confined to model plants, but subsequently expanded to economically important crops as disease resistance became a key yield determinant. Transgenic resistance technologies have been developed against major pathogens including viruses, bacteria, and fungi. Viral resistance involves Pathogen-Derived Resistance (PDR) utilizing viral coat, movement, or replicase proteins, and Pathogen-Targeted Resistance (PTR) employing nucleases, peptide aptamers, ribosome-inactivating proteins, and plantibodies. In bacterial resistance, transformation includes R genes, avirulence genes, and antibacterial proteins derived from plants, insects, or bacteriophages. Fungal resistance is achieved by enhancing structural defenses, detoxifying fungal toxins, and expressing antifungal genes from non-plant sources. Furthermore, New Breeding Technologies (NBTs), including genome editing tools such as ZFNs, TALENs, and CRISPR/Cas9, have enabled precise modification of resistance traits, revolutionizing modern plant disease management.

Keywords: Genetic engineering, New breeding technologies, R genes, Disease resistance, Avirulence genes

Detection of resistant sources of foxtail millet against blast, rust and banded leaf and sheath blight diseases

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Abstract

Among the small millets, Foxtail millet (*Setaria italica* (L.) P. Beauv) is an important crop next only to finger millet. It is fairly tolerant of drought and cannot tolerate waterlogging. It is one of the world's oldest cultivated millets in the Poaceae family, distributed widely among the millets. Foxtail millet is also known as Italian millet, and it has other colloquial names, including kangni, navane, tenai, korra, and rala. Foxtail millet grains are rich in protein, fibre, β -carotene, minerals, viz., calcium, iron, potassium, magnesium, zinc, antioxidants, and vitamins. However, it has been affected by many diseases, including blast, rust, smut, brown spot, downy mildew, and udbatta, which have been reported on this crop. Blast and rust are the yield-limiting biotic constraints, and banded blight has emerged as a deadly disease in this crop, significantly reducing yields. Screening of varieties with inbuilt genetic resistance is the best means of managing this disease, as the crop is predominantly grown by resource-poor farmers who can hardly afford to use chemicals for its control. Hence, a field experiment was conducted to screen 22 foxtail millet entries against leaf blast, rust and banded blight during *kharif*, 2024 under natural field conditions at Agricultural Research Station, Vizianagaram, Andhra Pradesh. Among the entries screened, one entry (KOPFx 2107) was found to be highly resistant, and the remaining 21 entries were found to be resistant to leaf blast disease. However, all entries were highly resistant while two entries (SIA 4253, FX23137) were resistant to rust disease. Among 21 entries, 16 entries were found to be susceptible and six entries were highly susceptible to banded leaf and sheath blight disease.

Keywords: Foxtail millet, Leaf blast, Rust, Banded blight

Genetic variability and selection parameters for yield and blast resistance in finger millet (*Eleusine coracana* (L.) Gaertn.)

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Abstract

A field experiment was conducted at the Agricultural Research Station (ARS), Vizianagaram during the kharif season of 2024–25 to evaluate finger millet genotypes for grain yield, yield-related traits and blast disease reaction under natural field conditions. The experimental material consisted of 20 entries, comprising 17 test genotypes and three standard checks. Observations were recorded on phenological traits, morphological characters, yield parameters and blast disease traits. The analysis revealed significant variability among genotypes for all the traits studied. Grain yield ranged from 2411.1 to 3970.4 kg ha⁻¹, with a mean of 3218.5 kg ha⁻¹. The genotypes VR 1256, VR 1260, VR 1245, VR 1266 and VR 1258 recorded superior grain yield and outperformed the overall mean. Moderate to high values of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed for grain yield, finger length, finger width and blast disease traits, indicating the presence of considerable genetic variability. In general, PCV values were higher than GCV values, suggesting environmental influence on trait expression. High heritability coupled with high genetic advance as percent of mean (GAM) was recorded for grain yield, finger length, finger width, leaf blast severity and neck blast incidence, indicating the predominance of additive gene action and effectiveness of selection for these traits. Grain yield exhibited moderate heritability (59.44%) with high GAM (21.52%), suggesting good scope for improvement through selection. Blast disease traits showed very high GCV, PCV, heritability and GAM, reflecting wide variation among genotypes and enabling effective identification of resistant lines. Overall, the study identified VR 1256, VR 1260, VR 1245, VR 1266 and VR 1258 as promising finger millet genotypes combining high yield potential and acceptable blast resistance, and traits such as grain yield, finger length, finger width and blast resistance can be effectively exploited in breeding programmes aimed at developing high-yielding and blast-tolerant varieties.

Keywords: Finger millets, *Eleusine coracana*, Disease, Blast

Floral waste valorization for sustainable biopesticide development: An *in silico* multi-target evaluation of flavonoidsT. Janavi¹, S. Shantkriti^{1*}

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ABSTRACT:

The widespread reliance on synthetic pesticides has resulted in severe environmental pollution, pesticide resistance, and risks to human and ecosystem health, highlighting the urgent need for sustainable pest management strategies aligned with circular economy principles. Floral waste, generated in large quantities from religious, commercial, and domestic activities, represents an underexploited biomass that can be valorized into high-value bioactive products. In this study, floral waste was utilized as a renewable feedstock for the recovery of flavonoids—luteolin, apigenin, and quercetin—and their potential application as eco-friendly biopesticides was evaluated through *in silico* molecular docking analysis. The selected flavonoids were docked against key insect and pathogen-associated protein targets, including cadherins, aminopeptidase N (APN), cytochrome P450 monooxygenase (CYP450), RNA-dependent RNA polymerase (RdRp), cellulase, protease, glutathione S-transferase (GST), and ATP-binding cassette transporter ABCC2 from *S. frugiperda*, *T. absoluta*, *P. gossypiella*, and *Thrips* using PyRx software and visualized using PyMOL. The docking results revealed strong, favorable binding interactions across multiple targets, indicating that these compounds can interfere with essential physiological, digestive, and detoxification pathways. Notably, apigenin and luteolin exhibited a high binding affinity with APN (−9.0 kcal/mol) and (−8.8 kcal/mol), suggesting potential disruption of nutrient assimilation and toxin-binding processes in insects. Additionally, Quercetin showed significant interaction with CYP450 (−9.0 kcal/mol), a critical enzyme involved in xenobiotic metabolism and pesticide resistance, highlighting its possible role in resistance management. This study establishes *in silico* molecular docking as an efficient preliminary screening approach for identifying multitarget biopesticidal flavonoids from floral waste, offering a novel circular-economy-driven strategy for sustainable pest management. Overall, this study demonstrates a sustainable, circular economy-driven strategy for biopesticide development and provides a computational foundation for further experimental validation and field application.

Keywords: Floral waste, Biopesticides, Flavonoids, Circular economy, Multi-target

Salicylic acid-mediated enhancement of biochemical and antioxidant defense in rice (*Oryza sativa* L.) against bacterial leaf blight

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Abstract

Rice (*Oryza sativa* L.) is a vital staple crop for a sizable section of the global population, underscoring its importance and the need for effective management strategies. However, bacterial leaf blight (BLB), caused by *Xanthomonas oryzae*, is a significant threat to rice yield. BLB inhibits photosynthesis, nutrient transport and general plant vigor, resulting in significant yield losses. Salicylic acid (SA), an endogenous signaling molecule in plants, is essential for regulating defense mechanisms and developing systemic acquired resistance to many pathogens. This Study investigates how salicylic acid administration affects the morphological, biochemical and antioxidant aspects of rice plants infected with *Xanthomonas oryzae*. Exogenous salicylic acid administration significantly reduced BLB symptom severity while increasing plant resilience. Biochemical investigation found that SA-treated plants had much higher levels of chlorophyll, carbohydrates, proteins, proline, amino acids and phenolic compounds than untreated infected controls, indicating greater metabolic stability under pathogen stress. Furthermore, salicylic acid therapy significantly increased antioxidant defense responses. The activity of major antioxidant enzymes, such as catalase and peroxidase, was increased considerably, indicating effective elimination of reactive oxygen species produced during infection. Non-enzymatic antioxidants, such as total phenols and flavonoids, accumulated at higher levels, thereby improving cellular protection and disease resistance. These coordinated biochemical and antioxidant responses demonstrate salicylic acid's potential as a long-term strategy for crop protection. Overall, the data show that applying salicylic acid is an effective, sustainable method for reducing BLB severity in rice by enhancing biochemical and antioxidant defenses, ultimately improving disease control and crop resilience.

Keywords: Rice, Bacterial leaf blight, *Xanthomonas oryzae*, Salicylic acid, Biochemical properties

Crop shoots composition and the biochemical parameters of green leaves responsible for quality of tea under different harvesting methods

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Abstract

UPASI scientific department recommends a plucking interval of 8 to 10 days for hand plucking and it is extended to 17–18 days for shear harvesting and further extended to 26–28 days for machine harvesting. As a result under hand plucking due to selective harvesting the composition of the intact shoots without damage in the harvest is 98.5–99% and the remaining 0.9 to 1.5% is only damaged shoots/leaves were as under shear harvesting and machine harvesting due to non-selective harvesting the shoot composition harvest is totally different, due to the cutting action of the blades under shear harvesting composition of the intact shoots in the harvest is 70.8 to 71.3%. The remaining 28.7 to 29.2% is damaged shoots/leaves due to the high-speed reciprocating action of the blade under the machine-harvesting method. The intact shoots in the harvest are 56.8 to 60.1% and the remaining 39.9 to 43.2 is only damaged shoots/leaves. The damaged shoots/leaves were further segregated into 80% light green coloured leaves and dark green coloured leaves, both of which are categorized as the coarse components. Under hand plucking method the dark green damaged leaves percentage is only 0.2–0.3%, whereas it increased to 5 to 6.2% under shear harvesting, and it further increased to 16- 17.5% in machine harvesting. Therefore, all the important biochemical parameters responsible for quality of made tea were investigated in the study. Under the hand plucking system total Polyphenol content is 25.80 %, it is slightly reduced to 24.18 % under Shear harvesting and it is further reduced to 22.42 % under machine harvesting. Under the hand plucking system total Catechin content is 16.36%, it is slightly reduced to 15.22 % under Shear harvesting and it is further reduced to 14.18 % under machine harvesting. Under the hand plucking system total Amino acid content is 1.60 %, it is slightly reduced to 1.38% under Shear harvesting and it is further reduced to 1.16 % under machine harvesting. Under the hand plucking system Caffeine content is 2.54 %, it is slightly reduced to 2.46 % under Shear harvesting and it is further reduced to 2.22 % under machine harvesting.

Keywords: Hand plucking, Shear harvesting, Machine harvesting, Quality parameters

Microgreens for sustainable agriculture: production efficiency, resource use, and urban farming integration

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Abstract

Microgreens are rapidly emerging as an important component of sustainable agriculture due to their short production cycle, high nutritional density, and minimal resource requirements. These tender greens are harvested within 7–14 days of germination, allowing rapid crop turnover and efficient land utilization. Their cultivation demands significantly less water, space, and agricultural inputs than conventional crops, making them ideal for climate-resilient, resource-efficient food production systems. The role of microgreens in enhancing sustainable agriculture through improved production efficiency and integration into modern urban farming models. Controlled environment agriculture (CEA) systems—including hydroponics, vertical farming, and LED-based lighting—support year-round, consistent cultivation with improved yields, superior quality, and reduced dependence on agrochemicals. These systems are especially advantageous in densely populated urban areas where arable land is limited. Microgreens have rich nutrient profiles, with elevated levels of vitamins, minerals, antioxidants, and phytonutrients, making them valuable for functional foods and for improving dietary diversity. Their incorporation into urban agriculture strengthens local food systems by reducing supply chain length, lowering postharvest losses, and providing urban populations with limited access to nutrient-rich foods with fresh produce. Additionally, microgreens promote environmentally sustainable food production by reducing carbon footprints, minimizing soil disturbance, and supporting circular agriculture practices. Their adaptability to household, rooftop, and commercial-scale farming systems underscores their versatility and relevance in addressing food security challenges.

Keywords: Microgreens, Sustainable Agriculture, Nutrient profiles, Sustainable food production

Sustainable agriculture through algae: Eco-friendly fertilizers and growth promoters

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Abstract

The rising global population has markedly increased the demand for agricultural products. With continued advancements in biotechnology, crop production is shifting toward approaches that can meet this demand while embracing more sustainable, environmentally friendly practices. Consequently, there is growing interest in alternative strategies for supplying plant and soil nutrients, particularly as the harmful effects of synthetic fertilizers become more evident. This review examines the potential of algae as a sustainable, greener alternative for agricultural crop production. It identifies the major factors influencing plant and soil health and discusses the detrimental impacts of synthetic fertilizers, including greenhouse gas (GHG) emissions and water pollution. Algae are naturally rich in essential plant nutrients such as Nitrogen, Phosphorus, and Potassium (NPK), along with minerals, growth hormones, and other beneficial compounds that support plant growth and soil improvement. The review highlights different types of algae, their cultivation systems, and processing methods. Notably, algal biomass can be effectively produced using wastewater, which serves as a nutrient-rich medium and further enhances its viability as a sustainable fertilizer source. The advantages of algae-based fertilizers and plant stimulants demonstrate their ability to enhance soil and plant health, improve growth and productivity, and strengthen resistance to both biotic and abiotic stresses. Overall, this work contributes to ongoing efforts to develop sustainable, eco-friendly agricultural practices to meet rising global food demand.

Keywords: Algae, Sustainable Agriculture, Growth Promoters, Synthetic fertilizers

Pelletization of mango seed waste biomass from food industry into solid fuel pelletsKavitha M. Sambasivam^{1*}

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Abstract

The current study utilizes the mango seed waste from agro waste industry into solid fuel pellets. Mango seed biomass was converted into hydrochar via hydrothermal carbonization (HTC), with production optimized using response surface methodology; the hydrochar was then converted into solid fuel pellets. The maximum hydrochar yield of 86% was obtained at 200 °C, with a water-to-biomass ratio of 1 and a reaction time of 3 h. The hydrochar synthesized at a HHV content of 21.4 MJ/kg which is comparable to 16.35MJ/kg of raw mango seed biomass. Hydrochar synthesized was analysed using Powder X-ray diffraction (PXRD), Thermogravimetric analysis (TGA), Field emission scanning electron microscopy (FESEM), and Fourier-transform infrared spectroscopy (FTIR). The formation of stable aromatic carbon structures and increased crystallinity was confirmed by PXRD. Reduced volatile content and increased thermal stability were studied by TGA analysis. FESEM revealed cellulose decomposition and hemicellulose formation, as well as increased pore formation in the hydrochar. FTIR reveals the c=c aromatic groups at (1500-1600 cm⁻¹), hydroxyl bending and carboxylate at (1000-1300 cm⁻¹) and (1015 cm⁻¹) Si-O-Si or Si-O-C bonds. The porosity, surface area, calorific value, crystallinity, carbon content, and thermal stability of mango seed hydrochar were enhanced by HTC, thereby offering immense applications across various industries, including the energy sector and environmental applications.

Keywords: Mango seed, Hydrochar, FTIR, HTC, FESEM

***In-situ* transesterification for madhuca biodiesel: from synthesis to life cycle assessment**Kavitha M. Sambasivama^{1*}

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Abstract

The present study reveals the importance of evaluating the process condition of *In-situ* transesterification of mahua biodiesel synthesis, kinetic study, exergy analysis and Life cycle assessment (LCA). The work recommends the application of Plackett–Burman design (PB) followed by central composite design (CCD) to maximize the biodiesel yield. PB design identified the significant variables in biodiesel synthesis that influence yield. The dominant fatty acids present in mahua include oleic acid (36.95%), stearic acid (26.115%), linoleic acid (20.05%) was confirmed by Gas chromatography mass spectrometer (GC-MS). The Maximum biodiesel yield was around 95% in CCD and confirmation of oil into biodiesel was confirmed by FTIR. ANOVA results in CCD design reveal R² 97.37 %, 94.55% of R² adjusted and predicted R² of 82.82%. The kinetic study showed 98% of R² value and with an activation energy of 19.16 kJ mol⁻¹. Energy spent on different techniques in biodiesel synthesis and LCA was also analysed. Energy used for conversion of seed to biodiesel through mechanical extraction was 55.656 kJ, *in situ* process around (19.8 kJ), solvent extraction (48.312 kJ). Thus *in-situ* process has better compared to solvent extraction and mechanical extraction.

Keywords: FTIR, LCA, Biodiesel, GC-MS

Exploring the science of marine seaweeds

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Abstract

The science of marine seaweeds encompasses the study of their biology, ecology, physiology and diverse applications within natural and human-influenced environments. As primary producers, seaweeds form the foundation of many coastal ecosystems, converting sunlight into energy and sustaining a wide variety of marine organisms. Their structural diversity, from delicate green algae to massive brown kelps reflects remarkable adaptations to waves, light availability, salinity and nutrient conditions. The study of seaweed biology includes understanding their life histories, reproductive mechanisms, growth dynamics and interactions with associated organisms such as microbes, grazers and symbionts. Ecologically, seaweeds enhance water quality by absorbing excess nutrients and capturing carbon, making them crucial contributors to climate resilience and the health of coastal ecosystems. In addition to their ecological roles, seaweeds have significant biotechnological and commercial value. Their bioactive compounds, such as alginates, carrageenans, fucoidans, pigments, and natural antioxidants, are widely used in food, pharmaceutical, cosmetic, agricultural, and industrial applications. Scientific exploration of seaweeds includes understanding their life cycles, reproductive strategies, growth patterns and ecological interactions. Seaweeds play essential role in nutrient cycling, shoreline protection, carbon sequestration and habitat formation. Their interactions with marine microbes, herbivores and environmental factors shape ecosystem productivity and resilience. They are rich in bioactive compounds such as polysaccharides, antioxidants, pigments and antimicrobial agents, which support industries including food, pharmaceuticals, cosmetics, agriculture and bioenergy. Sustainable seaweed farming and bioremediation techniques highlight their potential in climate action and blue economy initiatives. Overall, exploring the science of marine seaweeds reveals their ecological significance, biological complexity and growing relevance in sustainable development and marine resource management.

Keywords: Marine seaweeds, Scientific exploration, Ecological importance, Bioactive compounds, Sustainable development

***Kappaphycus alvarezii* as a functional biopolymer source for food and packaging applications**

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Abstract

The present paper focuses on the potential of the red seaweed *Kappaphycus alvarezii* as a sustainable biopolymer source for food and packaging applications. Increasing concern over environmental pollution caused by non-biodegradable synthetic packaging materials has accelerated the search for eco-friendly alternatives derived from renewable resources. Biopolymers such as polysaccharides, proteins, and lipids have emerged as promising substitutes, particularly in the development of active and edible packaging systems. *Kappaphycus alvarezii*, widely cultivated in Southeast Asia, is rich in κ -carrageenan, a sulfated polysaccharide with excellent film-forming and gelling properties. Despite these advantages, films derived from *K. alvarezii* exhibit limitations, including high moisture sensitivity, poor thermal stability, and inadequate mechanical strength. This paper reviews the cultivation, composition, and biopolymer potential of *K. alvarezii*, examines its applications in edible and active packaging, discusses major challenges, and highlights recent advancements including nanocomposite development and polymer blending strategies. The role of *K. alvarezii* within the bio-circular economy is also emphasized, particularly its contribution to sustainable packaging solutions and coastal livelihood development.

Keywords: *K. alvarezii*, biopolymers, carrageenan, edible packaging, active packaging, bio-circular economy

Seaweed-derived biochar as a sustainable adsorbent for cadmium removal from polluted coastal seawater

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Abstract

Heavy metal contamination, particularly cadmium (Cd^{2+}), poses a serious threat to coastal and marine ecosystems due to its persistence, toxicity and bioaccumulative nature. The present study evaluates the potential of biochar derived from marine macroalgae as an eco-friendly and low-cost adsorbent for cadmium removal from polluted coastal seawater. Live samples of *Gracilaria edulis* and *Sargassum polycystum* were collected from the Thondi Coast, Palk Bay, India and processed through slow pyrolysis at 500°C, 550°C and 600°C under low-oxygen conditions. The resulting biochar was acid-modified with 1M H_2SO_4 to enhance surface functionality and adsorption efficiency. Batch adsorption experiments were conducted using acid-modified biochar (6g in 300mL of polluted seawater) and cadmium concentrations were quantified using Atomic Absorption Spectroscopy (AAS). Structural and chemical characteristics of the biochars were analysed using UV-Visible spectroscopy, FTIR, and XRD techniques. FTIR analysis confirmed the presence of functional groups such as $-\text{OH}$, $\text{C}=\text{O}$, $\text{C}=\text{C}$ and $\text{C}-\text{O}$, which are critical for Cd^{2+} binding, while XRD patterns revealed semi-crystalline structures with amorphous carbon and mineral phases contributing to adsorption behaviour. The results demonstrated effective cadmium removal by both biochars, with *Sargassum polycystum* showing a higher removal efficiency (37.90%) than *Gracilaria edulis* (32.65%). The superior performance of *Sargassum* biochar is attributed to its enhanced crystalline mineral content and surface reactivity. This study highlights the promising application of seaweed-derived biochar, particularly from *Sargassum polycystum*, as a sustainable biosorbent for cadmium remediation in marine and coastal environments. The findings support the utilization of abundant marine biomass for pollution control and contribute to environmentally sustainable wastewater treatment strategies.

Keywords: Seaweed biochar, Cadmium removal, Coastal seawater remediation, Adsorption, Heavy metal pollution, Sustainable wastewater treatment

Bio-stimulatory effects of seaweed-based formulations on agricultural crops

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Abstract

Seaweeds or marine macroalgae are rich in diverse compounds like lipids, proteins, carbohydrates, phytohormones, amino acids, osmoprotectants, antimicrobial compounds and minerals. Their potential for agricultural applications has been recognized since antiquity, but recent demand for organic farming and organic food has spurred the use of organic treatments such as seaweed extracts. The benefits of seaweed application in agricultural fields are numerous and diverse, such as stimulation of seed germination, enhancement of health and growth of plants, namely shoot and root elongation, improved water and nutrient uptake, frost and saline resistance, biocontrol and resistance toward phytopathogenic organisms, remediation of pollutants of contaminated soil, and fertilization. In this review, scientific progress in this field was collected and critically assessed to lay grounds for further investigations and applications.

Keywords: Seaweeds, Macroalgae, Amino acids, Agricultural fields

Sustainable straw management for improved finger millet yield and soil quality in red sandy loam soils

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Abstract

The persistent adoption of conventional farming practices particularly intensive tillage combined with in-situ burning of crop residues has a detrimental impact on soil fertility in modern agriculture. With growing concern for sustainable agriculture, there is renewed interest in maintaining and enhancing soil fertility through improved land-use and management strategies. Among these, the return of crop residues typically considered waste after harvesting the main crop has proven to be a valuable source of organic matter. When incorporated back into the soil, these residues contribute significantly to nutrient cycling and to improvements in physical, chemical, and biological soil properties. Effective in-field crop residue management plays a crucial role in conserving soil and its nutrient resources while minimizing environmental damage. In this context, a field experiment was conducted at the Agricultural Research Station, Vizianagaram, from 2018 to 2021 to investigate the effect of straw incorporation on soil fertility and finger millet yield under red sandy loam soil conditions. The results revealed that the treatment involving the incorporation of shredded finger millet straw along with urea @ 5 kg/ha, single super phosphate @ 5 kg/ha, and 75% of the recommended dose of fertilizers (RDF) recorded the highest grain yield (2700 kg/ha). This yield was statistically on par with the full RDF treatment (2571 kg/ha) but achieved a superior benefit-cost (B:C) ratio of 2.38, making it the most efficient and cost-effective option. Furthermore, post-harvest soil analysis indicated significantly higher available nitrogen (N) and phosphorus (P₂O₅) levels in the treatment that included a microbial consortium (Decompo A + Decompo B) for accelerating straw decomposition. These findings highlight the potential of incorporating straw, combined with microbial and nutrient inputs, to enhance soil fertility and sustain crop productivity, thereby contributing to more resilient, environmentally friendly farming systems.

Keywords: Crop Residues, Soil Health, Finger Millet, Organic Matter, Sustainable Agriculture

Phytoremediation of *Monocrotophos* pesticide-polluted soil

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Abstract

Pollution is a major problem in the present scenario that affects our living surroundings especially soil, air and water. *Monocrotophos* is a pesticide that is used heavily to control insects which leads to accumulation in the Soil. Soil reclamation is very important for growing healthy crops. In the present study, *Crotalaria retusa* L. seeds were used to remediate *Monocrotophos*-contaminated soil at concentrations ranging from 0.5 to 2.5 %. *Crotalaria retusa*: growth parameters of the seedlings, including shoot length and root number, were observed. Growth retardation of the seedlings was observed at 60 60-day concentration. Seedling growth was higher in the control. Further, GC-MS study revealed the presence of *Monocrotophos* in *Crotalaria retusa* grown seedlings. Our results showed that the possibility of uptake of *Monocrotophos* by *Crotalaria retusa* seedlings which may help to reduce the pollution in the Soil.

Keywords: Phytoremediation, *Monocrotophos*, *Crotalaria retusa* L., GC-MS

Soil enzyme profiles in different banana plantations at Salem District, Tamil Nadu

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Abstract

Soil enzymes play an essential role in organic matter recycling and nutrient cycling, influencing energy transformation, environmental quality, and agricultural productivity. There is limited information regarding the impacts of different crop rotations and tillage methods on soil biological attributes, particularly enzyme activities and microbial community structure in banana cultivation soils. The pH ranged from 7.16 to 8.13 in surface soils and 7.08 to 8.24 in rhizosphere soils which indicate that the samples are slightly alkaline in nature. Despite a significant reduction in TOC (0.56 to 1.18%) and SOM (0.96 to 2.03%) as compared to control, nearly 80% of the rhizosphere soils had < 1% of TOC in different banana cultivations. Unlike other C cycling enzymes, soil dehydrogenase and protease activities were two to fourfold higher in the rhizosphere and surface soils, respectively. However, soil urease activity was also higher in all the sampling sites in both soils. The maximum dehydrogenase activity was evident in the Kathali variety. The soil pH showed a strong positive correlation with all the studied soil enzymes in surface soils, whereas it had a negative correlation with protease and dehydrogenase in rhizosphere soils. Generally, the enzyme activities in banana soils are associated with better nutrient availability, organic matter turnover and improved soil health, making them vital for sustainable banana cultivation. The outcomes will help take the necessary steps to enhance soil quality and fruit productivity in the next cultivation phase.

Keywords: Banana, TOC, Soil enzymes, Recycling

Assessment of soil enzyme activities in the rhizosphere zone of calcicole plants in magnesite mine sites

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Abstract

The metals and minerals derived from mining industries created environmental pollutions in the aspect of soil, water, and air pollution. Further, the deforestation along with soil pollution is the major issue in mining activities. For plant establishment to be successful an active soil microbial community is essential. Therefore, monitoring of microbial activities including studies on soil enzymes are important to maintain the sustainable soil management. For tropical regions, there are few studies on the use of microbial indicators in reclamation of mining areas and even fewer studies on use of soil enzymes to assess the success of reclamation. Hence, the present work aimed to assess the changes produced in the rhizosphere soils of calcicole plants in magnesite mine sites through the assessment of soil enzyme activities. The soil enzyme activities in the rhizosphere soils of different calcicole plant diversities (S1-S15) exhibited at magnesite mine sites were broadly classified into six categories based on the type of plant families belongs to Fabaceae (S1, S7, S8, S12, S13, S14 and S15), Apocynaceae (S2 and S11), Rubiaceae (S4 and S5), Rutaceae (S6 and S9), Casuarinaceae (S3) and Phyllanthaceae (S10). The TOC and SOM in the rhizosphere soils were maximum at S8 as 0.73% and 1.26%, respectively. In general, the order of soil available macronutrient contents in the rhizosphere soils collected from different calcicole plants in the magnesite mine site was Ca > Na > Mg > K > N > P. The order of soil enzymes differ with different calcicole plants indicated the role of soil microbial activity on nutrients and sustained the growth of calcicoles in harsh environmental conditions. Further, increase in the soil biological activities could be used for restoration of mine sites with ideal indigenous calcicole plants.

Keywords: Calcicoles, Rhizosphere zone, Magnesite mines, Soil enzymes

Areca nut waste as bioresources for Eco-friendly vermicompost production, amending biochar

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Abstract

There has been an increased generation of areca nut waste in the Salem District, Tamil Nadu, during processing, which is attracting attention due to its accumulation in the environment. Hence, the present study attempted to utilize areca nut wastes for vermicompost production. In this study, areca nut waste and cow dung (1:1) were predecomposed with *Pleurotus* spawn, followed by vermicomposting with *Eudrilus eugeniae*, with five treatments in triplicate. The vermibeds were maintained in an environmentally controlled room at an average temperature of $27\pm 2^{\circ}\text{C}$ and $75\pm 5\%$ humidity. Vermibeds were periodically sprinkled with water, and samples were collected periodically for physicochemical, microbiological, and enzymatic analyses. The growth and fecundity of *Eudrilus eugeniae* were also assessed to determine the substrate combination suitable for vermicomposting. Overall, results revealed that the vermibed combination, areca nut + cow dung (1:1) with a 4% Biochar amendment, can produce nutrient-rich vermicompost.

Keywords: Earthworm, *Eudrilus eugeniae*, Mushroom spawn, Organic wastes, Vermiconversion

Bioremediation of antibiotic-polluted agricultural soils using beneficial bacteria

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Abstract

The extensive use of antibiotics in livestock, poultry, and aquaculture has led to the accumulation of antibiotic residues in agricultural soils through excreta and wastewater. These residues persist in the soil, disrupting the native microbial communities, reducing soil fertility, and impairing crop productivity. Moreover, antibiotic-polluted soils contribute to the emergence and spread of antibiotic-resistant bacteria, posing a risk to environmental and human health. Bioremediation, an eco-friendly and sustainable approach, employs beneficial bacteria to degrade, neutralize, or absorb these antibiotic residues, restoring soil microbial balance and promoting plant growth. This review summarizes current knowledge on the sources and impacts of antibiotic pollution in agricultural soils, highlights the mechanisms by which beneficial bacteria facilitate bioremediation, and discusses practical applications within a One-Health framework that integrates environmental sustainability, agriculture, and public health. Challenges, research gaps, and future perspectives on optimizing microbial bioremediation for sustainable agriculture are also addressed.

Keywords: Bioremediation, Antibiotic-polluted soil, Beneficial bacteria, Soil health, Sustainable agriculture

Gamma ray–induced mutagenesis alters growth, biochemical traits and antioxidant activity in rice (*Oryza sativa* L.)

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Abstract

Rice is a staple food in India, providing sustenance to more than 60% of the population. India consumes more than 50% of the world's rice and is the second largest producer in the world and increasing its stress tolerance is critical for long-term production. The current study investigated the metabolic and antioxidant responses of rice to gamma irradiation-induced stress. Seeds were subjected to gamma radiation dosages ranging from 50, 100 to 600 Gy. Rice seeds are highly radiosensitive, as shown by a steady drop in germination percentage and seedling development as radiation intensity increased. The LD₅₀ was calculated at 200 Gy. Photosynthetic pigments, particularly chlorophyll a and b, decreased dramatically with increasing dosage, whereas carotenoid levels peaked at 200 Gy, indicating a hormetic response. Primary metabolites such as carbohydrates, proteins and free amino acids rose initially, indicating stress-induced metabolic reprogramming. Proline levels increased proportionally with radiation dosage, serving as an early indicator of oxidative and osmotic stress. Antioxidant defence mechanisms were significantly activated, as shown by the increased activity of catalase (CAT), peroxidase (POD) and superoxide dismutase (SOD), which jointly decreased lipid peroxidation, determined as malondialdehyde (MDA) and reduced reactive oxygen species (ROS) damage. Secondary metabolites, including phenols and flavonoids, also rose, perhaps contributing to ROS scavenging. Histochemical staining demonstrated ROS buildup, while FTIR analysis revealed radiation-induced metabolic changes. Overall, gamma-ray-mediated mutation breeding represents a promising approach for developing rice genotypes with improved morpho-physiological and biochemical efficiency and antioxidant defence potential, thereby contributing to sustainable rice improvement programs.

Keywords: Paddy, Mutation breeding, Gamma rays, Biochemical analysis, Antioxidant activity

Effects of gamma irradiation on germination, growth, biochemical composition and antioxidant defence in rice (*Oryza sativa* L.)

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Abstract

Rice is a vital staple food for a large proportion of the global population, particularly in tropical regions of Latin America, the West Indies and East, South and Southeast Asia. To enhance genetic variability beyond the limits of conventional breeding, mutation breeding programs are employed to broaden mutation frequency and spectrum, including point mutations, deletions and chromosomal rearrangements, thereby increasing the occurrence of viable and functional variants. In the present Study, seeds of the rice variety ADT 43 were exposed to gamma irradiation at 0, 50, 100 and 600 Gy to evaluate the effects of radiation on seed germination, plant survival and morphological, physiological, biochemical and antioxidant traits. In the M₁ generation, gamma-ray treatment resulted in a dose-dependent reduction in seed germination and survival percentages, along with decreased shoot and root lengths. Biochemical constituents, including carbohydrates, proteins, proline and amino acids, decreased in treated plants compared to the control. In contrast, antioxidant responses were markedly enhanced following irradiation. Enzymatic antioxidants, including catalase and peroxidase, showed increased activity, while non-enzymatic antioxidants, such as flavonoids and phenolic compounds, also accumulated at higher levels in irradiated plants. Overall, gamma-ray-mediated mutation breeding emerges as a promising strategy for developing stress-resilient rice genotypes with improved morphological performance, physiological efficiency, biochemical composition and antioxidant defense capacity, thereby contributing to sustainable rice production.

Keywords: Paddy, Mutation breeding, Gamma rays, Morpho-physiology, Antioxidant properties

Abscisic acid-mediated alleviation of drought-induced oxidative stress in rice (*Oryza sativa* L.)

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Abstract

Rice (*Oryza sativa* L.), a primary food crop for more than half of the global population, is highly vulnerable to drought stress, which severely disrupts its morphological, physiological and biochemical functions, ultimately leading to substantial reductions in growth and yield. Drought stress restricts water availability, suppresses plant height and biomass accumulation, and impairs photosynthetic efficiency. Abscisic acid (ABA), an essential phytohormone, plays a key regulatory role in plant stress adaptation and drought tolerance. In the present study, rice plants were subjected to drought conditions and treated with different concentrations of ABA to evaluate associated morphological, physiological, biochemical and antioxidant responses. Drought stress significantly inhibited plant growth, as reflected by reduced height and biomass. At the biochemical level, stress conditions trigger the accumulation of osmolytes, such as proline, which contribute to osmotic adjustment and cellular protection. Concurrently, excessive production of reactive oxygen species (ROS) resulted in oxidative stress. However, rice plants activated their defense mechanisms by enhancing the activities of antioxidant enzymes, including catalase and peroxidase. Among the tested treatments, the application of an optimal ABA concentration proved most effective in alleviating drought stress. This treatment markedly improved growth attributes, photosynthetic pigment and carotenoid content and enhanced key biochemical parameters such as carbohydrates, proteins, proline, phenolic compounds and antioxidant enzyme activities. Overall, exogenous ABA application effectively mitigates drought-induced damage by strengthening antioxidant defenses, maintaining water balance and reducing oxidative stress, thereby improving rice resilience and supporting sustainable productivity under water-limited conditions.

Keywords: Rice, Drought, Phytohormones, Abscisic acid, ROS

Gamma irradiation induced morphophysiological and biochemical alteration in rice

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Abstract

Rice is a staple food for over 50% of the global population. This study investigated how gamma irradiation affects the metabolic and antioxidant responses in rice. Seeds were exposed to increasing doses of gamma rays (0, 50, 100... 500 Gy), and their morphological, biochemical, and oxidative responses were evaluated. Germination progressively declined with increasing doses, with maximum inhibition at 500 Gy. The lethal dose (LD₅₀) was determined to be 250 Gy, indicating strong radiosensitivity beyond this level. Growth parameters decreased in a dose-dependent manner, suggesting disrupted cell division and metabolism. Photosynthetic pigments such as chlorophyll a and b decreased at higher doses, while carotenoids peaked at 250 Gy, suggesting a hormetic response before declining due to ROS-induced damage. Metabolites like carbohydrates, proteins, and amino acids initially increased at 250 Gy. Proline levels rose consistently with dose, serving as an indicator of stress tolerance. Antioxidant enzymes (CAT, POD and SOD) showed significant increases, helping mitigate lipid peroxidation and scavenging reactive oxygen species (ROS). Phenolic and flavonoid content also increased, contributing to ROS detoxification. Overall, gamma irradiation significantly increased the biochemical and antioxidants in M1 generation of rice.

Keywords: Gamma irradiation, Rice, Biochemical, Antioxidant, LD₅₀

Synergistic use of plant genetic resources for climate-resilient and sustainable agriculture

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Abstract

Sustainable agricultural development is critical for ensuring global food security while preserving environmental integrity under increasing climatic and resource constraints. Bioresources, particularly plant genetic resources, constitute a fundamental component of sustainable crop improvement programs. Advances in genetics and plant breeding enable the effective utilization of these bioresources to enhance productivity, adaptability, and resilience in crop plants. The present study emphasizes the strategic integration of genetic diversity, indigenous germplasm, and eco-friendly breeding approaches to develop improved crop genotypes suited to sustainable agricultural systems. Genetic variability for key agronomic traits, including yield potential, stress tolerance, and resource-use efficiency, was exploited through systematic selection and evaluation across diverse environments. The synergistic use of plant genetic resources with sustainable agricultural practices reduces dependence on chemical inputs, improves soil health, and enhances crop stability under variable environmental conditions. Incorporation of bioresource-based inputs further supports environmentally responsible crop production. The outcomes highlight the significance of bioresource-driven breeding strategies in strengthening climate resilience and promoting long-term agricultural sustainability. Integrating genetic improvement with sustainable resource management offers a viable pathway for developing resilient cropping systems that balance productivity and environmental conservation. This approach supports global initiatives aimed at sustainable agriculture and reinforces the role of plant breeding in addressing future food and environmental challenges.

Keywords: Plant genetic resources, Genetics and plant breeding, Bioresource synergy, Sustainable agriculture, Crop improvement

Spectroscopic insights, metabolic and oxidative stress responses in rice (*Oryza sativa* L.) induced by gamma irradiation

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Abstract

Rice (*Oryza sativa* L.) an important food for more than half of the global population and understanding its stress responses is essential for crop improvement. Present study evaluated the effects of gamma irradiation on growth, metabolism, antioxidant defense mechanism of rice. Seeds were exposed to gamma doses ranging from 0, 50, 100 to 500 Gy. FTIR analysis revealed dose-dependent modifications in functional groups, including changes in O–H, C–H, C=O, and aromatic vibrations, while preserving the basic molecular framework up to 500 Gy. ESR spectroscopy confirmed the generation and stabilization of radiation-induced free radicals, with characteristic g-values around ~2.0, increasing with dose. Germination percentage and seedling growth showed a progressive decline with increasing dose, with an LD50 value at 300 Gy, indicating high radiosensitivity. Photosynthetic pigments, including chlorophyll a and b, decreased markedly under irradiation, whereas carotenoid content peaked at 300 Gy, suggesting a hormetic response. Primary metabolites such as carbohydrates, proteins and amino acids exhibited an initial increase at higher doses, reflecting stress-induced metabolic reprogramming. Proline accumulation increased dose-dependently, serving as an early biochemical marker of irradiation stress. Enhanced activities of antioxidant enzymes catalase, peroxidase and superoxide dismutase were observed, concomitant with reduced malondialdehyde, indicating efficient reactive oxygen species scavenging. Elevated phenolic and flavonoid contents further contributed to oxidative stress mitigation. Overall, these results demonstrate that gamma irradiation induces coordinated physiological, biochemical and antioxidant responses in rice, providing insights into radiation-mediated stress adaptation and its potential application in mutation breeding.

Keywords: ESR, FT-IR, Rice, Biochemical, Antioxidant activity

Physiological and biochemical responses of rice (*Oryza sativa* L.) to gamma ray–induced mutagenesis

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Abstract

Rice (*Oryza sativa* L.) is a major staple crop that supports nearly half of the world's population, and improving its productivity and adaptability can be vital to global food security. The genetic potential of many high-yielding rice varieties, however, is constrained by a narrow genetic base, which may limit progress through conventional breeding approaches. Induced mutagenesis using gamma irradiation offers an effective alternative for generating novel genetic variability and potentially improving desirable traits in rice. Gamma rays, typically emitted by a Cobalt-60 (⁶⁰Co) source, are highly penetrating ionizing radiations capable of inducing stable, heritable mutations. These mutations result from DNA damage such as chromosomal breaks, base substitutions and other molecular changes. In the present Study, healthy, uniform paddy seeds were exposed to different doses of gamma radiation to induce mutations and evaluate their biochemical responses. The irradiated materials were advanced through successive generations to assess the expression and stability of the induced variations. Biochemical analysis is crucial for understanding the physiological and metabolic effects of gamma irradiation. Important biochemical parameters, including total carbohydrates, proteins, free amino acids, phenols, chlorophyll content, and antioxidant enzyme activities, were analyzed in irradiated and control plants. Variations in these constituents suggest gamma-ray influence on stress-response mechanisms. Moderate doses often enhanced specific biochemical traits, whereas higher doses could cause inhibitory effects due to cellular damage. Overall, integrating gamma-induced mutagenesis with biochemical evaluation can help identify promising mutant lines for further agronomic improvement and sustainable rice production.

Keywords: Gamma irradiation, Induced mutagenesis, Biochemical analysis, Rice improvement, Antioxidant enzymes

Genetic and physiological insights into dust deposition effects of *Ficus religiosa* and *Ficus bengalensis*: A Comparative study

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Abstract

This study examined the impact of roadside dust deposition on the biochemical, physiological and molecular characteristics of two widely occurring urban tree species, *Ficus religiosa* and *Ficus bengalensis*. Evaluated parameters included leaf pH, Relative Water Content (RWC), total chlorophyll, chlorophyll a, and chlorophyll b. Leaves from polluted sites showed a significant reduction in chlorophyll content and RWC compared to control samples ($p \leq 0.005$), indicating impaired photosynthetic efficiency and disrupted water balance. *F. bengalensis* exhibited greater chlorophyll concentrations and higher dust accumulation than *F. religiosa*, suggesting increased tolerance to dust stress. SEM analysis confirmed heavy dust loading, with particulates. RAPD profiling using primers Z13, Z17, and Z18 revealed distinct polymorphisms between the two species, reflecting genetic variability associated with stress response. Collectively, these findings demonstrate that dust pollution significantly alters plant biochemical and physiological traits and highlight *F. bengalensis* as a suitable candidate for urban greening and pollution mitigation efforts.

Keywords: Dust pollution, Chlorophyll content, Relative Water Content, SEM analysis, RAPD markers

Engineering stress-resilient crops: Integrating stress physiology with genetic engineering

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Abstract

Abiotic stresses such as drought, salinity, heat, and cold severely limit crop productivity worldwide. Understanding stress physiology provides critical insights into plant adaptive responses at morphological, physiological, biochemical, and molecular levels. Key mechanisms include osmotic adjustment, antioxidant defense, hormonal regulation, and stress-responsive gene expression. Advances in genetic engineering have enabled precise manipulation of these physiological pathways to enhance stress tolerance. Transgenic approaches and genome editing technologies allow targeted modification of genes involved in stress perception, signal transduction, and protective metabolite synthesis. Integration of stress physiology with genetic engineering facilitates the development of crops with improved resilience while maintaining yield stability under adverse environments. Such interdisciplinary strategies offer promising solutions for climate-resilient agriculture and sustainable food production.

Keywords: Abiotic stress, Stress physiology, Genetic engineering, Genome editing, Stress tolerance, Climate-resilient crops.

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