

INTERNATIONAL CONFERENCE ON ECOTOXICOLOGY & ENVIRONMENTAL SCIENCES [ICEES-2025]

Venue

St. Xavier's College (Autonomous), Kolkata
Raghabpur Campus

Date: 10-11 October, 2025

Jointly Organized by
INSTITUTE OF ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (IE&ES)
Y/7, XI, Purbachal, Salt Lake, Kolkata-700 097, India

In Collaboration With:
St. Xavier's College (Autonomous), Kolkata
Napalgange PO, Magurkhali, Kolkata-700 103, India

Supported by

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Anusandhan National Research Foundation

INTERNATIONAL CONFERENCE ON ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (ICEES-2025)

10th - 11th October, 2025

at

St. Xavier's College (Autonomous), Kolkata

Napalgange PO, Magurkhali, Kolkata-700 103, West Bengal, India

ABSTRACT VOLUME

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INSTITUTE OF ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (IE&ES)

In collaboration with

ST. XAVIER'S COLLEGE (AUTONOMOUS), KOLKATA

Supported by

भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

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PRINCIPAL
ST. XAVIER'S COLLEGE (Autonomous)

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Message from Fr. Principal



It is indeed a privilege to extend my warm appreciation to the organizers of the *International Conference on Ecotoxicology & Environmental Sciences (ICEES 2025)*, hosted in collaboration with St. Xavier's College (Autonomous), Kolkata. This academic venture comes at a most appropriate time, providing a vibrant platform for researchers, scholars, and students to engage in meaningful dialogue on contemporary environmental issues. By focusing on ecotoxicology, the conference highlights the pressing obligation we all share to safeguard our natural resources, protect biodiversity, and ensure the well-being of present and future generations through sustainable practices.

I wholeheartedly commend the vision, dedication, and perseverance of the organizing team whose consistent efforts have made this conference possible. Such initiatives resonate strongly with the mission of St. Xavier's College—nurturing intellectual growth while fostering a spirit of responsibility towards society and the environment.

I am confident that ICEES 2025 will encourage innovative thinking, stimulate interdisciplinary collaboration, and contribute significantly to environmental science and policy. On behalf of St. Xavier's College, I extend my very best wishes for the success of this conference and trust that it will leave a lasting impact on both academia and society.

With warmest wishes and God's blessings! Nihil Ultra!

Rev. Dr. Dominic Savio, SJ
Principal,
St. Xavier's College (Autonomous), Kolkata
Chief Patron, ICEES 2025

Message from Patron



I would like to express my sincere compliments to International Conference on Ecotoxicology & Environmental Sciences (ICEES 2025) in collaboration with St. Xavier's College (Autonomous), Kolkata for organizing the seminar at St. Xavier's College, Raghabpur Campus. The conference is carefully planned & executed demonstrating the institute's unwavering dedication to promoting scientific curiosity & innovation. The occasion provides a useful forum for demonstrating student's research, scholar's & faculty's scientific aptitude - communication between young minds & subject matter specialists. I applaud the commitment & zeal of the Staff, instructors & students who helped make ICEES 2025 an unforgettable occasion. I look forward to the event & its contributions.

With Warmest Wishes and God's Blessings.

Nihil Ultra.

Rev. Fr. Johnson Padiyara, SJ
Vice Principal,
St. Xavier's College (Autonomous), Kolkata

Message from Chairperson



As the President of IE&ES, it is my immense pleasure to cordially invite all the eminent scientists, researchers, young scholars and delegates at the 9th "International Conference on Ecotoxicology and Environmental Sciences" 2025. The conference is organized in collaboration with St. Xavier's College (Autonomous), Kolkata.

IE&ES is a non-profit organization which is involved is involved in growing awareness on Pollution control and Management since its establishment in 2001. This conference is the platform to address environmental challenges and exploring the modern scientific advancements. IE&ES always encouragesscientific discussion, exchange of views which can contribute to better understanding and discussions.

Heartfelt gratitude to the authority of St. Xavier's College (Autonomous), Kolkata, and our International and National Scientific Advisors for enormous support and guidance. I express my sincere thanks to the sponsors.

Our effort will be successful if the young Scientists / researchers are benefitted from the deliberations of resource persons.

Dr. Sarmila Pal
President, Institute of Ecotoxicology & Environmental Sciences (IE&ES)
Chairperson, ICEES - 2025

Message from Organizing Secretary



It gives me immense pleasure to convey my heartfelt appreciation to International Conference on Ecotoxicology & Environmental Sciences (ICEES 2025) in collaboration with St.Xavier's College (Autonomous), Kolkata for organizing the seminar at St.Xavier's College, Raghabpur Campus.

This significant academic initiative offers a dynamic platform for researchers, academicians, and students to engage in meaningful dialogue on critical environmental issues. The emphasis on ecotoxicology reflects the urgent need to understand and mitigate the impact of pollutants on ecosystems and public health.

I commend the organizing team for their vision, dedication, and meticulous planning in curating such a relevant and timely event. I am confident that ICEES 2025 will inspire innovative ideas and foster collaborations that contribute meaningfully to sustainable science and policy.

I extend my best wishes for the grand success of ICEES 2025 and look forward to its valuable contributions to the scientific community.

Dr. Arup Kumar Mitra
Associate Professor, St. Xavier's College (Autonomous), Kolkata
Fellow, Institute of Ecotoxicology & Environmental Sciences (IE&ES)

Message from Convener



This is my great pleasure to welcome you all to ICEES 2025, at St. Xavier's College (Autonomous), Kolkata. This conference aims to address pressing environmental challenges, explore the latest scientific advancements, and foster collaboration across disciplines. We encourage you to engage in discussions, exchange ideas, and forge partnerships that will contribute to our collective understanding and solutions.

Participants from various sectors and from different corners of the country along with the foreign delegates will definitely contribute to make this conference a great success.

I hope that the main motto to organize this conference will be achieved. The participants especially the students and researchers will be benefited. My sincere gratitude to Fr. Principal and Fr. Johnson for their cooperation and continuous support. I do admire the contribution and guidance of Dr. Arup Kumar Mitra. My special thanks to BSI, ANRF and EDCIC for their support. Thank you for being part of this important dialogue. Together, we can advance our knowledge and commitment to protecting our planet.

Dr. Debabrata Mukherjee
Secretary, Institute of Ecotoxicology & Environmental Sciences (IE&ES)
Convener, ICEES - 2025

Message from Joint Convener



This is my extreme privilege to welcome you all in International Conference on Ecotoxicology & Environmental Sciences (ICEES 2025), 9th Chapter, in collaboration with St. Xavier's College (Autonomous), Kolkata, Raghabpur Campus. We are thrilled to have you all join us, both in-person and virtually, for this significant event that brings together leading researchers, faculties and students from around the globe to discuss pressing environmental challenges and innovative solutions. The discussions on the cutting edge researches of the themes like Environmental Pollution, Toxicology of metals and metalloids, Environmental management and sustainability, Green Chemistry, Nano-technological approach, Safety evaluation of food, Microbes operating in environment, Environmental and Biomass engineering, will definitely quench the thirst of the knowledge of the researchers. I extend my sincere gratitude to our distinguished guests, for gracing this occasion with their presence and valuable insights. A special thanks also goes to our esteemed speakers, session chairs, and sponsors, whose contributions are invaluable to the success of this seminar. We encourage you to actively engage in the sessions, participate in the discussions, and network with fellow participants to forge new connections and collaborations. Your active involvement is crucial to making this seminar a truly enriching experience for all. We wish you a productive and inspiring time at the ICEES, 9th chapter. May this event serve as a catalyst for transformative change in the field of environmental science and contribute to a more sustainable future for our planet.

Dr. Sudeshna Shyam Choudhury
Associate Professor, St. Xavier's College (Autonomous), Kolkata
Joint Convener, ICEES 2025

Message from Coordinator



It is my pleasure to welcome you all to the 9th International Conference on Ecotoxicology and Environmental Sciences. We are delighted to host this event to address critical environmental challenges.

This year's conference promises to be an enriching experience, with a diverse program featuring keynote speeches, panel discussions especially with local farmers and fishermen, and special interactive session with research scholars and PG students for carrier guidance. We encourage you to actively participate, interact, and engage with fellow attendees.

Over the next two days, you will have the opportunity to engage with leading researchers, participate in stimulating discussions, and explore new ideas that advance our understanding of ecotoxicology and its impact on ecosystems and human health. I hope We hope you find the conference both inspiring and informative.

My heartfelt gratitude to Fr. Principal, Fr. Johnson and Dr. Arup Kumar Mitra for their continuous support. My sincere thanks to ANRF, BSI and EDCIC for their financial support to make the event a successful one .

Ms. Shreyasee Mukherjee
Treasurer, Institute of Ecotoxicology & Environmental Sciences (IE&ES)
Coordinator, ICEES - 2025

Keynote

EXPLORING BIOMASS PATHWAYS TO ESTABLISH THE GLOBAL FOOD, FUEL, AND CLIMATE SECURITY LINKAGES

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Abstract:

Biomass stands at the core of an integrated solution to global food, fuel, and climate security challenges. With the global population expected to surpass **9.8 billion by 2050**, food demand is projected to increase by **70%**, while global energy needs could rise by **nearly 50%,** placing enormous pressure on finite natural resources and energy systems. Simultaneously, the planet faces a climate emergency, with agriculture, energy, and waste collectively contributing over **65%** of global greenhouse gas (GHG) emissions. Biomass—derived from agricultural residues, forest by-products, energy crops, algae, and organic waste—offers a strategic pathway to simultaneously address these interlinked challenges.

This paper investigates biomass pathways and their potential to create synergistic benefits across food production systems, renewable energy generation, and climate mitigation. Through integrated bio-based solutions such as composting, anaerobic digestion, pyrolysis, and gasification, biomass can be converted into valuable products including biofertilizers, biogas, bio-CNG, biohydrogen, and biochar. These conversions can enhance soil fertility by **20–45%,** increase crop yields by **15–40%**, and replace up to **20%** of global fossil fuel consumption. In parallel, bioenergy systems can reduce lifecycle GHG emissions by up to **80%** and mitigate over **5 gigatons of CO_2** annually when deployed at scale. **This will emphasise carbon (C) sequestration and its significant impact on mitigating global warming by enhancing soil organic carbon stocks and reducing atmospheric CO_2 concentrations.** Furthermore, decentralized biomass systems have been shown to reduce landfill waste by **30–50%,** generate clean energy for off-grid communities, and create an estimated **70–100 jobs per 10,000 tons of biomass processed.** The environmental co-benefits extend to improved soil organic carbon, enhanced water retention, and reduced nutrient runoff. Economically, biomass valorization aligns with circular economy models and supports inclusive rural development.

This paper presents a systems-level framework for biomass deployment that integrates food, energy, and climate strategies while aligning with the Sustainable Development Goals (SDGs), especially SDG 2, SDG 7, SDG 12, and SDG 13. By establishing biomass as a keystone resource in policy and practice, nations can unlock transformative opportunities for sustainability, resilience, and equitable development. Our findings emphasize that biomass is not merely a by product of agriculture but a cornerstone of a regenerative bioeconomy capable of reshaping the global sustainability agenda.

IP-001

FROM DATA TO CLEAN AIR: THE AI REVOLUTION IN AIR QUALITY MANAGEMENT

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Abstract:

Air quality—both indoors and outdoors—stands among the most pressing environmental challenges, drawing increasing attention from the scientific community. Growing evidence highlights the severe consequences of air pollution on human health and society at large (Wu et al., 2024). Despite notable advances, significant gaps persist in air quality management and related research. Key variables often remain difficult to quantify, while predicting individual pollution events or long-term trends continues to be highly complex (Jin et al., 2022).

In this context, artificial intelligence (AI) is emerging as a powerful tool to tackle these challenges. Recent studies (Amin Al-Habaibeh et al., 2024) illustrate the use of AI in air quality monitoring, with applications ranging from vehicle counting to estimating traffic volumes, achieving greater accuracy than traditional methods that are often prone to human error. Moreover, AI enables real-time data processing, accelerating collection and analysis while reducing anomalies in results. Advanced techniques such as Decision Trees, Random Forests, Convolutional Neural Networks, and hybrid frameworks demonstrate strong potential for capturing complex variable interactions and integrating heterogeneous datasets—including images and text. Nevertheless, widespread adoption of AI is still hindered by substantial equipment costs and a shortage of specialized expertise (Olawade et al., 2024).

Keywords: AI; air quality; pollution; models; human health.

IP-002

GREEN NANOTECHNOLOGY FOR NEXT GENERATION, SUSTAINABLE AGRICULTURAL PRODUCTIVITY

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Abstract:

Agricultural ecosystem is input driven and various deliverables, i.e., fertilizer, pesticide, medicines, feed, fodder etc. routinely add for enhancing productivity in terrestrial as well as aqua based farming systems, are also the source of environmental menace. To this end, green nanoparticle inspired delivery of agri-input appears efficacious and environmentally safe. Our research initiatives depicted seed coated nano-silica at 150 ppm followed by 250 ppm dose can be effectively delivered as alternative nanosilica based fertilizer for improving chickpea cultivation when tested in morphological, biochemical and molecular platform. Plant tissue derived green silver nanoparticle inferred low cytotoxicity to zebrafish (*Danio rerio)* in comparison to chemically synthesized nanosilver. Residual tissues of citrus and pomegranate can be used for synthesizing silver nanoparticles having anti-biofirm and anti-viral propensity. Nano lime applied in place of routine lime for counteracting soil acidity in chickpea (*Cicer arietinum*) cultivation appeared safe to rhizospheremicrobes, exhibited higher bio-distribution as well as biological activities at $1/50^{th}$ to $1/100^{th}$ doses when analyzed through metagenomics sequencing, ICP-MS profiling as well as transcriptomics analysis respectively. Semiconductor nanoparticle can degrade colorations developed due to jute retting waste water through photocatalysis property which denoted an alternative safe method of nano-remediation. Green selenium proved growth stimulation for rohu larva as evaluated under molecular platform. Hence, green nanotechnology driven formulations and products can be an environmentally safe deliverables with higher efficacy for achieving sustainable goals in agricultural productivity.

Keywords: Green nanotechnology, environment, molecular tool, sustainability, fish, cropping system

IP-003

HARNESSING NANOTECHNOLOGY FOR SUSTAINABLE MANAGEMENT OF E-WASTE AND MITIGATION OF ENVIRONMENTAL IMPACTS

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Abstract:

As technology evolves quickly, the amount of electronic waste produced worldwide is rising at a concerning pace. Inadequate disposal and unregulated recycling of e-waste result in significant environmental problems. Harmful materials found in e-waste, such as lead, mercury, cadmium, and brominated flame retardants, can seep into the soil and pollute groundwater, presenting prolonged threats to both ecosystems and human health.Nanoparticles are being investigated more and more as inventive approaches for the breakdown and recycling of electronic waste (e-waste). In particular, nanoparticles of metals and metal oxides, including iron oxide (Fe_3O_4), titanium dioxide (TiO_2), and zinc oxide (ZnO), have demonstrated significant capabilities in facilitating the degradation of harmful organic substances through photocatalytic and other ways. Proper e-waste management and recycling methods are essential to mitigate these environmental threats and promote sustainable resource use.

IP-004

MARINE TRANSGRESSION AND THE DYNAMICS OF ITS RATE ALONG THE EAST COAST, INDIA: A SEDIMENTOLOGICAL AND GIS-BASED APPROACH

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Abstract:

The east coast of India has undergone multiple phases of marine transgression throughout the Quaternary and recent geological past, resulting in a diverse and complex sedimentary archive. These transgressive events have left behind distinct stratigraphic signatures, shoreline displacements, and geomorphic imprints, which collectively serve as critical indicators for reconstructing coastal evolution. Understanding both the rate and spatial extent of these shoreline advances is vital not only for deciphering palaeo environmental change but also for assessing contemporary vulnerabilities associated with accelerated sea-level rise and sediment imbalance.

This study adopts an integrated sedimentological and GIS-based approach to evaluate the dynamics of marine transgression along selected sectors of the east coast. Detailed investigations are employed to characterize lithofacies variations, depositional environments, and the alternation of transgressive-regressive sequences. These field-derived datasets are accomplished by satellite imagery, palaeoshoreline mapping, and high-resolution geospatial analysis to track shoreline migration patterns and quantify the rate of marine encroachment.

Special emphasis is placed on the role of the sediment budget in modulating the pace of transgression. GIS-based modelling reveals that sediment deficit conditions—arising from deltaic lobe switching, long shore drift interruptions, and anthropogenic interventions—significantly enhance the rate of shoreline retreat. Conversely, zones with relatively balanced sediment supply show slower or stabilised shoreline adjustments. By linking sediment budget assessments with coastal geomorphology, the study provides a comprehensive perspective on the mechanisms driving marine transgression.

The findings provide predictive insights into the future trajectory of coastal change driven by global warming effects, with particular emphasis on sea-level rise. The integrated framework not only refines our understanding of past shoreline behaviour but also contributes to strategic coastal management and climate adaptation planning along the east coast of India.

Keywords: Marine Transgression; Stratigraphic signatures; Shoreline displacements; Geomorphic imprints; Global warming; Integrated Sedimentological and GIS-based approach; East coast of India.

IP-005

SUSTAINABLE AGRICULTURE THROUGH MICROBIAL BIOSTIMULANTS: INSIGHTS FROM *KOCURIA MARINA* DAGII

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Abstract:

Sustainable and eco-friendly practices are essential in modern agriculture to ensure food security, meet rising demand, and maintain ecological balance. Plant-associated bacteria and their bioactive metabolites are increasingly recognized as natural biostimulants, owing to their ability to improve nutrient uptake, enhance stress tolerance, and promote crop productivity. In this study, the efficacy of the extracellular metabolites, or cell-free supernatant (CFS), derived from a newly isolated bacterium, *Kocuria marina* DAGII, was evaluated for its role in enhancing the growth and productivity of *Brassica juncea*, a crop of significant agricultural importance. Seed biopriming with 1 mg/mL CFS resulted in a 26.34 ± 1.52% increase in seed germination, a 71.74 ± 4.95% improvement in vigor index, and a 49.35 ± 2.20% increase in total chlorophyll content in *B. juncea*. Furthermore, the CFS at 1 mg/mL exhibited *in vitro* antifungal activity against *Sclerotiniasclerotiorum* and *Alternaria* sp., two major mustard pathogens, thereby contributing to plant disease protection. A genotoxicity assay confirmed the biocompatibility of both the bacterium and its CFS. Overall, this work highlights *Kocuria marina* DAGII as a promising biostimulant for enhancing crop productivity while promoting ecological sustainability.

Keywords: *Kocuria marina* DAGII; Cell-free supernatant; Seed biopriming; Biostimulant; Crop improvement; Environmental sustainability.

IP-006

FOREVER CHEMICALS: A PERSISTENT ENVIRONMENTAL ISSUE

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Abstract:

Per- and polyfluoroalkyl substances (PFAS) are a diverse class of synthetic chemicals widely used for their water- and grease-resistant properties in industrial applications and consumer products. Due to their extreme persistence, mobility, and potential toxicity, PFAS have emerged as a global environmental and public health concern even in remote ecosystems. This presentation reviews the current understanding of PFAS distribution in the environment and highlights primary sources such as industrial discharges, fire fighting foams (AFFF), wastewater treatment plants, and landfills. It will also explore the environmental behaviour of PFAS, including long-range transport and bioaccumulation in biota and humans, as well as regulatory developments and health risk assessments. Finally, emerging remediation technologies are evaluated for their effectiveness and scalability.

IP-007

HOLISTIC APPROACH IN ARSENIC REMEDIATION IN LOWER BENGAL

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Abstract:

Arsenic contamination in lower Bengal is not a simple abiotic problem, it is actually a geologic problem because of the gradual entry of the arsenic containing strata below the Bengal Basin, with the increase in the uncontrolled utilization of ground water, there is sinking of deep tube wells, which resulted in the gradual dissemination of arsenic in the drinking as well as irrigational water. The remediation of arsenic may be by physical, chemical and biological in nature, of which bioremediation is the best method because of the cost effectiveness. This investigation gives a holistic method of bacterial remediation, which can be either by deposition inside the cell or change in the oxidation state, i.e. arsenite (+3) to arsenate (+5), which remarkable reduce its solubility in water. Some of the bacteria can convert arsenite to arsine, as a result of which it is converted from solid to gaseous state, thus making the ground water safe for longer period of time. Another group of firmicutes isolated from *Azolla* rhizosphere, had the ability to remove arsenic from the aquatic body to the plant body of *Azolla*. These bacteria also have efficient plant growth promoting activity, which make the aquatic pteridophyte to withstand more stress. This system of growing *Azolla* is quite popular in the paddy field and thus can be widely used as a low cost mitigation technology of arsenic in the paddy fields. Even the meagre amount of arsenic that enter the paddy plants is limited to the root and stem and in no way contaminate the grains. Moreover, the nitrogen fixing *Anabaena* endophyte is not harmed, so the biofertilizer activity and nitrogen supply is not inhibited in any way. This investigation thus indicates a holistic protection from arsenic menace in lower Bengal without any major side effect.

Keywords: Arsenic menace, bio remediation, *Anabaena*, *Azolla*, endophyte

IP-008

WILD EDIBLES AS NATURE-BASED SOLUTION FOR FOOD SECURITY IN CURRENT CLIMATE CHANGE SCENARIO

Sandeep Rawat[1]*, Puja Acharya[1], Sitanshu Das[1], Sultan Mahamud[1], Premika Rai[1], I.B. Bhatt[2]

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Abstract:

Food insecurity and malnutrition are intensifying under climate change, with just 12 major crops supplying about 80% of global caloric intake, and only 30 plant species meeting 95% of food needs. In India, nearly 80% of the rural population and 70% of the urban population survive on diets below caloric requirements. High-yield monocropping not only reduces dietary diversity, but also degrades agro-ecosystems, creating an urgent need for alternative food sources.Wild edible plants (WEPs) offer a promising nature-based solution (NbS) due to their resilience and nutritional richness. More than 675 species are found in the Indian Himalayan Region (IHR), but basic nutritive properties have been documented for only about 200 of the wild edibles consumed there. Among these, nearly 90 species are also used in traditional medicine and small-scale entrepreneurship. We characterized more than 30 wild edibles from the Eastern and Western Himalaya, which provide essential nutrients. A high degree of genotypic (e.g., in *Rubus ellipticus*and *Fragaria nubicola*) and species level variability was recorded in fruit morphological parameters, nutritional and phytochemicals parameters. Rich sources of riboflavin (*Rubustreutleri R. ellipticum, and R. paniculatus*), ascorbic acid (*Hippophae rhamnoides, Ficus palmata, Terminalia chebula, Phyllanthus emblica, Berberis asiatica, Ponticum indica R. treutleri, R. Ellipticus* and *R. nevius*), β-carotene (*Ficus auriculata, R. treutleri, R. paniculatus, R. ellipticus)* phenolics (*Terminalia chebula, Phyllanthus emblica*and *Myrica esculenta*), flavonoids (*Pyaracantha crenulata, Terminalia chebula* and *Berberis asiatica)* and anthocyanin (*Ficus palmata, Berberis asiatica Morus alba, R. nevius, R. paniculatus, R. treutleri*and *Fragaria nubicola*) were identified. Wild edibles also provide fatty acids, antioxidants, and provitamin A carotenoids that are critical for human health. By supporting dietary diversity, genetic crop improvement, and rural income, WEPs align with the Sustainable Development Goals on zero hunger and sustainability, offering a climate-resilient pathway to food security.

Keywords: Wild food, nutritional security, Food security, Climate adaptation, Nature based solution

IP-009

VARIETAL DIFFERENCES IN SALINITY STRESS RESPONSE AMONG INDICA RICE GENOTYPES

Aryadeep Roy Choudhury

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Abstract:

Rice (*Oryza sativa* L.) exhibits genotypic variation in salt tolerance; the high yielding varieties like M- 1-48, IR-29, IR-64, etc. being salt-sensitive, while the low yielding varieties Pokkali and Nonabokra are salt-tolerant. In an attempt to understand the molecular basis of salt-stress response in the aromatic rice Gobindobhog, our data reflected Gobindobhog as a salt-sensitive cultivar, susceptible to high salt induced growth-inhibition, ion imbalances, membrane/oxidative damages with lower expression of stress-tolerant genes, thus showing closer resemblance to M-1-48 than Nonabokra. Comparative protective potentiality of exogenously applied polyamines (PAs), namely spermidine (Spd) and spermine (Spm), in mitigating NaCl toxicity and inducing short-term salinity tolerance were examined. The salt injuries, encountered in the susceptible varieties, were more pronouncedly alleviated and counteracted by the PAs, than the tolerant variety. The rice *Rab16A* (*Responsive to Abscisic acid*), belonging to Group II *late embryogenesis abundant* (*lea*) gene families or the dehydrins (D-11), is up regulated in response to exogenous salt stress, abscisic acid and water deficit. Over expression of *Rab16A* in transgenic tobacco and susceptible rice variety Khitish induced sufficient level of salt tolerance, thereby improving growth and exerting lesser oxidative damages. Electrophoretic mobility shift assay and South Western Blot using [^{32}P]-*Rab16A* promoter with the rice leaf nuclear extract showed that OSBZ8 is the master regulatory bZIP factor interacting with both motif 1 (abscisic acid responsive elements) and motif II (coupling element-like) sequences in the upstream region of *Rab16A* gene, with motif I showing higher binding intensity. All these observations will be highlighted in the presentation with critical analysis of results.

IP-010

COMMUNICABLE DISEASES AND TOTAL HEALTH SOLUTIONS: THE HUMAN, BIODIVERSITY AND THE ENVIRONMENT INTERRELATIONSHIPS

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Abstract:

Ecological and environmental degradations are domain- and dimension-defying. Ecotoxicology derails the delicate environmental balance and impacts the health and wellbeing of the ecosystem. Environmental resilience and surveillance across the biosphere are being increasingly prioritised wherein biotechnological interventions play a critical role. Eco-factors like abiotic components and the biotic communities including wildlife are often overlooked, although these play a crucial role in delicately balancing the complex wellbeing challenges. Initially identified by Wildlife Conservation Society (WCS) in 2004, these affect humans and animals alike ever more. Aboriginal communities across the globe identified, acknowledged and applied holistic, nature-based community approaches to ensure a delicate albeit sustainable ecosystemic balance between humans, animals and plant. Such practices are progressively being emulated by other communities globally. The idea of addressing health issues at the human-animal-environment interface was widely promoted by international health agencies, government and academic stakeholders during the late 1990s and early 2000s, which also became a core agenda in the G-20 summit hosted by India during 9–10 September 2023. The mainstream scientific communities and the policy makers both approved the importance of such integrated approaches, to address health, social, economic and ecological challenges. Agencies like World Health Organisation (WHO), World Organisation for Animal Health (WOAH), Food and Agriculture Organisation (FAO), United Nations Environment Programme (UNEP), Convention on Biological Diversity (CBD) and the United Nations System Influenza Coordination (UNSIC) collaborated on this. Efforts gradually evolved as the 'One Health', widely recognised as a useful tool to address complex health issues and ensure universal wellbeing. It is high time to visualise environment and ecotoxicology from broader perspectives and strive to achieve global health and wellbeing while complying with the UN's global sustainable development efforts. The lecture shall cover the 'one health' and 'total health solution' approaches, and the broader relevance and impact.

Keywords: ecological balance; ecosystem; GSD; one health; sustainable development; total health

IP-011

TOXIC CITIZENSHIP: ENVIRONMENTAL RACISM, POLLUTION, AND SURVEILLANCE IN ROMA GÂRCINI, ROMANIA

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Abstract:

This presentation shows how environmental pollution operates not only as a material hazard but also as a mechanism of social control and exclusion. Focusing on the Roma community of Gârcini, Romania, the study shows how pollution is entangled with policies, histories of marginalization, and practices of surveillance. Environmental degradation in Roma neighborhoods is simultaneously overlooked as a public health concern and hyper-visible as a justification for state monitoring framed around power and security. This paradox produces what I call toxic citizenship—a condition where communities are exposed to hazardous environments while being bureaucratically erased from rights-bearing citizenship. Drawing on ethnographic fieldwork and visual documentation, and informed by Nixon's concept of slow violence, Mbembe's necropolitics, Tsing's damaged landscapes, and Gilmore's racialized infrastructure, the paper reveals how environmental racism is reproduced through both neglect and surveillance. By situating pollution within histories of systemic discrimination, this work calls for a transnational environmental justice framework that challenges dominant paradigms of environmental governance and foregrounds the well-being of marginalized populations.

Keywords: environmental pollution, toxic citizenship, Roma, surveillance, environmental justice

IP-012

EFFECT OF UV RADIATION ON THE COMMERCIAL AND THERAPEUTIC QUALITIES OF TEA (*Camellia sinensis*)

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Abstract:

UV radiation is the main abiotic factor to cause cell molecular damage causing reduction in viabilities of living system creating oxidative stress, as an effect of global warming. Plants are having stationary lifestyle, so can't escape from the UV related oxidative stress and cell molecular damages. But that UV-induced stress could develop robust antioxidant strategies in plants which can further contribute good health benefits towards humankind. Tea (*Camellia sinensis)*is a candidate plant, grows at different altitude of mountain like Himalaya and exposed to variable natural UV radiation doses. As a result the development of antioxidant strategies are variable for different altitude grown tea like Darjeeling tea (grown from 2000 to 7000 ft.msl). The up-regulated antioxidant strategies in tea plants (leaves collected from different altitudes and different valley-grown Darjeeling tea) are due to the enhanced secondary metabolites like flavonoids and its derivative like flavonoid glycoside. That up-regulated flavonoid glycoside serves as the aroma precursor (commercial quality) and renders better antioxidant, antimicrobial, anticancer, anti-diabetic, anti-inflammatory potential which makes it therapeutically valuable. Natural UV doses was replicated with UV-lams in laboratory and factory over one-year old potted tea plant and post-harvest tea leaves which also shows the up-regulation of commercial and therapeutic qualities of tea with enhancement of flavonoids. The metabolomic profiles of tea leaves under natural and artificial UV radiation was mapped with HPLC, ESI-MS, FTIR, Spectrophotometric scan, Spectrofluorimetric scan, TLC, GC-MS analysis. It specifically shows the enhancement of flavonoid Glycoside Rutin which was isolated and purified. Moreover tea polyphenols were conjugated with ZnO to make therapeutically enhanced nano-particle. The transcriptomics and Proteomics analysis data was corroborated with the metabolomics and genomic profiling of the UV exposed-tea leaves indicating the up-regulation of commercial and therapeutic quality metabolites which could develop the high-value tea in field, laboratory and factory.

Keywords: Darjeeling tea, UV radiation, commercial value, therapeutic potential, flavonoid glycoside

Lead Speaker

THE ACTIVITIES OF THE ITALIAN NATIONAL STUDY GROUP (GDS) ON INDOOR AIR POLLUTION BY ISTITUTO SUPERIORE DI SANITÀ

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Abstract:

In Italy, in 2010, the National Study Group (GdS) on Indoor Air Pollution was established by National Health Institute (Istituto Superiore di Sanità – ISS). The Group is composed by the representatives of the ministerial bodies (Ministry of Health, Ministry for the Environment, Ministry of Labor and Social Policies), regions, local authorities and research institutes (ISS, CNR, ENEA, ISPRA, SNPA, INAIL).

The GdS is working to provide shared technical-scientific documents and reports in order to allow harmonized actions at national level.

There are several initiatives by the GdS with the primary aim of filling the knowledge gaps on indoor air pollution (IAP). The main findings of these works have been reported in ISS reports series, available online on the official website of ISS dedicated to IAP.

The GdS has drawn up twelve reference documents for air monitoring strategies for the main indoor chemical and biological pollutants, the role of different sources, the specific characteristics of indoor work environments, energy efficiency activities and different types of indoor combustion. The technical guidelines are provided as national references and may be useful for the definition of national legislation because they take into account the WHO guidelines.

The GdS has also prepared leaflets and podcasts on the subject, which can be downloaded from the institutional website: https://www.iss.it/podcast:

- Informative brochure entitled “The air in our homes”.
- Informative brochure entitled “Carbon monoxide poisoning. How to protect yourself”.
- When there is a bad atmosphere in the home - what to do (or not to do) to improve indoor air quality;
- Carbon monoxide, a silent, invisible and deadly gas. Let's learn how to avoid it.

Currently, the GdS is engaged in the preparation of two technical-scientific reports (ISTISAN Reports) that address the issue of indoor air quality during fires and at contaminated sites, identifying specific monitoring methods and possible health implications.

CP-001(AP)

BIOACTIVE AND PHYTOCHEMICAL ANALYSIS OF BACILLUS SPECIES FROM LONAR LAKE, MAHARASHTRA, INDIA: POTENTIAL FOR INNOVATIVE APPLICATIONS

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Abstract:

Lonar is famous for its impressive Lonar Crater and scenic Lonar Lake, located at 19°58′N76°30′E. The crater features a saltwater lake, 1.8 km in diameter and approximately 137 meters below the crater rim, with a saline pH of 10.5. Formed by a meteorite impact around 50,000 years ago, the lake has recently taken on a stunning pink hue due to high salinity and abundant algae.As the challenge of drug resistance grows, we have isolated antimicrobial substances from Bacillus species found in the lake's water, surface mat, and sediment. Our study identified six Bacillus isolates through various tests and 16S rRNA gene sequencing, revealing three species: Bacillus fusiformis, Bacillus circulans, and Bacillus cereus.This research highlights the potential of these Bacillus species as valuable sources of antimicrobial bioactive substances, offering new opportunities in medical microbiology to address antibiotic resistance and enhance public health.represent a new and rich source of secondary metabolites that need to be explored in medical microbiology.

Keywords: Lonar Lake; *Bacillus* sp.;Antimicrobial; Bioactive substances; GCMS

CP-002(RS)

THE ROLE OF MEDIA IN DISSEMINATING ENVIRONMENTAL CONSCIOUSNESS

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Abstract:

The present study aims at how the different media forms contribute towards environmental consciousness and how the consciousness is perceived by different strata of the society. Print media through newspapers, journals and books has the most effective and the best means of conscientizing starting from school level. And modern investigative journalism often brings to light the consequence of environmental degradation such as tsunami, cloud burst, flood and drought etc, which have adverse effect on the survival of the humanity. The broadcasting platform such as radio, television, internet etc, give a up to date information about the prevailing ecological condition of places and the impending ecological dangers for the immediate response of the civil authorities and policy makers. Digital and social media has become handy in promoting ecological welfare and to educate the younger generation according to their cognitive appealing. Rooted still in oral tradition and performative storytelling, the Folk media has gained whole hearted approval of the rural and indigenous population for their environmental related content. These culturally embedded formats serve as powerful vehicles for ecological narratives, fostering relational and community-driven understanding. Cinematic media including documentaries and eco-fiction, help to evoke emotional engagement and critical reflection. On the level of understanding the role of media in disseminating environmental consciousness, Quantitative analysis revealed significant demographic variations. A Chi-square test indicated a statistically significant gender-based difference in environmental understanding ($\chi^2(2) = 2.425$, $p = 0.027$). Descriptive statistics highlighted occupational disparities: teachers scored highest (mean = 98.33), followed by administrators and retired individuals, while students and domestic workers scored lowest. Urban residents demonstrated slightly higher awareness (96.63) than rural counterparts (96.44), with semi-urban and town populations trailing. Educational qualifications influenced comprehension: B.A. degree holders scored highest (96.66), followed by B.Sc., B. Com., and Class 12 students. Institutional type also mattered—students from girls' institutions (97.70) outperformed those from co-educational and boys' schools, while private institutions showed marginally higher scores than government-aided and government-run counterparts. These findings underscore the need for media interventions tailored to demographic and cultural contexts.

Keywords: Print Media, Broadcasting Media, Digital Media, Folk Media, Environmental consciousness

CP-003(P)

BALANCING FOOD SECURITY AND CLIMATE GOALS: ASSESSING PADDY YIELD AND GHG UNDER ORGANIC AMENDMENT

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Abstract:

Rice is the cornerstone of global food security, yet paddy cultivation in the fields is a major source of greenhouse gases (GHGs), particularly methane (CH_4) and nitrous oxide (N_2O). This scenario is attributed to the fact that paddy cultivation requires the field to be inundated for an appreciable duration during the 'standing crop' period. While numerous studies have investigated the effects of organic and chemical fertilisers on paddy cultivation and GHG emissions, the findings often remain fragmented and frequently context-specific, thus creating uncertainties in developing climate-smart paddy field management strategies. To address this research gap, a meta-analysis synthesising the secondary data from recent peer-reviewed published literature was conducted with strict inclusion criteria, such as: i) the experimental system must be paddy fields, ii) studies must report both the grain yield and GHGs (CH_4 and N_2O) emissions, and iii) the trials must include treatments (separate trial plots) with organic as well as chemical fertilisers. The data were extracted to evaluate the yield responses and GHG fluxes across diverse agroecological settings. The meta-analysis aimed to quantify the trade-offs and synergies between food production and climate mitigation, with particular emphasis on how the organic amendments influenced the pedospheric processes, yield stability and GHGs emission dynamics as compared to the conventional fertilisation pracrices. Preliminary synthesis of the secondary data from the literature indicated that organic inputs may sustain or enhance the yield while moderating CH_4 emissions, although the effects on N_2O were less consistent. By consolidating the evidences across the studies, this work sincerely attempts to advance the understanding of how the management of allochthonous nutrient inputs could shape both the productivity and environmental outcomes in paddy cultivation systems.

Keywords: chemical fertilisers; grain yield; greenhouse gas; meta-analysis; organic amendment; paddy cultivation

CP-004(P)

INTERACTIVE ROLE OF COMPOST AND PGPR IN REDUCING SALINITY-INDUCED STRESS IN MUNG BEAN (*Vigna radiata* L.)

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Abstract:

Saline stress has emerged as a major challenge in agriculture as it drastically reduces the aerability, soil fertility and crop productivity, especially in the costal belts. The detrimental consequences of salt stress are associated with reduced seed germination rates, photosynthesis, crop growth and yield, and elevated generation of reactive oxygen species (ROS), ultimately reducing crop productivity. To address these issues, sustainable management strategies are being explored as alternatives to conventional agrochemicals. In this study, the effects of single and combined applications of plant growth promoting rhizobacteria (PGPR) and organic amendments (compost) were investigated to mitigate salinity stress, improve soil quality and enhance the growth of mung bean (*Vigna radiata* L.). A randomised block design was used in this experiment involving two treatments: control and salt-stressed conditions. The phytological growth parameters (root length, shoot length, shoot biomass, root biomass and weight of leaves), biochemical traits (sugar, proline and chlorophyll contents), and the activities of antioxidant enzymes (superoxide dismutase, catalase and peroxidase) were evaluated. Additionally, the soil physicochemical characteristics and microbial counts were estimated at the end of the study to analyse the effect of PGPR, compost and their synergistic effects. The findings have revealed that synergistic application of compost and PGPR enhanced root and shoot length, plant biomass, chlorophyll content and sugar content. Further, synergistic interaction of compost and PGPR increased accumulation of osmolyte, enhanced antioxidant activity to neutralise ROS and stimulated microbial activity, offering viable solutions to address the negative impact of salinity.

Keywords: Antioxidant enzyme; Compost; PGPR; Salinity; *Vigna radiata*

CP-005(P)

TARGETING BIOFILM REGULATORY PROTEIN SarA OF METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* (MRSA) *IN SILICO*: IDENTIFYING POTENTIAL ANTI-BIOFILM BIOCOMPOUNDS

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Abstract:

The drug-resistant Methicillin-resistant *Staphylococcus aureus* (MRSA) strain is a major cause of chronic wound infections, majorly due to its ability to form biofilm. Staphylococcal accessory regulator A (SarA) protein plays a critical role in the infection and biofilm formation processes by regulating the virulence genes that encode adhesins, toxins and immune evasion factors, while also repressing extracellular proteases and nucleases which enhances the stability of the biofilm. SarA further contributes to resistance against β-lactam antibiotics, making it an ideal therapeutic target. Phytochemicals against SarA were screened in the present study, using molecular docking (PyRx), with 3-D and 2-D visualisation through Discovery Studio and PyMOL to identify key binding residues. Among the various phytochemical compounds tested, stigmasterol, berbamine and aromoline demonstrated favourable binding energies. Berbamine was selected for molecular dynamics (MD) simulation in GROMACS. A 50 ns simulation revealed stable interaction of SarA and berbamine that was supported by RMSD, RMSF, SASA, radius of gyration, increased H-bonding, principal component analysis, and free energy landscape profiling. MM-PBSA calculations confirmed strong binding free energy. Parallel docking with phenol-soluble modulins alpha and beta (PSMα and PSMβ) was performed, though SarA exhibited the most stable interaction with berbamine. Overall, the findings highlight berbamine as a promising anti-biofilm candidate against MRSA, warranting further *in vitro* and *in vivo* validation.

Keywords: berbamine; chronic diabetic wound; dynamic simulation; *in silico*; molecular docking; MRSA; phytochemical; SarA

CP-006(P)

COMPARATIVE ANALYSIS OF THE STARCH CONTENTS IN *CHLORELLA VULGARIS* UNDER WHITE AND RED LED LIGHT

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Abstract:

An estimated 20 million metric tonnes of plastic waste enters the environment annually. Around 23 million tonnes of this gradually reaches the oceans. Studies suggest that almost 99% of these plastics have sunk to the ocean floor. As the world marches towards the advent of Artificial Intelligence and numerous other cutting-edge technologies, a bigger danger seems imminent. Synthetic plastic was first introduced in 1907 by Leo Baekeland as bakelite. Since then, we have reached a point where plastic has become a menace and the world searches for sustainable alternatives. Biodegradeable plastics are emerging as a promising solution. Starch is a very good material for casting bioplastics. Microalgae like *Chlorella vulgaris* are popular as sustainable bioresources due to their high starch and biomass contents. Studies suggest that environmental conditions in which the microalgae grow impact the photosynthetic activity, which gradually impacts the yield of starch, protein and other secondary metabolites. The wavelength of the incident light under which a culture grows is one such factor. This study attempted to establish a comparative study on the effect of Red LED light on the growth and starch content of *Chlorella vulgaris* over the conventional white LED light. Two parallel sets of experiments were set. The cultures were grown under normal white LED lights in a photobioreactor in set 1, whereas the culture was exposed to a Red LED light inside a closed chamber in set 2. The nutrient (BG-11) was similar in both the test sets. Quantitative assays were performed for both the cultures to detect altered starch content after a time interval after inoculation. Results showed significant rise in starch content (per ml of culture) in the culture grown in Red LED light. It could be justified with the concept of absorption maxima of chlorophyll a and b, where red light effectively drives photosystem II activity, promoting carbon fixation and subsequent starch storage. In contrast, white light, although encompassing broader spectrum and distributed energy across non-photosynthetic wavelengths, which gradually led to a relatively low starch deposition although the overall biomass remained high. Further study aims to unleash the potential of spectral optimisation for targeted metabolite production in microalgal biotechnology.

Keywords: *Chlorella vulgaris*; Starch accumulation; Red LED; White LED; Photosynthesis

CP-007(RS)

BIOGAS TECHNOLOGY FOR A SUSTAINABLE FUTURE: BRIDGING GAPS IN SCIENCE, TECHNOLOGY AND TRANSLATION

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Abstract:

Biogas technology represents a viable and scalable vital strategy toward sustainable energy generation coupled with effective waste management. Yet, its large-scale field implementation continues to face scientific, technical and socio-economic barriers. Global dependence on the fossil fuels has intensified environmental degradation and raised the global climate change concerns, creating an urgent need for alternative renewable energy options that could also support the UN's mandated circular economy practices in line with global sustainable development. Biogas obtained through anaerobic digestion of various organic refuse including agricultural residues, animal manure, and municipal waste offers a dual advantage of generating the gaseous renewable energy (biogas) and the nutrient-rich semi-solid to liquid residue (biodigestate) as an organic agricultural input. However, challenges like low bioconversion efficiency, feedstock variability and limitations in reactor (biodigestor) stability are the compelling factors behind its restricted adoption. Researches in recent times have enriched our understandings of the microbial community dynamics, substrate pre-treatment strategies, and innovative biodigestor designs, resulting in improved biogasification, higher methane yield and process resilience. Despite these scientific advancements, a significant gap still persists between the laboratory findings in controlled conditions and the real-world field applications, particularly in rural and decentralised energy ecosystems. The effort is to bridge that gap by integrating scientific insights with technological innovation and practical case studies, highlighting how optimised biogas systems could address local energy demands while reducing the greenhouse gas emissions. By presenting both technological solutions and field-level evidence, the discussion emphasises the critical role of biogas in advancing energy security, environmental sustainability, and socio-economic development, while underscoring its contribution to global climate resilience and sustainability goals.

Keywords: anaerobic digestion**;** biogas technology**;** circular economy**;** renewable energy**;** sustainable development**;** waste management

CP-008 (RS)

BIOTRANSFORMATION OF E-WASTE USING ALGAE: CIRCULAR BIOECONOMY FOR SUSTAINABLE WASTE MANAGEMENT

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Abstract:

Electronic waste (e-waste) has appeared as a fast-growing waste stream globally that poses significant environmental and health risks due to the presence of heavy metals like cadmium (Cd), lead (Pb) and chromium (Cr). Conventional e-waste recycling techniques are often energy-intensive, chemically unsafe and economically unsustainable. This study proposes an innovative, nature-inspired approach to manage e-waste by harnessing the biotransformation potential of genetically-optimised microalgae in a controlled photobioreactor system. Genetically enhanced native *Chlorella vulgaris* strain which over-expressed metallothionein and phyto-chelatin genes that enabled high-efficiency sequestration of toxic metals from shredded printed circuit board (PCB) leachates was employed. A lab-scale, closed-loop algal bioreactor integrated with CO_2 capture and biomass valorisation was used for the purpose. The photobioreactor system achieved above 85% removal of Pb, 79% Cd and 72% Cr from the simulated e-waste effluent over a 14-day cycle, while generating high-protein algal biomass that was suitable as a biofertiliser or for biochar production. The residual algal biomass was thermochemically converted into metal-rich biochar through pyrolysis, enabling potential recovery of valuable metals and carbon-rich byproducts. The integrated system was assessed using life cycle (LCA) and techno-economic (TEA) analyses, indicating a 32% reduction in greenhouse gas emissions and a feasible payback period under three years at the pilot scale. This study introduces a scalable and sustainable bioengineering strategy for circular management of e-waste, combining green biotechnology, waste valorisation and carbon sequestration. The work bridges the gaps between synthetic biology, environmental engineering and circular economy principles, offering a viable alternative to conventional e-waste recycling strategies. Future work will focus on upscaling the system and exploring consortial algal cultures for multi-metal tolerance. The study offers a transformative pathway for low-cost and eco-friendly bioremediation of e-waste, aligning with the global sustainability goals and SDG 12 (responsible consumption and production) of the UN.

Keywords: circular economy; electronic waste (e-waste); heavy metal bioremediation; life cycle analysis; metallothionein; phyto-chelatin; sustainable waste management

CP-009 (RS)

SPATIAL VARIABILITY IN TRACE METAL BIOACCUMULATION IN FINFISH OF THE INDIAN SUNDARBANS: INFLUENCE OF ANTHROPOGENIC PRESSURE

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Abstract:

This study investigates spatial differences in the bioaccumulation of four trace metals, namely zinc (Zn), copper (Cu), lead (Pb), and cadmium (Cd)in finfish from two distinct sectors of the Indian Sundarbans. Four commercially important species, namely Polynemusparadiseus, Tenualosailisha, Liza parsia, and Liza tadewere analysed, sampled from Kakdwip, an urbanized and industrially influenced site; and Jharkhali, a location with less anthropogenicity. Results showed clear spatial variation in metal loads, with Kakdwip samples consistently having higher concentrations. Zinc was the dominant metal, with levels at Kakdwip ranging from 135.44–202.79 mg kg^{-1}, significantly higher than 60.33–94.12 mg kg^{-1} found at Jharkhali. Copper followed a similar pattern, peaking at 89.43 mg kg^{-1} at Kakdwip, with Jharkhali concentrations being 30–40% lower. Even Pb and Cd concentrations at Kakdwip were nearly double than those at Jharkhali. Species-specific accumulation patterns were also evident. Liza tade was the most efficient bioaccumulator, consistently showing the highest levels of all four metals, while Tenualosa ilisha registered the lowest. The elevated bioaccumulation in Kakdwip can be attributed to industrial effluents, urban sewage, and port activities. These findings highlight the fishery vulnerabilities in the western Indian Sundarbans to metal contamination, which has implications for both ecosystem health and human health through dietary exposure. The study underscores the urgent need for biomonitoring and pollution control to protect this vital ecosystem.

Keywords: Bioaccumulation, heavy metals, Hooghly estuary, Indian Sundarbans, trace metal contamination, Finfish

CP-010 (P)

MITIGATING ALUMINUM TOXICITY IN BRASSICA JUNCEA USING MELATONIN-SELENIUM NANOCOMPOSITE: PHYSIOLOGICAL AND BIOCHEMICAL INSIGHTS

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Abstract:

Aluminum (Al) toxicity, a major limitation in acid soil (pH ≤ 5), which significantly hinders the crop growth and yield by influencing reactive oxygen species (ROS) generation and cellular damage. Though Brassica is a well-known heavy metal tolerant species, its response to Al stress remains inadequate. So, this research aimed to evaluate the physiological and biochemical responses of 22 days old *Brassica juncea (L.) Czern.* cv. Karnti seedling exposed to varying doses of aluminium chloride concentration (0-500 µM) over 15 days where the result shows that at 500 µM would be most possible threshold concentration within which plants can induce the stress tolerance in different angles. Different up regulation of antioxidative enzyme studies, malondialdehyde, protein carbonyls, superoxide, hydrogen peroxide levels, cell viability further confirmed Al-induced toxicity. Furthermore, changes in flavonoid accumulation and chlorophyll fluorescence under stress, suggests potential biomarkers for Al sensitivity. So, to mitigate the damage, a novel composite of melatonin and selenium nanoparticles (SeNP-MT) was synthesized and characterized for its physicochemical properties and applied the nano doses from 0.02-0.1 gL^{-1} in combination and singly. Melatonin is a well-known regulator in redox balance and SeNP is also established as a powerful antioxidant. Sulfur/ selenium-based detoxification shared a chalcogenic nature to co-transport mechanism of Se and sulfur in plant metabolism. Being a sulfur rich crop, this composite ultimately helps to up regulate the sulfur metabolism in synergistic way by modulating demonstrated improved antioxidant responses, reduced nuclear damage, better photosynthetic efficiency, and enhanced root viability. The study emphasizes the potential of SeNP-MT composites in augmenting stress resilience by modulating glutathione accumulation, malate metabolism, and sulfur-related antioxidation pathways. Thus, this research is not only representing the Al sensitivity profile, but also to establish a promising mitigation strategy through nano-conjugated antioxidant delivery.

Keywords: Reactive oxygen species (ROS); Selenium nanoparticles (SeNPs); Nano-enabled stress mitigation; Redox homeostasis; Cell viability

CP-011(RS)

SPATIAL HETEROGENITY OF MANGROVE DIVERSITY IN THE INDIAN SUNDARBANS: A QUANTITATIVE APPROACH

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Abstract:

The Indian Sundarbans hosts a spatially heterogeneous mangrove mosaic shaped by tidal hydrology (preferably salinity) and human pressure. We quantified species diversity at ten representative stations, namely Harinbari (Stn. 1), Chemaguri (Stn. 2), Sagar South (Stn. 3), Lothian Island (Stn. 4), Prentice Island (Stn. 5), Canning (Stn. 6), Sajnekhali (Stn. 7), Chotomollakhali (Stn. 8), Satjelia (Stn. 9), and Pakhiralaya (Stn. 10); using the Shannon–Wiener Diversity Index (H′) computed*via* a bespoke C-language routine from field counts. Station-wise H′ values were Harinbari = 2.128972, Chemaguri = 1.964972, Sagar South = 2.213468, Lothian Island = 2.329293, Prentice Island = 2.276217, Canning = 2.094267, Sajnekhali = 2.537247, Chotomollakhali = 2.351553, Satjelia = 2.128785, and Pakhiralaya = 2.364008. The study was conducted during August 2024. Highest diversity occurred at Sajnekhali (a protected sanctuary), followed by Pakhiralaya and Chotomollakhali, indicating comparatively intact mangrove community structure. Moderate values at Lothian Island and Harinbari suggest good diversity under conservation-friendly hydrological settings. Lower indices at Chemaguri, Canning, and Sagar South reflect localized anthropogenic stress (like jetties, markets, fish landing stations, tourism units etc). The observed gradient underscores how protection status and riverine connectivity mediate mangrove diversity across the delta. Thus, integrating station-wise H′ values with management categories provides an operational baseline for prioritizing site-specific conservation and monitoring of mangrove resilience across the Indian Sundarbans.

CP-012(PG)

PLASTICS TO BIO-PLASTICS: A BACTERIAL ENDEAVOUR

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Abstract:

Plastic pollution is one of the most significant issues the world faces today. An estimated 267 metric tonnes of plastic waste is generated every year globally, and when they are carelessly discarded, they convert into microplastics from weathering forces. These particles have an almost ubiquitous presence on the planet and have been detected in the body tissues of humans and other organisms. They impair the photosynthetic efficiencies of plants and accumulate toxic hydrophobic chemicals on their surfaces. Based on these facts, it can be concluded that plastic pollution needs to be tackled fast and efficiently. Many bacteria and fungi have been observed to break down plastics with enzymes into their constituent monomers and even use these as a food source. On the flip side, bio-plastics could be used as a more sustainable and environmentally friendly option as compared to modern fossil-fuel based plastics. This study aimed to amalgamate these processes using a group of bacteria that could chemically re-cycle plastic waste into bacterial bio-plastics. Four unique marine bacterial strains were isolated from a discarded plastic bottle in the waters of the Bay of Bengal that showed the ability to produce hydrolytic enzymes of the cutinase, esterase and laccase families as well as the ability to store polyhydroxyalkanoates (PHA) in the presence of excess carbon. The strains were identified through 16S rRNA sequencing to be *Bacillus safensis*, *Providencia rettgeri*, *Salinicoccus salsiraiae* and *Pseudomonas aeruginosa*. They were used as a consortium to determine polyethylene terephthalate (PET) and polystyrene (PS) valorisation capabilities by growing them in marine broth with the respective plastics being the only sources of carbon in the media. Over a period of six days, it was observed that a weight reduction of 3.414% occurred to the PET and 1.2% to the PS, with the simultaneous extraction of 85.78 µg/mL and 19.8 µg/mL of PHA from each of the set-ups respectively. Scanning electron microscopy was able to reveal the extent of degradation in both the plastics as well as the adherence of bacteria to its surfaces, while FT-IR spectroscopy was employed to determine the chemical nature of the bio-plastics being produced.

Keywords: Consortium, Bacteria, Plastic, Bio-plastic, Enzyme, Metabolism, Polyhydroxyalkanoate, FT-IR spectroscopy, Up-cycling

CP-013(P)

EFFECT OF SEWAGE CONTAMINATION AND PHYSICOCHEMICAL DETERIORATION OF DASSAM FALLS STAGNANT WATER

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Abstract:

Dassam Falls ($23^0 11' 22.56" N$, $85^0 30' 16.52" E$), a prominent tourist destination in the Ranchi district of Jharkhand, is currently confronting significant environmental degradation due to escalating sewage contamination. This study was undertaken to conduct a comprehensive assessment of the physicochemical deterioration of the water and to characterize the associated microbial community. The analysis of water samples revealed a marked deviation from established safety standards given by the WHO, across several key parameters, including pH, Electrical Conductivity (EC) and Total Dissolved Solids (TDS). A particularly critical discovery was the high level of coliform load, which serves as an unequivocal indicator of fecal pollution and poses a substantial public health risk to visitors and the local ecosystem. The effects of this contamination are most pronounced in the stagnant water pockets of the falls, where the absence of natural flow exacerbates pollutant concentrations and facilitates the proliferation of pathogenic microorganisms.

Microbiological analysis revealed a diverse and abundant microbial community. Some of the isolates were named DS1, DS2, DS3 and DS4. As per Hi-Crome Agar colony characterization, the isolates were presumptively identified as *Bacillus firmus, Bacillus*sp, *Bacillus coagulans* and *Bacillus subtilis* respectively. A significant number of isolates demonstrated resistance to common antibiotics. This suggests a potential for the dissemination of antibiotic-resistant genes within the environment. This environmental challenge, however, also presents a unique opportunity. A subset of Gram-positive bacteria isolated from the contaminated samples were found to produce a variety of industrially relevant enzymes, including cellulase, pectinase, protease, amylase, lipase, urease. The enzyme activity of cellulase for DS2 was found to be 0.0246 U/mL and that of pectinase for DS1, DS2, DS3 and DS4 were found out to be 0.1187 U/mL, 0.1027 U/mL, 0.0552 U/mL, 0.1187 U/mL respectively. These enzymes are valuable for diverse biotechnological applications, such as in the formulation of detergents, food processing, and biofuel production. The implications of this research highlights the urgent need for effective waste management and sanitation strategies to safeguard the ecological integrity and public health at Dassam Falls. This study provides a vital baseline for future environmental monitoring and the development of targeted policies to mitigate the adverse effects of sewage pollution, ensuring the long-term sustainability of this natural landmark.

Keywords: Sewage contamination; Coliform bacteria; Antibiotic resistance; Enzyme production; Waste management; Water quality deterioration

CP-014(P)

THE EXTREMOPHILIC ANSWER TO UNFAVOURABLE AGRICULTURAL CONDITIONS

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Abstract:

Six bacterial strains (T1–T6) were isolated from Tsomoriri Lake of Ladakh, particularly four of which are the highlighted (strains T1,T2,T4 and T6) exhibiting extreme resistance to pH (up to 11.6), high salinity (16%), cold (5°C), heat (60°C), UV (240 nm), and heavy metal particularly lead(2000 ppm).The isolates were also checked for their drought tolerance and melanin production abilities, where increased melanin quantity is directly proportional to increased UV resistance. Additionally the four isolates were subjected to 2D (UV+8% salinity and pH-10.8+8% NaCl) and 3D (pH-10.6+8% NaCl+240nm UV) stresses furthermore highlighting their polyextremophilic role. Identified as *Bacillus cereus* (T1 and T2) using 16srRNA sequencing, and T4 was identified as some species of *Pseudomonas*, while T6 identified as *Bacillus* in Hichrome bacillus agar and Hichrome UTI agar media respectively, some strains displayed multidrug resistance (T1 and T6) and produced metallothionein. Strains T2 and T6 showed nitrogen-fixing, phosphorus-solubilizing, and potassium-solubilizing abilities, along with IAA producing capacity,where additionally T2 also exhibits zinc solubilisation property. T1 and T4 both were positive for NH3 production ,and it was also observed that T4 furthermore exhibits IAA and HCN production,highlighting their agricultural potential.Ongoing research explores their genetic and metabolic profiles for applications in bioremediation and sustainable agriculture.

Keywords: extremophiles; polyextremophiles; multidrug resistance; drought tolerance; bioremediation; extremophilic agriculture ; sustainable agriculture.

CP-015(PG)

REVIVING GHORAMARA: SOIL MICROBIOME SOLUTIONS FOR A DROWNING ISLAND

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Abstract:

Ghoramara Island is a rapidly shrinking landmass in delta regions of the Indian Sundarbans, which is a critical example of the socio-ecological impacts of climate change on vulnerable coastal areas. Once a fertile agricultural hub with flourishing rice and betel cultivation, the island has faced dramatic changes due to sea level rise, high salinity, and frequent cyclonic storms, which have severely degraded soil quality and reduced the island's total area from approximately 9 square kilometres in the 1970s to less than 4.5 square kilometres today, thus, creating a pressing need for sustainable solutions. Our study investigates scientific methods to restore agriculture on Ghoramara through a comprehensive study of soil samples from the island. Five soil samples from various regions of Ghoramara Island were analysed for their physicochemical parameters, including pH, electrical conductivity and macro and micronutrients. Indigenous soil microorganisms were isolated from these soil samples and tested for their salinity tolerance. Their enzymatic potential was also tested through various assays, thus highlighting their role in organic matter breakdown. They were further tested for their nutrient-solubilizing property, and were characterized using Hichrome Bacillus and UTI media. The findings indicated the presence of salinity-tolerant, enzyme-producing, and plant-growth-promoting microorganisms in the soil, suggesting their potential use in agricultural practices. In future, this study aims to formulate a plant growth promoting microbial consortium using these native strains which will be tested on field in Ghoramara for its efficiency in improving soil quality, and crop yield. Long-term goals include scaling up of the consortium for large-scale applications, and its incorporation into sustainable agricultural practices. Educating the local farmers on such cultivation will be prioritised. Accordingly, it is hoped that the project would recreate agriculture in Ghoramara Island and also establish a sustainable model for other deteriorated coastal ecosystems.

Keywords: Ghoramara; PGP mixture; agriculture; crop yield; soil quality

CP-016(P)

KERATINOLYTIC ENZYMES ISOLATED FROM EXTREMOPHILIC BACTERIA *Camelus bactrianus*

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Abstract:

Wild Bactrian camels (*Camelus bactrianus*), commonly known as the two humped camel, inhabit the high-altitude cold desert of Nubra Valley, Ladakh, and shed substantial amounts of fur each summer, providing a unique niche for extremophilic bacteria. This study aims to biochemically characterize the fur- and hair bulb- associated bacterial isolates as potential producers of industrially significant enzymes including keratinase, laccase, amylase, protease, lipase and gelatinase, given their broad applications in biotechnology, textile processing, food industries, and environmental bioremediation. Four strains viz. **BCF1**, **BCF2**, **BCF3**, **BCF4** from fur and two strains viz. **BCFR5** and **BCFR6** from hair bulbs were characterized by Gram staining, HiChrome Bacillus, HiChrome UTI agar, and endospore staining. 16S rRNA sequencing confirmed all isolates as members of the genus *Bacillus*. Enzyme production was assessed through qualitative plate assays. Amylase production, using starch as substrate and Gram's Iodine as indicator, was detected in BCF1, BCF2, and BCF3. Protease activity, evaluated on skim milk agar, was observed in BCF1, BCF2, BCF3, BCF4. Keratinase activity, tested on keratin-rich hen feather agar, was present in all six strains. Gelatinase assay on plates containing gelatin as media displayed no visible colony growth formation. The lipase assay, using Tween80 as substrate, yielded a positive result only for BCF4. In the guaiacol-based laccase assay, BCFR6 showed intense reddish-brown halo formation under aerobic conditions; BCF1, BCF3, and BCFR5 showed moderate activity, while BCF2 and BCF4 were inactive. All strains were susceptible to most frontline antibiotics, indicating minimal pathogenic risk and supporting their safe industrial application. The qualitative assays revealed that multiple strains are capable of producing more than one industrially relevant enzyme, suggesting their potential as multi-enzyme producers. Thus, these *Bacillus* strains exhibit diverse industrial potential in paper, food, and textile processing, beverage and detergent manufacturing, wool degradation, pollutant degradation, soil bioremediation, and effluent detoxification. These findings highlight how camel fur-associated bacteria can function as multi-enzyme systems for sustainable industrial processes and environmental bioremediation.

Keywords: Bactrian camel fur; industrial enzymes; *Bacillus* strains; keratinase, antibiotic susceptible

CP-017(UG)

POTENTIAL OF RHIZOSPHERIC BACTERIA FOR SUSTAINABLE TEA CULTIVATION: A MICROBIOMEDRIVEN ALTERNATIVE TO CHEMICAL FERTILIZERS

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Abstract:

Tea is cultivated globally in various countries as one of the leading cash crops including India. It is the second most widely consumed non-alcoholic drink after water and is cultivated from time immortal due to its evident stimulatory effects and numerous additional health benefits. It is particularly manufactured from the roasted leaves, leaf buds and internodes of numerous sub-varieties of *Camellia sinensis* (L. O. Kuntze) plants belonging to the family *Theaceae*. The major concerns of tea cultivation are both abiotic and biotic stresses which lead to a grave decline in tea leaves production and thereby adversely affect the tea industry. In this investigation, rhizosphere soil samples were collected from tea plants of Experimental Tea Garden of Centre of Floriculture and Agri-Business Management (CO-FAM), University of North Bengal (26.706215° N, 88.356097° E). A total of thirteen bacterial strains were isolated from the soil samples and were subsequently screened for further morphological and biochemical characterization. However, out of these thirteen isolates, five bacterial strains named as TS1, TS2, CS1, CS3 and CS8 were proved to be the most promising in respect to NPK (Nitrogen, Phosphorus, Potassium) solubilization, Biofilm production, Zinc solubilisation, HCN production and Cellulase enzyme activity. Antibiotic resistance property and Haemolytic activity on blood agar were also screened. Moreover, it was observed from Cross streak assay that these bacterial strains are compatible with each other which indicates the future potential to formulate an effective microbial consortium with these five high performing strains. Also, further work will be carried out to explore the role of these bacterial strains in enhancing the growth and yield of tea plants while countering various biotic and abiotic stresses. The future research would include further characterization and quantitative estimation of certain biochemical properties of these bacterial strains to efficiently determine their roles as effective PGPR and to provide frontline defence to roots against pathogen attacks. Thus, in future these bacterial strains can be successfully utilised to prepare a bioformulation at a commercial scale which will not only enhance the growth and yield of tea plants but also replace the harmful chemical fertilizers with this cost-effective and environment friendly alternative.

Keywords: Tea; Rhizosphere; PGPR; Bioformulation; Consortium; Biocontrol.

CP-018(AP)

AI, MEDIA, GENES & GERMS

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Abstract:

Human and environmental health today sits at the nexus of technology, biology, communication, and governance. The four critical forces- artificial intelligence (AI), media, genetics and disease biology, particularly the communicable diseases are shaping how societies respond to crises of climate change, pollution, and pandemics. This study proposes an integrated model in which AI tools, media advocacy, genomic insights, and epidemiological surveillance converge to guide more responsive and ethical public and environmental health policies.

This conceptual synthesis draws upon peer-reviewed studies, public health data, and case analyses of AI-driven disease surveillance platforms and environmental monitoring, media-led environmental campaigns as well as its role in misinformation during pandemics, and genomic studies linking susceptibility to environmental pollutants.

Genetic and epigenetic studies reveal that populations differ in their susceptibility to environmental exposures- be it pollutants or infectious pathogens. Zoonotic diseases such as COVID-19, Ebola, and Nipah demonstrate how ecological disruption accelerates disease spill over.In such a global scenario, AI has emerged as a transformative tool in disease surveillance and environmental monitoring. From predicting dengue outbreaks to detecting contaminated water sources through biosensors, AI systems offer unprecedented precision and timeliness. Yet, the value of these predictions depends on their integration into governance frameworks and their communication to the public.

Media serves as the key mediator in this process. Through journalism, documentaries, and social platforms, media amplifies awareness of climate risks and pandemic origins. It can mobilize collective action- as seen in global climate movements- but it can also spread misinformation, which undermines trust in science and policy.

An integrated approach that brings together AI's predictive power, media's communication reach, genetic insights into vulnerability, and an understanding of pathogen ecology can reshape both public and environmental health policy, making them most effective when these four domains inform one another rather than functioning in isolation.

Keywords: AI; genetics; population; news; social media; climate change; pandemic; pollution; infection

CP-019(RS)

CARBON DOTS FROM FLORAL WASTE AS A GREEN NANO SENSING PROBE FOR FOOD SAFETY APPLICATIONS

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Abstract:

Pesticides, widely used in modern agriculture to increase the yield, potentially cause harm to the environment and human lives. Hence, the development of a highly sensitive sensing element to detect pesticide residues is important for food safety and environmental protection. In this work, a simple and sustainable one-pot synthesis of carbon dots from floral waste was performed using the hydrothermal carbonization method at a mild temperature of 180 °C. The chemical composition and morphological characteristics of the synthesized carbon dots were determined using transmission electron microscopy and X-ray photoelectron spectroscopy. The prepared carbon dots contain abundant functional groups, excellent water solubility, and stable photoluminescence. Leveraging these favorable physicochemical properties, the CDs demonstrated high sensitivity and specificity in the detection of the pesticide 4-nitrophenol.Furthermore, carbon dots exhibited strong antioxidant and antimicrobial activities, which were validated through both controlled assays and in vitro studies. It shows sensitive and specific responsiveness towards 4-nitrophenoland good biocompatibility. Overall, this study has illustrated an environmentally friendly and cost-effective strategyfor the synthesis of blue fluorescent carbon dots with remarkable potential for further utilization in sensing devices.

Keywords: Carbon dots; Pesticides; 4-nitrophenol; Sustainability; Sensor; Quenching

CP-020(RS)

FERMENTATION AS A SUSTAINABLE BIO-PROCESS: LINKING TRADITIONAL KNOWLEDGE WITH ENVIRONMENTAL HEALTH

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Abstract:

Fermentation is one of the oldest biotechnological methods, practiced across cultures. The process of fermentation enhances the shelf life, sensory qualities such as flavour, taste, aroma of food as well as improves bioavailability of valuable minerals. As per the International Scientific Association for Probiotics and Prebiotics ISAPP, fermented foods are 'foods made through desired microbial growth and enzymatic conversions of food components.' Nowadays, fermentation is gaining global attention due to its various health-beneficiary effects, particularly in gastrointestinal relevance. Unlike industrialized production process, preparations of traditional fermented products largely rely on the native microbes available from the substrate as well as environmental conditions, where this indigenous microbial community transform raw substrates into safe, nutritious, and culturally significant products. These processes are inherently eco-friendly, generating minimal waste while extending shelf life and reducing the need for synthetic preservatives.

In the current context of global environmental challenges, fermentation is evolving as an excellent model of circular economy where biological resources are recycled back into functional products beneficial for both humans and the ecosystem. Local and indigenous fermentation processes are often based on household or community-level knowledge and valorise simple agricultural products, food by-products, transforming them into functional foods and beverages. This not only prevents wastage, but also improves nutritional quality, bioactive potential and greater stability. At the same time, these processes reduce food waste, mitigate loss of resources and lowers environmental footprints.

The inclusion of traditional fermentation practices into modern sustainability framework has dual advantages- first is the conservation of cultural heritage and secondly advancement of ecological responsibility. As the world faces crisis of climate change, scarcity of natural resources, growing demand of food supply as the global population increases in exponential manner- fermentation provides a naturally reliable solution. In this study fermentation is shown beyond a conventional food processing method- extending its scope towards a regenerative, sustainable pathway connecting traditional knowledge to modern science and impacting human health, cultural heritage and above all securing environmental health.

Keywords: Fermentation; Sustainability; Circular economy; Recycle; Natural resources

CP-021(P)

UNVEILING THE ROLE OF INDIGENOUS RHIZOSPHERE SOIL BACTERIA IN SUSTAINABLE TEA CULTIVATION

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Abstract:

Camellia sinensis, the tea plant, belonging to the family Theaceae, is a globally recognized cash crop having lucrative financial aspects. Tea, the beverage, a natural stimulant, crafted from the dried and roasted leaves of the plant, also offers several health benefits. Tea rhizosphere, of matured tea bushes, provides a natural ecological niche for the microbial interaction governed by a specific environment. But adverse climate and several detrimental diseases significantly impact tea yield and quality. In this present study, an attempt has been undertaken to overview the distinguishing characteristics and features associated with the microbial diversity of the tea rhizosphere soil and their possible effective future implementations in the tea industries. The tea rhizosphere soil samples were collected from tea plants of the Experimental Tea Garden of Centre of Floriculture and Agri-Business Management (COFAM), University of North Bengal(26.706215°N, 88.356097°E) in the month of January 2025. The soil sample was then characterized to determine its physical parameters including pH, water holding capacity, organic carbon content, nitrogen, phosphorous and potassium etc. From this soil sample, ten bacterial strains were isolated and subsequently screened for further morphological, biochemical characterization. These were further screened based on Hemolytic Assay and Antibiotic Sensitivity Assay. Among the ten isolates, six bacterial strains named TS1, TS2, CS1, CS3, CS6, CS8 were proved to be most promising in terms of both PGPR and biocontrol activity. Qualitative detection of nitrogen, phosphorous, potassium, zinc solubilization activity, biofilm production, cellulase enzyme activity, protease activity and volatile compounds like hydrogen cyanide, ammonia production etc. were performed. Quantitative analysis of inorganic phosphate solubilization, phytohormones like- Gibberellic acid, Indole- 3- Acetic Acid production was also evaluated. These bacterial strains were primarily identified as firmicutes, probably *Bacillus* spp. They are part of the natural flora of rhizosphere giving holistic protection to the tea plants. However, detailed research is needed to explore their roles as effective PGPR and biocontrol agents. Thus, it will also correlate their role in stimulating plant growth and protection, so that in future, a proper microbial bioformulation for an effective consortium can be commercially manufactured as an alternative to harmful chemicals.

Keywords: Tea; Rhizosphere; Plant Hormones; PGPR; Biocontrol; Firmicutes; Bioformulation.

CP-022 (RS)

SUSTAINABLE BIOTHERAPEUTIC POTENTIAL OF *KOCURIA MARINA* DAGII CELL LYSATE AGAINST SKIN-ASSOCIATED PATHOGENS

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Abstract:

The skin, as the body's primary protective barrier, is constantly exposed to pathogenic microorganisms and environmental stressors. *Pseudomonas aeruginosa* and *Staphylococcus aureus*, which persist in diverse environments, play a significant role in biofilm formation and the spread of antimicrobial resistance. In parallel, environmental reactive oxygen and nitrogen species induce lipid peroxidation and protein and DNA damage. These processes accelerate skin aging, impair barrier function, and increase susceptibility to skin infections. Thus, effective prevention of dermatological disorders is vital for maintaining skin health and overall well-being. The development of novel and efficient strategies to mitigate pathogenic colonization and neutralize free radicals is therefore of critical importance.This study evaluated the efficacy of cell lysate from the carotenoid-producing bacterium *Kocuria marina* DAGII in inhibiting pathogenic microbial growth and scavenging free radicals. At 2 mg/mL, the cell lysate exhibited potent antimicrobial activity, producing inhibition zones of 15.33 ± 0.47 mm against *S. aureus* and 16.67 ± 0.47 mm against *P. aeruginosa*, along with biofilm inhibition of 77.19 ± 1.35% and 74.61 ± 1.04%, respectively. The cell lysate (2 mg/mL) also demonstrated over 80% scavenging activity against ABTS radicals, indicating its effectiveness in mitigating oxidative stress. Furthermore, MTT assay results showed high biocompatibility, with >90% cell viability in human embryonic kidney cells. This work proposes a sustainable bio-based strategy to combat skin-associated pathogens and environmental reactive species.

Keywords: *Kocuria marina* DAGII; Cell lysate; Skin pathogenic microbe; Reactive species; Sustainable dermatological intervention.

CP-023(P)

CARBON SEQUESTRATION BY PEDOGENIC BACTERIA: MYTH OR REALITY?

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Abstract:

Soil microbes play a crucial role in regulating atmospheric carbon dioxide (CO_2) through both sequestration and release. This study aimed to investigate short-term microbial contributions to CO_2 cycling under controlled conditions and identify the organisms responsible. Soil samples were placed in microcosm setups and monitored daily for CO_2 levels over 10 days using a CO_2 monitor, while environmental conditions remained constant. Microbial isolates were cultured on HiCrome Bacillus Agar and HiCrome UTI Agar to identify species based on colony and Gram-staining characteristics. The findings were as such that CO_2 levels declined sharply from 615.83 ppm on Day 1 to 553.25 ppm on Day 2, reflecting rapid microbial uptake. From day 3 onward, CO_2 levels gradually rose, peaking at 776 ppm by Day 10. Notable mid-study values included 632.33 ppm on Day 3, 669.5 ppm on Day 4, and 714 ppm on Day 7. Interestingly, slight dips in CO_2 on Days 6 (668.33 ppm) and 9 (677.6 ppm) may reflect phases of renewed microbial sequestration. Identified organisms include Gram-positive rods (*Bacillus cereus*, *Bacillus subtilis*, and *Bacillus thuringiensis* or *Bacillus mycoides*), Gram-positive cocci (*Enterococcus faecalis, Staphylococcus aureus*), and Gram-negative rods (*Klebsiella pneumoniae* and one unidentified strain). Findings show that soil microbes act as both CO_2 sinks and sources, with roles shifting over time due to biofilm formation, respiration, and community interactions. The study highlights the complex and changing nature of microbial carbon cycling in soil and suggests that refining microbial community makeup and environmental conditions could help boost long-term carbon capture. Long-term profiling is needed to target microbes with the greatest potential for carbon sequestration.

Keywords: pedogenic bacteria; microcosm study; microbial respiration; carbon capture potential

CP-024(P)

MULTI DIMENSIONAL ROLE OF AQUATIC BACTERIA IN THE LENTIC SEGMENT OF DASSAM FALLS

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Abstract:

Dassam Falls, near Ranchi in Jharkhand, India, is a significant landmark due to its natural beauty and ecological importance. The falls themselves are a major tourist attraction, but their ecological significance lies in the potential for algal blooms due to water pollution from nearby sources. In this study four strains of bacteria were isolated and algae were grown which were extracted from the Dassam falls. The bacterial gram staining was performed and it was found that all are gram positive rods. Strains were grown in Hichrome Bacillus sp. in which DA-2,DA-3,DA-4 are bacillus. Some algae were identified as *Cosmarium, Spirogyra, Diatom, Filamentous green algae, Botryococcus*. Antibiotic sensitivity was performed and found that DA-1 is most antibiotic sensitive. The algae was inoculated in BG11 media for algal growth in sunlight. After this an algal and bacterial co culture was made and Incubate at 25 degree Celsius and Photoperiod: 16:8 (light:dark).Then enzyme assays like amylase, pectinase, cellulase, and urease were performed for the bacteria without algae and the co culture both qualitative and quantitative and it was found that the bacteria was supplying all these nutrients to algae.DA-4 gives urease,DA-3 and 4 give pectinase,DA-2,4 give cellulase,DA-1,4 gives amylase. It was also found that the bacteria were helping in the dead algae recycling and maintaining the algal biomass. Carbon sequestration capacity of algae was performed in the water and found out that the water consist of 24mg/l of CO2 which is maintained by bacteria. The bacteria has a multi dimensional role towards the algal growth of Dassam Falls and helps in different ways to survive and flourish.

Keywords: Dassam falls; *Cosmarium; Spirogyra; Diatom; Filamentous green algae; Botryococcus*, Nutrients; Carbon Sequestration; dead algae recycling; algal biomass

CP-025 (UG)

VALORIZATION OF JUJUBE SEED AS CARBON DOTS FOR QUANTITATIVE DETERMINATION OF METALS

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Abstract:

The growing environmental awareness of heavy metal pollution demands for the creation of sustainable analytical tools to accurately measure these pollutants. In this study, a novel way for exploiting underutilized and a widely accessible agricultural byproduct *Ziziphus jujuba* (Jujube) seeds as a "green" precursor for the facile synthesis of highly fluorescent CDs via a simple hydrothermal carbonization process is demonstrated. The synthesised CDs from jujube seeds showed good photostability and excitation-dependent emission, along with intense blue fluorescence and other desired photoluminescence characteristics. The potential use of these CDs in the quantitative measurement of several metal ions (such as Cu^{2+}, Pb^{2+}, Fe^{3+}) frequently present in environmental samples and industrial effluents was then investigated. Using fluorescence spectroscopy, the interaction between the CDs and several metal ions was examined. The quenching or amplification effects varied according to the metals. The creation of sensitive and selective fluorescent probes was made possible by the notable observation of considerable fluorescence quenching in the presence of particular metal ions. The potential of these bio-derived CDs as efficient and environmental friendly substitutes for traditional metal ion detection techniques was demonstrated by the determination of the linear range of detection and the limit of detection (LOD) for specific metal ions. This research highlights the dual benefit of transforming agricultural waste into valuable nanomaterials for environmental monitoring, contributing to both resource valorisation and the advancement of sustainable analytical techniques.

Keywords: Carbon Dots; Jujube seeds; nanomaterials; Fluorescence spectroscopy; hydrothermal

CP-026(UG)

AGRO-WASTE TO RURAL ENTERPRISE: *Pleurotus ostreatus* CULTIVATION IN A CIRCULAR BIOECONOMY MODEL

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Abstract:

Growing demand for effective agro-waste management and sustainable agricultural practices emphasizes that mushroom cultivation is a feasible bioconversion method. The development of *Pleurotus ostreatus* (oyster mushroom) and its nutritional value were evaluated in this study under home-based, low-cost settings using a variety of agro-waste substrates, such as straw, sugarcane fiber, wood dust, and their mixtures. Using the Lowry and phenol-sulfuric acid assays, five substrate formulations were assessed for mycelial colonization, fruiting performance, nutritional yield, protein and carbohydrate quantification. The results clearly showed differences for productivity that are substrate-dependent. Pure straw allowed multiple flushes plus efficient colonization. The highest yield produced was 73 fruiting bodies across six flushes. The sugarcane-straw mixture generated larger mushrooms with a diameter average of 15.6 cm but reduced overall counts. Wood dust-containing substrates were suboptimal as they prevented the growth of fruiting bodies. Carbohydrate levels ranged from 1.452 to 1.545 mg/mL, with the highest values occurring in sugarcane and straw cultures, whereas protein levels ranged from 0.866 to 1.644 mg/mL, peaking in substrates containing just straw. These results highlight the feasibility of incorporating mushroom farming into circular bioeconomy models, which recycle organic waste and turn agricultural residues into nutritious food. Agro-waste like straw is common in cereal-farming regions and can serve as a substrate for mushroom cultivation, enhancing both nutrition and income. The spent substrate becomes compost for the same fields, creating a cascading use of biological resources where higher-value products are prioritized and by-products reused. This systems-level framework reduces waste, pollution, and environmental impact. Beyond improving food security, sustainable business models centered on waste recycling, economic empowerment, and social reform—such as agri-waste recycling services, dried mushrooms, and nutraceuticals—can strengthen rural bioeconomies. These can scale through farm-to-market networks, cooperative clusters, and women-led self-help groups, creating inclusive opportunities. Oyster mushroom cultivation can improve rural livelihoods, empower marginalized communities, and promote long-term socioeconomic resilience through agro-waste recycling and community-driven enterprises.

Keywords: Agro-waste management; Circular bioeconomy; Mycelial colonization; Nutraceuticals; *Pleurotus ostreatus*; Socioeconomic empowerment; Sustainable rural entrepreneurship.

CP-027(PG)

NOVEL EXTREMOPHILE FROM TSOMORIRI RAMSAR SITE, ITS APPLICATION AND FUTURE PROSPECTS

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Abstract:

High altitude environment such as Tsomoriri Lake in Ladakh, India, represent extreme environments. Microbes inhabiting such ecosystem evolves with unique physiological and metabolic adaptations that makes them able to survival under multiple stresses while indicating potential applications in different scientific and industrial field. Among the bacterial isolates obtained from this highest altitude Ramsar site of India Tsomoriri Wetland water, strain T3 was identified as *Lysinibacillus composti*. These strains were cultured and underwent detailed characterization. T3 (*Lysinibacillus composti*) show highest viability. The bacterial strain can survive variety of environmental stress, temperature of 4°C to 60°C, 10% salinity stress. They show UV (shortwave - 240nm) stress resistance. T3 (*Lysinibacillus composti*) are also alkalophilic, they can survive up to 11.6 of pH. The stains survive lead concentration upto 4000 ppm and iron concentration upto 500ppm. T3 (*Lysinibacillus composti*) produce metallothionein which are small, cysteine-rich proteins that has important role in detoxification of heavy metals. T3 (*Lysinibacillus composti*) from TsomoririRamsar site is capable of surviving in two-dimensional combination stress of pH 10.6 and Salinity 8% and Salinity 8% and UV short wave (240nm). Further they proof their polyextremophilic properties by surviving in three-dimensional environmental stress of Ph 10.6, Salinity 8% and UV short wave (240nm). In addition, T3 (*Lysinibacillus composti*) tested positive for melanin production, a pigment known for UV-protective as well as antioxidative roles, further supporting its adaptation to extreme high-altitude environment. Using Jensen, Pikovskaya, and Aleksandrow media for the nitrogen fixation, phosphorus solubilisation, and potassium solubilisation experiments, respectively, the agricultural potential of these isolates and was evaluated. Strain T3 (*Lysinibacillus composti*) proved positive for all three experiments.T3 (*Lysinibacillus composti*) evaluated to be IAA-positive, HCN positive, NH3 positive, Zn positive highlighting their potential agricultural applications. T3, *Lysinibacillus composti*, exhibited high enzymatic potential. T3 produce multiple industrially relevant enzymes, such as chitinase, ligninase, amylase, protease, lipase, pectinase, catalase, and cellulase, indicating its versatility in biotechnology and industrial field. These traits highlight the dual agricultural significance and biotechnological promise of *Lysinibacillus composti* as a source of agriculture enhancer, robust enzymes and stress protective biomolecules.

Keywords: Wetland; Polyextremophile; Agriculture; Industrial, Pigment.

CP-028(P)

GEOGRAPHICAL IMPACT ON VARIATION IN BIOACTIVE COMPOUNDS IN JUJUBE (ZIZIPHUS SPP.): A COMPARATIVE ASPECT OF NUTRITION AND PHYTOCHEMISTRY

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Abstract:

The jujube (Ziziphus spp.), cultivated widely in Asia, the Middle East, and Africa, has emerged as a functional fruit owing to its high content of bioactive compounds and potential therapeutic uses. Considerable heterogeneity in the nutritional and phytochemical composition of jujube exists as a result of environmental conditions, cultivar variation, and geographical origin. In Chinese jujube (Z. jujuba), comparative research indicates significant differences in phenolic constituents, flavonoids, triterpenic acids, organic acids, and cyclic adenosine monophosphate (cAMP) among cultivars and growing regions. Interestingly, desert-cultivated cultivars have higher accumulations of osmoprotectants and secondary metabolites, whereas irrigated region cultivars usually have greater phenolic and flavonoid content, highlighting significant environmental regulation of bioactives. Moreover, phenolics, pigments, and antioxidant capacity decline during fruit ripening, as reported, suggesting temporal dynamics of nutritional quality together with spatial heterogeneity.

Concurrent studies in Indian jujube (Z. mauritiana) exhibit a characteristic bioactive profile with high total phenolics (172–328 mg GAE/100 g) and high ascorbic acid levels (19.5–99.5 mg/100 g). Special compounds including berberine, quercetin, kaempferol, β-sitosterol, and diosgenin are responsible for the species' antibacterial, anti-inflammatory, and antioxidant activities. The hardiness of Z. mauritiana under arid and semi-arid conditions further supports diversity of secondary metabolites, reflecting a close correlation between environmental conditions and phytochemical richness.

Comparative phytochemical analysis of China, India, and Middle Eastern jujube fruits repeatedly shows differences in flavonoid subclasses and triterpenoids strongly controlled by the climate, soil mineral nutrient content, and agricultural practices in addition to vitamin C and polysaccharide contents. Dehydration of jujube leaves most of its bioactive material—particularly amino acids, polysaccharides, and flavonoids—though the composition remains location dependent. These results together emphasize location as a primary driver of jujube's nutritional and functional properties, with cultivar, developmental stage, and environmental stressors interplaying to influence its bioactive profile. Robust regional characterization and standardization are therefore critical for maximizing jujube value in nutraceutical and functional food applications.

Keywords: Jujube (*Ziziphus jujuba, Ziziphus mauritiana*); Bioactive compounds; Geographic variation; Nutraceutical potential

CP-029 (RS)

REVEALING THE HIDDEN RISKS OF AGRICULTURAL CONTAMINATION OF THIAMETHOXAM: IN VITRO ANALYSIS OF TOXICOLOGICAL IMPACTS ON *TUBIFEX TUBIFEX*

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Abstract:

The present study investigated the severe effects of the widely used neonicotinoid thiamethoxam on the bottom-dwelling oligochaete *Tubifex tubifex*. TMX is frequently used as a seed treatment and foliar spray to manage insects and pests such as leafhoppers, aphids, and whiteflies. The study assessed the TMX lethal effects by analyzing mortality, behavioral responses, and physiological activities. Acute toxicity testing revealed LC_{50} values of 44.428 mg/L, 31.801 mg/L, 31.801 mg/L, and 11.631 mg/L at 24, 48, 72, and 96 hours, respectively. Long-term sublethal exposure to TMX causes the induction of oxidative stress and nitrosative stress by the elevation of reactive oxygen species (ROS) and nitric oxide species (NO). Neutral red retention time (NRRT) and MTT assays show decreased lysosomal membrane stability and mitochondrial dysfunction. Additionally, exposure to TMX causes a notable elevation of antioxidant defense enzymes, catalases (CAT), superoxidedismutases (SOD), protein oxidation level through protein carbonyl (CP) adduct formation, lipid peroxidation level (LPO), level of lactate dehydrogenase (LDH), indicating tissue damage, glutathione peroxidase (GPx), and glutathione-S-transferases (GST) level. On the other hand, a significant decline in total protein content (TP), glutathione (GSH), glutathione reductases (GRs), and acetylcholine esterases (AChE) levels indicates the stressful condition due to chronic exposure. The integrated biomarker response (IBR) index, applied to summarize the multi-biomarker responses through a star plot, calculatesthe area indicates the overall stress intensity of TMX to tubificid worms.

Keywords: *Tubifex tubifex*, Thiamethoxam, chronic exposure.

CP-030(P)

BIOCONTROL EFFICACY OF HIGH ALTITUDE EXTREMOPHILE

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Abstract:

The Pangong Tso is a high-altitude brackish water 134 km long lake with a maximum depth of 100 m extending from eastern Ladakh in India to western Tibet. It is situated at an elevation of 4225 m. It is a part of the Himalayan cold desert ecosystem. It is a landlocked basin separated from the Indus River basin. High-altitude lakes are comparatively pristine with a unique mixture of microbial diversity selected by severe environmental pressures that reduce species richness and increase prokaryotic dominance. The lake ecosystem is subjected to severe environmental stresses including multiple freeze-thaw cycles, high salinity, exposure to ultraviolet radiation and very low nutrient content. The electrical conductivity (EC) of the water sample from Pangong is 2.43 μS/cm. Total dissolved solids (TDS) are 1.21 ppm. The dissolved oxygen (DO) of the water sample is 8.1 ppm. The pH of the water is 9.06 i.e., the water is alkaline in nature. The microbial load of the water sample is 6.06 x 10^2 CFU/100 ml. Our study mainly aims to characterize the culturable *Micrococcus luteus*, from Pangong Tso. This microbe is a coccus shaped alkaliphile. It is tolerant to ultraviolet radiation due to production of the pigment carotenoid and has shown growth at high salt concentrations (up to 12%). The extremophilic properties of the bacterial community can be exploited in several fields of research and application. Antibiotic resistance sensitivity tests have shown that although they are resistant to some of the common antibiotics including Linezolid, Cotrimoxazole, Tetracycline, Meropenem, Ampicillin, Cefotaxime SD724-1VL and Cefotaxime SD040-1VL but it is sensitive to most of the others. It has also shown production of volatile organic compound (VOC) HCN which inhibits the growth of fungi (*Fusarium sp.*). Due to this property, it can be exploited as a biocontrol agent. More qualitative and quantitative assays are underway to understand its pigment production and explore the scope of its biocontrol efficacy. The microorganisms of the cold habitat have drawn tremendous attention due to the complex secondary metabolisms assisting their survival, adaptation, and evolution. Perhaps these cold habitats could be a rich source of new taxa, genes, and metabolites with remarkable biotechnological applications.

Keywords: Extremophile; Alkaliphile; UV; Carotenoid; Biocontrol

CP-031(RS)

CHEMICAL PROFILING AND THERAPEUTIC POTENTIAL OF *Crepidium acuminatum*

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Abstract:

Crepidium acuminatum (family orchidaceae, Ayurvedic name:Jeevak) is one of the eight medicinal plant of Astavarga group of rejuvenating herbs. The plant is valued for its restorative properties, particularly in enhancing vitality, immunity, and longevity.Despite the its potential for ethno-medicine, in-depth research on chemical characterization has not been carried out. In this study, complete metabolomic profiling of the *C. acuminatum* through HR-LCMS Orbitrap analysis wasconducted using two solvent systems (methanol and ethyl acetate). A total of 583 distinct metabolites, including primary and secondary metabolites were identified. Among, secondary metabolites, alkaloids, glycosides, terpinoids, flavonoids, and phenolics were the dominant groups. Methanol extracts extracted higher number of compounds (434 nos.) than ethyl acetate (301 nos.).Therapeutical potential of the species was determined using network pharmacology approach. More than 8% compounds were found suitable after *in-silico* ADMIT analysis. Oxidative stress and diabetes was recorded as major disease targets compound–disease network analysis. Several significant compounds were found to exhibit potent binding affinities for anti-oxidative and anti-diabetic properties using molecular docking analysis. This study demonstrates therapeutic potential of many compounds present in the species as a pharmacologically relevant orchid with promising anti-oxidant and anti-diabetic qualities backed by an abundance of metabolomic and *in-silico* data. This study highlights both the traditional uses and prospective future drug development tactics from the plant species. As the plant falls under the endangered category, conservation and sustainable use are also taken into consideration.

Keywords: *Crepidium acuminatum, In-Silico,* Metabolomics, Network pharmacology, Molecular docking,

CP-032(RS)

ENVIRONMENTAL SUSTAINABILITY THROUGH EXTREMOPHILES ISOLATED FROM GANGOTRI AND YAMUNOTRI

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Abstract:

Hydrocarbons are recalcitrant hazardous environmental contaminants consisting solely of carbon and hydrogen. These are also chief components of many types of fuels because of the catenation property of carbon. There is an immediate need for remediation due to the rise in hydrocarbon-related environmental pollution brought on by society's modernization and rapid population growth. Hydrocarbon-degrading bacteria are ubiquitous and can use these substances as sources of carbon and energy. Here, previously well-characterized five extremophiles have been selected for the study. *Bacillus subtilis* BRAM_G1(MW00633), *Bacillus subtilis* BRAM_G2 (MT998280), *Bacillus subtilis* BRAM_G3 (MT998617) were isolated from river Ganga; Gangotri ghat; and *Mesobacillus subterraneous* BRAM_Y2 (MW002419), and *Brvibacillus parabrevis* BRAM_Y3 (MW081864) were isolated from Yamunotri; Surya kunda hotspring. After morphologically characterizing we have found BRAM_G1, BRAM_G2, BRAM_G3 gram positive rods. Whereas, BRAM_Y2 and BRAM_Y3 were found to be gram variable rods. 16S rRNA sequence analysis identified them as *Bacillus subtilis* BRAM_G1, *Bacillus subtilis* BRAM_G2, *Bacillus subtilis* BRAM_G3, *Brvibacillus parabrevis* (MW081864), *Mesobacillus subterraneous* BRAM_Y2 (MW002419), and *Brvibacillus parabrevis* BRAM_Y3 respectively. The current investigation aims to optimize the growth conditions in the presence of aliphatic and aromatic hydrocarbons and characterize the bacterial species with respect to their hydrocarbon-degrading nature. The isolates were examined for their growth and hydrocarbon degradation ability in minimal salt media supplemented with medium chain aliphatic hydrocarbon n-hexadecane and mono-aromatic hydrocarbon as the sole carbon source. The isolates were characterized through biochemical tests. Through the investigation, we have found that G2 (83.5%) and Y2(74.5%) showed the maximum n-hexadecane degradation, and G2 (68%) showed toluene degradation at 37°C in alkaline pH 8 and pH 9, respectively. *Mesobacillus subterraneus BRAM_Y2 (MW002419)* exhibited very high cell surface hydrophobicity (CSH). Both strains showed a high ability to produce surfactin and exhibited bio-emulsification activity. Therefore, our study unambiguously indicates that the isolates can potentially be employed for bioremediation to clean up hydrocarbon-polluted areas.

Keywords: Polyextremophile, hydrocarbon degradation, surfactin, bio-emulsification.

CP-033(P)

BIOCHEMICAL CHARACTERIZATION OF FRESH AND MANUFACTURED MEGHALAYA TEA (*Camellia sinensis*) LEAVES: A MULTI-TECHNIQUE ANALYSIS OF PROCESSING-INDUCED PHYTOCHEMICAL AND BIOACTIVITY TRANSFORMATIONS

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Abstract:

Meghalaya, a North-East state of India is also a tea growing place. The leaves were collected from Upper Shillong Tea Farm, Meghalaya (4900 ft. msl) and the manufactured MEG-TEA was collected from the attached factory. This study presents a comprehensive biochemical characterization of fresh and manufactured Meghalaya tea (*Camellia sinensis*) to elucidate the phytochemical and bioactivity transformations induced by the manufacturing process. A multi-technique analytical approach was employed, including spectrophotometric assays for total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activity, along with chromatographic profiling via high-performance liquid chromatography (HPLC) and thin-layer chromatography (TLC). Additionally, Fourier transform infrared (FTIR) spectroscopy was used for molecular-level structural analysis, and an antimicrobial assay was performed to assess biological activity. The findings demonstrate that the manufacturing process causes a fundamental alteration in the tea's biochemical profile. While the manufactured leaves exhibited higher TPC and TFC values, the fresh leaves displayed a significantly greater antioxidant capacity and superior antimicrobial activity. This discrepancy is attributed to the enzymatic oxidation of primary polyphenols, such as catechins, into secondary, more complex compounds like theaflavins and thearubigins. The chromatographic and spectroscopic data further corroborates this transformation, revealing entirely different compound profiles between the two sample types. The study concludes that the processing of Meghalaya tea, while yielding a distinct product with characteristic sensory attributes, results in a quantifiable shift in its health-related bioactivities.

Key Words: MEG TEA; tea leaf; manufactured tea; antioxidant activity; antimicrobial activity; catechin

CP-034(RS)

SEASONAL VARIATION OF AMBIENT BIOAEROSOL AROUND URBAN LENTIC ECOSYSTEM

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Abstract:

Ambient bioaerosols are airborne particles of biological origin suspended in the atmosphere. They have been found to play active role in causing various respiratory diseases and pose different health risks. Bioaerosols are influenced by meteorology and various anthropogenic activities. Ambient urban bioaerosol across Kolkata has been scantily investigated. In this study, the ambient bacterial population has been sampled and characterised for one year to understand their impact on environment. The sampling was carried near urban lentic ecosystems with the help of a TISCH Six Stage Anderson Sampler. Meteorological data was obtained from the nearby CPCB Station. The total bacterial concentration had a positive correlation with PM10 throughout the sampling process. Bacterial concentration indicated positive correlation with rainfall during the monsoon season. The total culturable bacterial concentration present in the ambient air was found to be higher around the winter months reaching upto 3500CFU/m^3 and lowest in the premonsoon season, approximately 250CFU/m^3. Characterisation of these culturable bacterial strains revealed higher percentage of Gram-positive coccus bacteria followed by Gram-positive bacilli and a lower percentage of Gram-negative bacilli present among the isolated strains. Biofilm producing bacterial isolates (70%) were prevalent in premonsoon, whereas their percentage reduced in the ambient air during monsoon and winter. Although siderophore producing bacterial isolates were present in all seasons but the highest percentage was found in the premonsoon season, approximately 80%. Extracellular hydrolytic enzyme characterisation indicated protease, lipase, DNase producing bacterial isolates were dominant in the post monsoon season as compared to beta haemolysin producing bacterial isolates dominating over the winter months. It primarily includes *Streptococcus, Staphylococcus, Escherichia, Klebsiella* and *Bacillus* which have been isolated and preliminarily identified from our bacterial samples. This indicates the presence of potential pathogenic bacteria in the ambient air. On further analysis of the metagenomic data, phylum *Pseudomonadota, Actinomycetota* and *Bacillota* were dominant, whose members have been identified in the collected samples and known for their pathogenicity. The study thus indicates the presence of opportunistic pathogens in the ambient air causing potential health risk for immune compromised people or people with weakened immune system.

Keywords: Ambient bioaerosol, urban ecosystem, bacterial isolates, meteorological data.

CP-035(P)

CHARACTERIZATION AND APPLICATION OF ENDOPHYTIC BACTERIA FROM GROWING PROP ROOT OF *Ficus benghelensis*

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Abstract:

Ficus benghelensis commonly called the banyan tree is known to show extensive branching and development of aerial roots or prop roots. These prop roots grow long lengths extending from the main branches high above the ground till it reaches the soil to eventually form new branches. This unique growth pattern can be attributed to the complex interplay between various plant growth promoting hormones along with the influence of the endophytic bacteria living in such roots. This study focuses on the characterization of bacteria isolated from a young prop root of *Ficus benghelensis* and their potential application in root growth promotion. A growing prop root was collected and subjected to surface sterilization to ensure that only endophytic bacteria are isolated. Five different bacterial colonies were isolated from different parts of the root. Several biochemical tests were performed on them. The bacteria were screened for several plant growth promoting traits such as indole-3-acetic acid (IAA), ammonia production as well as their ability to solubilize nutrients like phosphate, zinc, potassium, etc. Three among the five bacteria were found to solubilize phosphate, four of them can solubilize zinc and nitrogen. Gram staining was performed followed by streaking on HI chrome bacillus agar media. All of them were found to be Gram positive bacillus like *Bacillus coagulans, B. subtilis,* and *B. cereus*. Enzymatic assays were also performed for cellulase, pectinase and amylase. The values for pectinase enzyme activity of the individual bacterial strains are 19 μM/min, 16 μM/min, 13 μM/min, 12 μM/min, which indicate a good pectin degrading property. Thus, the findings of this study will provide a more in-depth understanding of the intricate relationship between the Banayan tree and its endophytes, which may lead to new insights into sustainable agriculture and forestry.

Keywords:

Prop Roots; Endophytic Bacteria; Sustainable Agriculture; Plant Growth Promoting Traits

CP-036(RS)

PREVENTION OF DRUG ABUSE: SUSTAINABLE ANSWER FROM PLANT METABOLITE

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Abstract:

The therapeutic potentiality of traditional medicinal plants across the Eastern Himalaya plays a crucial role in treating antibiotic-resistant bacteria by preventing exponential use of drugs. This research looks into the antimicrobial potential of bioactive substances obtained from two medicinal plants: *Osbecki*a *octandra* and *Melissa axillaris.* A variety of beneficial bioactive phytochemicals were examined by High Performance Liquid Chromatography (HPLC) and Liquid Chromatography-Mass Spectrometry (LC-MS). LC-MS analysis revealed the presence of Caffeic acid, P-Hydroxybenzoic acid, Salicylic acid, β Coumaric acid, 5,6-Dihydroxy 3,4,7-trimethoxy-flavone, Sakuranetin, 4-O-Methyl- epigallocatechin, 7-Oglucuronide, Gallic acid dilactone in ethanolic plant extract of *Osbecki*a *octandra* and Vanillic acid, Hydroxybenzoketone- 2,3-Dihydroxy-1-guaiacylpropanone, Gallic acid, Coumaric acid, Hydroxybenzoketones 2,3-Dihydroxy-1-guaiacylpropanone, 5,6-dihydroxy 3,4,7-trimethoxy-flavone, Flavanone-8-Prenylnaringenin, Gallocatechin gallate, 4'-O-Methyl-epigallocatechin, 7-Oglucuronide, Naringin 4'-O-glucoside, Quercetin 3-O-xylosylrutinoside in ethanolic plant extract of *Melissa axillaris.* These findings also supported by FTIR vibrational characteristics.Several of these beneficial secondary metabolites are responsible for antimicrobial properties. Plant extracts of *Osbeckia octandra* and *Melissa axillaris* revealed their promising antioxidant potential and antimicrobial activity even at the low MIC value of 39 µg/ml against *Staphylococcus aureus* MRSA, *E. coli* ATCC and *E. Coli* MDR. Investigation also revealed that solvent extracts of novel plants were effective against *E. coli* MDR when combined with common human antibiotics such as Polymyxin-B, Meropenem, Tigecycline, and Imipenem. Thus, futuristic therapy against MDR will be a combination of antibiotic and phytometabolite. This will not only reduce the menace of antibiotics but also keep target pathogen under control without any major health hazard.

Keywords: antimicrobial potential; *Osbeckia octandra;Melissa axillaris*; Liquid Chromatography-Mass Spectrometry; antibiotics

CP-037(P)

BACTERIAL REMOVAL OF HEAVY METALS IN AN URBAN LENTIC ECOSYSTEM

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Abstract:

Industrialization and urbanization have led to widespread contamination of heavy metals in urban lentic systems such as ponds or lakes, causing ecological and human-health threats. These pollutants accumulate within the sediments and water column, posing lethal hazards on aquatic life and in course enter the aquatic food chains, causing long-term ecological and health issues. Biological methods, notably microbial remediation, pose a cost-effective and environmentally friendly alternative to metal remediation compared to the conventional physicochemical approach. This study explores the metal tolerance of five bacterial strains: IS4(1), IS5(3), IS2(1), & IS3(1) isolated from four industrial water bodies(IS4, IS5, IS2 & IS3, respectively) and DS2(1) isolated from a domestic water body(DS2), located at Bagi and Bhasa, South 24 Parganas, South Kolkata. The sampling sites were respectively impacted by Pb^{2+}, Cd^{2+}, Cu^{2+}, and Ni^{2+}. Each isolate was screened to exhibit effective tolerance against its target metal (IS4(1):Pb2+, IS5(3): Cd2+, IS2(1): Cu2+, IS3(1): Ni2+ and DS2(1): Ni2+). Isolates DS2(1) and IS3(1) showed tolerance at lower concentrations of nickel but strong inhibition at elevated levels, similarly for copper, isolate IS2(1) showed tolerance at low levels and complete inhibition at higher concentrations. However, in case of lead, isolate IS4(1) showed tolerance throughout the range of concentrations with gradual decrease in growth, whilst for cadmium, isolate IS5(3) was strongly inhibited across all concentrations. Thus, the capacity of the tested strains to endure various metal concentrations and the efficiency they showed for the removal of heavy metals strongly illustrate their potential application for bioremediation strategies.

Keywords: domestic water; industrial water; heavy metal; lentic ecosystem; metal tolerance; inhibition

CP-038(PG)

BACTERIAL ACTIVITY IN NUTRIENT RECYCLING AND HYDROCARBON DEGRADATION IN THE DYNAMIC SALINITY OF MANDOVI RIVER

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Abstract:

The most significant west-flowing rivers is the Mandovi river situated in Goa, India, where the Arabian Sea meets, influenced by both the tides and heavy monsoon rainfall from the Western Ghats gives an unique blend of saltwater and freshwater creates a rich and diverse ecosystem. Therefore it serves as an important natural resource for research into microbial communities, biochemical processes, and organic matter breakdown. This study aimed to isolate bacterial strains from the Mandovi estuary with a focus on hydrolytic enzymes for checking the possibility of nutrient recycling and petroleum-degrading enzyme activities. Screening for hydrolytic enzymes including cellulase, xylanase, amylase, catalase, pectinase, citrate-utilizing enzymes, and chitinase were done. These enzymes play a critical role in the breakdown of plant-derived polysaccharides from sources like mangrove litter, agricultural runoff, and decaying vegetation. In the present study, total 7 strains were isolated and among them the best three strains had shown the presence of all the hydrolytic enzymes, exhibit extremophilic trait that is catalase, amylase, xylanase, cellulase which signifies high adaptability, broad metabolic versatility, presence of chitinase and protease signifies defensive and predatory capabilities. The positive outcome of qualitative assay of hydrolytic enzymes ensures the breakdown of organic matter and that leads to release of essential nutrients ensuring nutrient recycling that sustains microbial growth, supports primary producers and ultimately maintains the productivity and ecological balance of the Mandovi River ecosystem and such enzymatic properties could be harnessed as valuable resources for diverse biotechnological applications. In addition to natural organic matter degradation, the river faces significant petroleum hydrocarbon pollution arising from shipping, mechanized fishing, port activities, and tourism. To evaluate the hydrocarbon-degrading potential of our isolated strain under such environmental conditions, a hydrocarbon degradation assay was performed. Isolates were cultured on Minimal Salt Agar (MSA) medium supplemented with 2% petrol. Although the current observation is yet to be completed, previous studies have reported significant petroleum contamination in this particular water body. This test aims to determine the strain's metabolic ability to utilize hydrocarbons as a carbon source, thereby indicating its potential application in bio-remediation of petroleum-contaminated environments.

Keywords: Mandovi River; hydrolytic enzymes; nutrient recycling; petroleum degradation; Extremophiles.

CP-039 (PG)

VALUE ADDITION AND POST-HARVEST MANAGEMENT OF LOCAL ORANGE AND DALLE CHILLI OF SIKKIM FOR LIVELIHOOD ENHANCEMENT

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Abstract:

Mandarin orange (*Citrus reticulata* Blanco) and dalle chilli (*Capsicum annuum* L.) are two culturally and economically significant crops of Sikkim. Mandarin oranges are valued for their unique delicious taste, easy-to-peel segments, and wide traditional use, while round dalle chilli from the region, holds a Geographical Indication (GI) tag owing to its intense pungency, distinctive flavor, and bioactive richness. In present work, quality parameters of fruits and develop value-added products were evaluated. Morphological and phytochemical profiling, including estimation of phenolics, flavonoids, vitamin C, carotenoids, and antioxidant activity (DPPH, ABTS, FRAP assays), was carried out. More than 05 value-added products, such as marmalade, squash, orange peel candy, and Dalle chilli pickles, were standardized through varying treatments of temperature, time, and ingredient composition. Techniques including oven-drying, pasteurization, and formulation optimization were employed to enhance stability, nutritional quality, and sensory attributes. Further, nutritional analysis of dalle chilli pickles prepared under different treatments (S1–S12) was conducted, where variations in ingredients, preservatives, and storage conditions influenced nutrient composition. For instance, treatment S1 exhibited higher caloric value (180.8 kcal/100 g) with fat (17.4 g), carbohydrates (5.95 g), and protein (0.1 g); while S2 and S3 formulations showed comparatively reduced fat content (10.2–10.7 g) and higher carbohydrate levels (6.4–8.77 g), with protein values of 0.2 g. These results indicate that product formulation significantly affects nutritional density and storage stability, thereby providing scope for developing nutritionally balanced and consumer-preferred variants. Agro-wastes like orange peel and cardamom husk were innovatively repurposed to promote zero-waste utilization. In mandarin orange, fruit drop, a major cause of productivity loss, was addressed through immediate processing into bioenzymes, fermented beverages, and other products. Improved storage, packaging, and handling practices were identified as essential for extending shelf life and marketability. The findings highlight that systematic value addition enhances product diversity, nutritional quality, and shelf stability while providing sustainable income opportunities. Integrating traditional knowledge with modern processing and post-harvest practices offers an effective strategy for livelihood enhancement, resource efficiency, and cultural preservation in Sikkim.

Keywords: Mandarin orange, dalle chilli, value addition, post-harvest management, Minor Forest Products

CP-040(P)

INDOOR AIR QUALITYIN INDIA: CURRENT RESEARCH, EMERGINGCHALLENGESAND SUSTAINABLE SOLUTION

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Abstract:

Indoor air quality (IAQ) is a critical determinant of public health, particularly in rapidly urbanizing and densely populated regions. Recent environmental studies indicate a significant deterioration in IAQ, driven by household combustion processes, inadequate ventilation, and the off-gassing of volatile organic compounds (VOCs) from domestic products and materials. In Indian households, the continued use of solid biomass fuels (wood, dung, crop residue) and kerosene for cooking—especially in low- and middle-income settings—remains a primary source of indoor air pollutants, including particulate matter ($PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2), and polycyclic aromatic hydrocarbons (PAHs). Even in urban households using liquefied petroleum gas (LPG), incomplete combustion and poor kitchen ventilation contribute to elevated levels of indoor contaminants. Prolonged exposure to these pollutants is associated with adverse health outcomes such as chronic obstructive pulmonary disease (COPD) and acute lower respiratory infections. Women and children are disproportionately affected due to their extended time spent in domestic environments. Recent findings also link indoor pollution to non-respiratory conditions, including neurocognitive decline and hematologic disorders such as anaemia. Fine particulate matter and associated toxins cross the blood-brain barrier, impairing cognitive function, while chronic exposure to CO and other pollutants impairs haemoglobin function and oxygen delivery. Indoor PM2.5 concentrations in Indian megacities like Delhi frequently exceed outdoor levels, particularly during winter months, exacerbated by poor ventilation and thermal insulation practices. Moreover, recent studies have revealed that individuals may inhale up to 68,000 microplastic particles daily indoors, compounding existing health risks. The cumulative burden of exposure necessitates urgent public health interventions, including the transition to cleaner cooking technologies (e.g., electric or induction stoves), architectural designs that enhance natural ventilation, and stringent IAQ monitoring frameworks. Raising awareness about the multifactorial sources and health implications of indoor air pollution is essential for reducing exposure and mitigating long-term health impacts, especially among vulnerable populations in urban and semi-urban India.

Keywords: IAQ; air pollution; health; particulate matter; monitoring; respiratory diseases

CP-041(PG)

MULTIFACETED ROLE OF HIGH-ALTITUDE *Pseudomonas stutzeri* IN THE CONTROL OF ORGANIC AND INORGANIC POLLUTION

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Abstract:

High-altitude lakes are generally regarded as pristine environments but increasing tourist activities are altering their ecological balance. Pangong Tso is a 134 km long brackish lake located at 4,225 m in the Himalayan cold desert ecosystem of Ladakh. The lake is characterized by alkaline water (pH 9.06), high salinity, low nutrient content, and severe climatic conditions including freeze–thaw cycles and intense ultraviolet radiation. These stresses have led to the selection of many polyextremophiles with several notable adaptations. Tourism has introduced additional pressures, particularly the presence of antibiotic-resistant bacteria.From the water sample of Pangong Tso , a strain of *Pseudomonas stutzeri* was isolated and characterized. It was studied for its industrial and bioremediation significance. The isolate tolerates salinity levels up to 12% and grows well under alkaline conditions. It synthesizesthe UV-protecting pigment melanin, which helps it survive in the extreme radiation at such high-altitude setting. This strain shows an efficient ability to reduce and detoxify chromium and to degrade phenol, making it valuable for the remediation of both inorganic and organic pollutants. It also contributes to nutrient cycling through ammonia production and produces several industrially useful enzymes, including lipase, chitinase, urease, and amylase.Antibiotic susceptibility testing revealed resistance to Meropenem, Minocycline, Tetracycline, and Cotrimoxazole, but sensitivity to Ampicillin, Erythromycin, and Ciprofloxacin. The occurrence of such in an isolated high-altitude lake emphasizes the hidden impact of human activities on fragile ecosystems. The combination of metal detoxification, phenol degradation, enzymatic versatility, melanin-mediated UV protection, and antibiotic resistance highlights *P. stutzeri* as a potential bioremediation agent as well as an indicator of anthropogenic influence. Pangong Tso therefore illustrates how an apparently pristine habitat can simultaneously serve as a reservoir of biotechnologically important microbes and an indicator of ecological disturbance linked to tourism and antimicrobial resistance.

Key words: polyextremophiles; tourism; melanin; bioremediation.

CP-42(UG)

THE ROLLING CIRCLE PATHOGEN PREVENTION IN THE RECLAIMED AGRICULTURAL WETLANDS OF EAST KOLKATA

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Abstract:

The East Kolkata Wetlands (EKW), a 12,500-hectare Ramsar site, functions as a natural sewage treatment and aquaculture system. This study investigated plant growth-promoting (PGP) properties of bacteria isolated from the rhizosphere of *Zea mays* (corn) plants collected from Choubaga, EKW. Six bacterial strains (SCR-1 to SCR-6) were isolated and identified. All six strains exhibited phosphate solubilization. Nitrogen fixation was observed in SCR-1, SCR-5, and SCR-6, while potassium solubilization was seen in SCR-1, SCR-3, SCR-5, and SCR-6. Auxin production was measured after 24 and 48 hours. SCR-1 showed the highest auxin production at 24 hours (0.93 µg/ml), while SCR-4 showed the highest at 48 hours (4.18 µg/ml).Quantitative assay of industrially important enzymes, biofilm assay and siderophore production ability of the bacterial isolates were also performed. Corn leaves were infected with white rust fungus. SCR-1, SCR-3, SCR-5, and SCR-6 demonstrated antifungal activity against this fungus. Volatile organic compounds (VOCs) produced by all strains inhibited fungal growth by 51.76%.SCR-1, SCR-5, and SCR-6 exhibited the most promising PGP properties. Consortia were developed after T-tests revealed that SCR-1 inhibited SCR-6. Two consortia, SCR-1 with SCR-5 and SCR-5 with SCR-6, were prepared. Corn plants treated with the SCR-1 and SCR-5 consortia showed a 21.5% increase in growth compared to those treated with the SCR-5 and SCR-6 consortia. 16s rRNA sequencing of these three isolates were done. SCR-1 is *Priestia megaterium*, SCR-5 is *Bacillus megaterium*, SCR-6 is *Bacillus mycoides.*

This research demonstrates the potential of these bacterial isolates, particularly SCR-1 and SCR-5, as biofertilizers and biocontrol agents for corn. Further investigation is warranted to explore their application in sustainable agriculture within the unique EKW ecosystem.

Keywords: East Kolkata Wetlands; PGP properties; consortia; volatile organic compounds; sustainable agriculture.

CP-043(UG)

ADVANCING SUSTAINABILITY: A CRITICAL REVIEW OF CIRCULAR ECONOMY AND THE WASTE-TO-RESOURCE PARADIGM

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Abstract:

Circular economy(CE) models are essential for replacing the traditional linear "take-make-dispose" industrial model, which has resulted in accelerated resource depletion. The waste to wealth philosophy redefines waste as a resource rather than a menace. Since the 1970s, India's yearly consumption has surged six-fold to 7 billion tons in 2015, catalysed by the Liberalisation Privatisation Globalisation (LPG) in early 1990s, and is expected to increase four-fold by 2030. But the recycling rates have plateaued out at 20%, compared to Europe's 70%. As only 7.2% of the global economy is circular, coupled with the waste generation anticipated to reach 3.4 billion tonnes by 2050, our civilisation is on the brink of getting inundated by solid waste. This review article includes case studies on municipal biowaste treatment facilities, sector-specific industrial sectors, and innovative energy recovery systems such as biogas production and waste-to-heat/power generation. These examples illustrate how CE can significantly increase economic resilience, ecological sustainability, energy self-sufficiency, and the development of modern urban centres through resource reutilization and emission reduction. Concepts like nature-based solutions (NBS), planetary boundaries framework (Doughnut Economics model), are integrated with the CE framework which ensures that waste-to-resource systems are in tune with the ecological limits and social foundations, essential for a just and sustainable future. Performance can be measured using material circularity indicators, carbon footprint reduction percentages, and energy recovery efficiency rates. The analysis emphasizes social innovation, public participation, and behavioural changes like composting, refillable containers, and sharing platforms as key drivers for circularity. The traditional LCA boundaries include "cradle to gate" (from resource extraction to finished product), "cradle to grave" (from extraction to disposal), and the fully regenerative "cradle to cradle" approach, which ensures that all materials are perpetually recycled biologically or technically to meet circular economy goals. The novelty of this review lies in its integrative approach, which consolidates sector-specific circular economy applications and links waste-to-resource innovations with life cycle assessment boundaries to advance regenerative and resilient societies.

Keywords: Sustainability; Circular Economy (CE); Waste-to-Resource; LCA; Material Flow Analysis (MFA); Extended Producer Responsibility (EPR); Resource Efficiency

CP-044(P)

ALLEVIATION OF ARSENIC TOXICITY IN RICE PLANT CULTIVATION USING CUFEO NANOPARTICLES GREEN SYNTHESIZED FROM *Moringa oleifera* LEAF EXTRACT

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Abstract:

*Oryza sativa*L., or the rice plant, belongs to the Poaceae family and is one of the most widely consumed staple food crops in India. Grown along the entire Indo Gangetic belt, this food crop feeds billions and also contributes to the country's revenue. But rice cultivation faces serious threat from heavy metal toxicity, especially arsenic species like As(III) and As(V). Our project aimed towards mitigating this arsenic stress from the crop plants by using Copper-Iron(III) Oxide Nanoparticles (CuFeO NPs) green synthesized from the plant extract of *Moringa oleifera*. XRD analysis showed the formation of crystalline Nanoparticles having Cu and Fe as the primary components. In our experiment, a series of rice plants, were grown. Some were subjected to arsenic stress, while some were treated with the nanoparticles to test their effectivity in sequestering the heavy metal. These experiments showed a positive result towards the idea that nanoparticles can effectively remove heavy metal toxicity from soil. Analysis of the physical parameters like shoot height and root length showed commendable increase in the nanoparticle treated plants from the ones growing under arsenic stress. Qualitative analysis followed by quantitative analyses of the biochemical parameters for nanoparticle treated plants like chlorophyll content, protein content, proline content and MDA content showed markedly similar values to the plants grown in normal tap water, strengthening the view that green synthesized nanoparticle-based mitigation of heavy metal stress in agricultural fields might become a sustainable method of increasing crop resilience against contaminants and pollutants.

Keywords: *Oryza sativa*; Arsenic; Nanoparticles; *Moringa*; green-synthesis

CP-045(PG)

CHARACTERISATION AND ROLE OF HALOPHILIC BACTERIA IN PROMOTING FISH GROWTH IN THE MANDOVI RIVER MOUTH, GOA

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Abstract:

The Mahadayi river also known as the Mandovi River, originating in the Western Ghats of the Belagavi district of Karnataka, forms a variable estuarine ecosystem at the river mouth where Arabian Sea's saline and marine environment converges with its freshwater inflow resulting in salinity fluctuations throughout the year from nearly 0 to 35 parts per thousand (psu). This dynamic transitional environment supports growth of diverse microbial communities, especially halophilic bacteria with potential ecological and aquaculture significance. To analyze the bacterial variety in the ambient aquatic environment of the Mandovi river mouth, a study was conducted where different physicochemical parameters of the sample like the total dissolved solids (TDS), electrical conductivity (EC) and the pH of the sampling site were recorded. Cell morphology and colony structure of seven different bacterial cultures were isolated and characterized. The ability of the bacterial isolates to grow across 2% to 16% NaCl concentrations indicate their tolerance to saline shifts demonstrating euryhaline halophilic traits that reflect adaptability to fluctuating estuarine conditions. To further evaluate their functional potential, a series of biochemical tests such as xylanase, citrate, catalase, protease, amylase and more were conducted for determining enzymatic capabilities and metabolic versatility. Among the top three isolates, C2o and C3 tested positive on HiCrome indicating *Bacillus* species while C5 was negative. Both cellulase and pectinase activities were detected by 57% of the isolates. Furthermore, positive results in MRS, KIA and casein hydrolyzing assays highlight their potential suitability as stable probiotics in brackish water aquaculture systems. Hemolysis patterns and biofilm formation assays were assessed to check for pathogenicity and ecological persistence respectively. 71% of isolates demonstrated positive results for chitinase assays which were performed to evaluate fish nutrition through chitin degradation. Overall, the study highlights the potential of halophilic bacteria from the Mandovi River mouth as promising bioresources, paving the way for future applications in nutrient recycling, disease management and sustainable strategies for aquatic farming.

Keywords: halophilic bacteria, probiotic potential, fish growth promotion, biomass degradation

CP-046(P)

OPPORTUNITIES, DIFFICULTIES, AND FUTURE PROSPECTS OF NANOTECHNOLOGY AS A SUSTAINABLE RESPONSE TO PLASTIC POLLUTION

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Abstract:

Plastic pollution has become one of the most urgent environmental problems the world faces threatening ecosystems, biodiversity, and human health. The persistent, non-biodegradable, and ubiquitous nature of plastics, including microplastics and nano plastics, has raised urgent concerns for waste management and sustainability. In this context, nanotechnology emerged as a potential solution for reducing plastic waste as well as developing sustainable alternatives. This introductory review discusses the emergent potential of nanotechnology to remedy plastic pollution with a focus on prevention, degradation, and remediation. Nanomaterials such as photocatalysts, metal-organic frameworks (MOFs), and carbon-based nanostructures have been studied for their capacity to cleanly transform plastics into environmentally benign products using photocatalysis and advanced oxidation applications. Nano sensors have also been created for the detection and monitoring of microplastic contaminants in water and soil, and therefore accurately assessing levels of pollution in these media. In addition to degradation and remediation initiatives, nanotechnology is a tool to prevent plastics from building up in the environment by designing biodegradable and bio-based polymers with a combination of strength, durability, and controlled degradation. Nanocomposite materials that include starch, cellulose, or chitosan with the addition of nanoparticles are also being researched for their application as sustainable, bio-based candidates to replace conventional plastics.

Moreover, despite these promising applications, challenges remain regarding the scalability, cost effectiveness and environmental safety in nano materials themselves. Concerns about the potential toxicity and persistence of engineered nano particles must be carefully addressed to ensure that nanotechnology solutions do not inadvertently create new environmental risks. Therefore, interdisciplinary research integrating materials science, environmental engineering and toxicology is essential to fully harness nanotechnology for plastic pollution mitigation.

Overall, nanotechnology offers a transformative approach to both controlling plastic waste and developing sustainable materials. With continues innovation, regulatory oversight, and responsible implementation, it has the potential, to significantly reduce the environmental burden of plastics and contribute to a cleaner and more sustainable future.

Keywords: Plastic pollution; Nanotechnology; Biodegradable polymers; Nanoplastics; Microplastics; Sustainable Materials

CP-047(P)

HARNESSING ENVIRONMENTAL MICROBES FOR SUSTAINABLE E-WASTE REMEDIATION AND CIRCULAR ECONOMY INTEGRATION

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Abstract:

The world is dealing with the fastest-growing crisis of E-waste, which is anticipated to surpass 75 million tonnes by 2030, imposing a huge environmental threat in terms of heavy metal toxicity of Pb, Cd. Hg and the plastic components of the wires, circuits etc. Initially being categorized as a solid waste, all the conventional recycling methods for E waste like incineration landfilling are either energy intensive or unsustainable in reality. Microorganisms, as the eco-innovators, have the potential to detoxify and recover important metals (i.e., Au, Ag, Cu, Pd) from these E-waste through biosorption, bioleaching, and various other enzymatic degradation methods. These microbial processes have been established internationally for their bioremedial and resource generation outcomes, like biogenic nanoparticle(NP) (i.e. AgNP. AuNP) generation, pure metal recovery, biosurfactants (i.e. Rhamnolipids, Sophorolipids), organic acids, and bioplastic (Polyhydroxyalkanoates) generation, etc. But the challenges lie in the difficulty of scaling up these processes along with the product quality and market acceptance. Most importantly the shortcomings of the regulatory framework in promoting the biotech-based recycling process for these E-waste. In this review we critically analyse the wondrous role of microbes in e-waste management. Various bacteria like *Acidithiobacillus ferrooxidans*, *Bacillus sp.*, *Pseudomonas putida* and fungi like *Aspergillus niger, Candida bombicola* participate in sustainable product recovery in numerous ways. It highlights the current research gaps in conjoining the attainable soil microbial ecology with environmental pollution surveillance and remediation. It also brings attention to various E-waste management strategies to combat mining and toxic waste stimulated climate change and biodiversity loss.

Keywords: Microbial bioremediation; biosorption; eco-innovators; bioleaching; biogenic nanoparticles

CP-048(P)

DEVELOPMENT OF MULTI-FUNCTIONAL PLASTER OF PARIS THROUGH BIO-INTEGRATION OF NOVEL BACTERIAL ISOLATES FROM DASSAM FALLS

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Abstract:

Plaster of Paris (PoP) is a material that is extremely prone to biological degradation. To increase its resilience and durability, a new bio-inspired technique was created. Multipurpose bacterial strains are combined in this study to provide antifungal and self-healing capabilities in a single system. A water sample from Dassam Falls in Jharkhand, India, yielded four different bacterial strains (**DB1, DB2, DB3, and DB4**). Gram staining, Hi-Chrome differential testing, enumeration, and antibiotic susceptibility profiling were used to characterize these isolates. The strains did not negatively interact in a T-streaking compatibility test, which is necessary to create a stable bacterial consortium. Functional assays like using **Thiosulphate Agar** to show sulphur uptake, **Calcite Agar** to show calcium uptake, **Calcite Agar supplemented with Urea** to show ureolytic MICP and finally using **9K media** to show Iron uptake and quantifying using **Atomic Absorption Spectroscopy** (AAS) to show the bacteria's ability to produce **Microbial-Induced Calcite Precipitation** (MICP) co-related with other pathways in order to determine their potential for self-healing. We made setups with bacterial consortium to observe self-healing and prepared blocks of PoP with pre-induced micro-cracks. The use of **X-ray diffraction (XRD)**, revealed the development of new calcium carbonate crystals inside the cracks, was then used to confirm the healing process. Tests of the isolates' antifungal qualities revealed that they inhibited the growth of *Aspergillus* species, a common fungal colonizer of PoP. Two unique mechanisms that are shared by all four strains are responsible for this effect: **Siderophores production**, prevent fungal growth by either competitively sequestering iron or by causing iron-mediated oxidative stress in fungal cells and **xylanase activity**, an enzyme that breaks down fungal cell wall components or disrupts metabolism. This synergistic approach would create a more robust and adaptable self-healing material. The bacteria would not just repair the cracks; they would also add to the material's durability and longevity by mitigating other forms of degradation and protect the concrete from biogenic acid attack, which can lead to material degradation over time.

Keywords: Microbial Consortium; Self-Healing Materials; Microbially-Induced Calcite Precipitation; X-ray diffraction; Antifungal Activity; Siderophores.

CP-049(RS)

HARNESSING NATURAL MICROBIAL EFFICACY FOR SUSTAINABLE ORGANIC TEA PRODUCTION

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Abstract:

Leaves of *Camellia sinensis* (L. O. Kuntze) Plants, belonging to the family Theaceae, are used to manufacture tea, one of themost consumed non-alcoholic beverages worldwide. Tea leaves contain a widespread variety of bioactive compounds that have numerous health benefits. Tea, a valuable cash crop has massive economical worth globally. Nevertheless, the occurrence of multiple diseases and abiotic stresses severely hampers tea plantations, thereby posing a serious threat to the tea industry. Moreover, reliance on excessive chemical fertilizers and pesticides in tea cultivation deteriorates soil quality, ecological balance, and the long-term tea productivity. This research is principally focussing on the rhizosphere soil as it is the chief habitation for the beneficial rhizosphere bacteria which improve yield and quality of the resultant tea leaves. Tea rhizosphere soil collected from the tea plants of the Experimental Tea Garden of 'Centre of Floriculture and Agri-Business Management (COFAM)', University of North Bengal (26.706215° N, 88.356097° E) in the month of January 2025. Initially, total twenty-three (23) bacteria were isolated and then screened for various PGPR and Biocontrol properties. These were tested on the blood agar plates for Hemolysis Assay and also screened for antibiotics sensitivity discs assay. Among the twenty-three (23) isolates, nine (9) bacterial strains named, B5, B7, B8, TS1, TS2, CS1, CS3, CS6, CS8 were proved to be most potential in terms of both PGPR and biological control activities. These are excellent nitrogen fixers, phosphorous, potassium and zinc solubilizers. These are proficient in Biofilm production along with some vital enzymes like-cellulase, protease. Production of some volatile compounds such as - hydrogen Cyanide (HCN), ammoniawere also detected. Phytohormones like- Gibberellic acid and Indole- 3- Acetic Acid production was also quantified. These bacterial strains were primarily recognized as firmicutes, and probably *Bacillus*spp through chrome agar. Thus, these indigenous bacterial strainsin turn give a holistic protection to the tea plants. However, more recent techniques must be incorporated to acquire the microbial diversity and their genetic manipulation to fully rely on the true potential of these bacteria in formation of various combinations of consortia which can act as successful PGPR as well as biocontrol agents in future.

Keywords: *Camellia sinensis*; rhizosphere; PGPR; biological control; firmicutes; consortium.

CP-050(PG)

COMBINED ETHICAL EFFORTS TO SEEK MITIGATION RESPONSES FOR ENVIRONMENT, CLIMATE & BIODIVERSITY

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Abstract:

The context of environment and ecology is undoubtedly the most important thing that the entire planet is struggling to deal with the disastrous consequences of Anthropocene timeline. An important message to raise public awareness flashed across the social media platforms, where the essence conveyed something like this: The world does not need more number of successful people, what it needs is good & compassionate people concerned about the nature & environment, story tellers and caregivers. Being compassionate for the nature and environment & fostering the components, caregiving is something that one can do on their own within the feasibility. But it is this storytelling that becomes very important as a tool to spread message further. Story telling though is not any conventional mode that comes under the braces of media, but it is itself a powerful medium to highlight the concerns and aspects of socio-cultural issues. There are a plenty of such storytelling as intangible cultural heritage addressing critical environmental concerns.

Sustainability demands for policy and advocacy as directives to seek solutions as mitigation strategies for the climate and environmental challenges. But it is not the legal bookish framing, which would be doing the justice. Else the stakeholders for sustainable practices and safeguarding the biodiversity would themselves be at stake. A very relevant context in this regard is the Kani tribe, the forest-dwellers of vast tracts of Southern India; with whom the concept of *Biopiracy*came into being globally. But the way they have been deprived of their components of nature is indeed a corporate plundering and crime.

Climate change, Biodiversity, and zoonosis all the three can be taken in together, which will form a tri-set model to show how all these are interlinked with each other in fine fragile balance. Disruption of any would eventually pave way for dire consequences. The world is certainly in a well-designed stage, where we are inevitably witnessing biodiversity loss. This accountability is ultimately none other than the 6^{th} Mass extinction, the planet is facing due to anthrpogenic effects. With emerging trends interfaces of Man-Nature, new diseases are emerging too; which concerns for one-health.

Keywords: Anthropocene, Socio-cultural, Biodiversity, Biopiracy, zoonosis

CP-051(PG)

DEVELOPMENT AND EVALUATION OF POMEGRANATE SEED OIL NANOEMULSIONS CO-ENCAPSULATING PUNICIC AND ANACARDIC ACIDS FOR ANTIMICROBIAL EFFICACY AGAINST PROMINENT FOOD-BORNE PATHOGENS

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Abstract:

Innovative, sustainable approaches to food preservation are required due to the growing threat of food borne diseases and antibiotic resistance. Using their complementary antibacterial properties, this study describes the creation and assessment of nanoemulsions that co-encapsulate anacardic acid (AA) from cashew nut shell liquid and punicic acid (PA) from pomegranate seed oil. Excellent colloidal stability was demonstrated by the development of stable nanoemulsions with droplet sizes as small as 3.47 nm and polydispersity indices (PDI) < 0.03 with the use of high-energy ultrasonication and tailored surfactant systems (Tween 20/Span 80, HLB 10).

Monodispersity was established by physicochemical characterisation using Dynamic Light Scattering (DLS), and antibacterial effectiveness against Pseudomonas aeruginosa and Staphylococcus aureus was evaluated using agar well diffusion. Co-loaded PA+AA formulations at 1000 µg/mL showed improved intensity gradients, indicating deeper antimicrobial penetration, while PA nanoemulsions showed consistent inhibitory zones (~1.1 mm^2). Droplet homogeneity and bioactive dispersion were greatly enhanced by ultrasonication, especially in formulations with high AA loading.

The limits of agar diffusion for lipophilic nanoformulations were highlighted by image-assisted zone analysis, which showed subtle antimicrobial dynamics despite modest inhibition in solid-phase experiments. These results support the use of mechanistic research and broth-based MIC/MBC tests to clarify the mechanisms underlying membrane disruption and biofilm suppression.

This study supports global trends in clean-label food preservation by highlighting the potential of plant-derived nanoemulsions as natural antibacterial agents. A promising platform for targeted administration, improved bioavailability, and less need on artificial preservatives is provided by the dual-encapsulation approach. Future incorporation into responsive delivery systems, active packaging, and edible coatings may transform food safety technology.

Keywords: Anacardic acid; Punicic acid; Antibacterial activity; Food preservation; Plant-derived antimicrobials

CP-052(RS)

IN-SILICO ANALYSIS OF THE TOXICITY AND MECHANISMS OF AN ACARICIDE, FENPYROXIMATE, IN HUMAN: PERCEPTIONS FROM INTEGRATED NETWORK TOXICOLOGY, MOLECULAR DOCKING AND BIOINFORMATICS DATA

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Abstract:

For human health, the food safety is very crucial. Fenpyroximate is a widely used new generation acaricide mostly employed in agriculture for the control of pests and mites, targeting enhancement of crop yield and quality. But if it accumulates in aquatic organisms like fish, snail etc. which comprises human diet, or the farmers gets exposed while spraying, it might interfere with human health. This investigation intends to illuminate the core toxic targets, the underlying molecular mechanisms of most affected organs and their related diseases induced due to fenpyroximate exposure through a combined venture of network toxicology, molecular docking and bioinformatics data analysis. Toxicity analysis of fenpyroximate through the ADMETlab database determined a close association with carcinogenicity, neurotoxicity and liver injury. Systematically utilizing GeneCards, OMIM and CTD databases and through Cytoscape tools, we identified potential and core targets (including CASP3, EGFR, PPARG, TP53, etc.) associated with the acaricide and brain injury or liver injury. GO and KEGG enrichment analyses indicate the association of targets with pathways related to cancer, the apoptosis pathway, EGFR tyrosine kinase inhibitor resistance pathway, PI3K-Akt signalling pathway. Molecular docking (conducted using AutoDock vina) confirmed the high-binding affinity interactions between the acaricide and key target proteins. These analysis delivers a foundation for an understanding of the molecular mechanisms causing the hepatotoxicity and neurotoxicity induced by fenpyroximate. Our inferences highlight the potential risks posed by this acaricide to brain and liver health, emphasizing on the necessity for further clinical and epidemiological investigation in future.

Keywords: Fenpyroximate; acaricides; ADMET properties; Network toxicology; Molecular docking; Brain injury; Liver injury; diseases.

CP-053(PG)

PREPERATION AND CHARECTERIZATION OF RIBOFLAVIN ENCAPSULATED CHITOSAN NANOPARTICLE

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Abstract:

In the last few decades nanocarriers has taken an important part in the pharmaceutical industry. It has been a matter of great conflict of interest in the field of nanotechnology where small sized particles ranging from 1 to 100 nm with extensive biocompatibility, biodegradability, absorption property, high stability, half-life in the blood stream, surface charge and hydrophobicity are used to deliver drugs to target tissue such that they are not degraded by the body enzymes or due to any other kind of instability of the drug itself. The drug easily penetrates into the tissue system without any kind of problem in the endolithial system or phagocytosis.

The drug encapsulated into the nanocarriers is released efficiently in the target site of action. Not only does it enhance the control release of the drug at the target site it also helps in less toxicity in the body. Nano particles can be made with a number of metal ions and other kind of polymers. Chitosan is a natural biopolymer which has a rapid activity in the drug delivery system. Not only is it composed of the functional amino acid and hydroxyl moieties, chitosan nanoparticle can efficiently release a specific drug in a controlled manner providing better stability and less pharmacological toxicity.

In this article, there is a detailed overview on how the chitosan nanoparticles are formulated as "nanocarriers" by Ionic gelation method for encapsulating the drug – Riboflavin (Vitamin B2) to monitor their Drug Encapsulation Efficiency by Ultrasonication and also focusing on their morphology and thermal stability by exposing the drug to various temperatures including the „in vitro release kinetics.

Chitosan is a natural, biodegradable polymer derived from chitin (usually from shrimp/crab shells) it breaks down easily in the environment without leaving toxic residues, unlike many synthetic polymers or encapsulation agent and reduces pollution and microplastic accumulation in soil and water systems. Chitosan is obtained from renewable marine waste (crustacean shells), promoting waste valorization and encourages circular economy by turning seafood waste into high-value materials.

Keywords: Chitosan, nanoparticles , Encapsulation Efficiency, DDS, Riboflavin, Ultrasonication , In vitro release kinetics.

CP-054(RS)

IMPACT OF IMIDACLOPRID EXPOSURE ON BLOOD BRAIN BARRIER INTEGRITY AND ITS CONSEQUENCES ON PROTEOSTASIS IN ADULT ZEBRAFISH BRAIN

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Abstract:

Imidacloprid, a first-generation neonicotinoid, is a systemic insecticide widely used on over 140 crops in 120 countries classified as "moderately toxic" (class II by WHO and toxicity category II EPAV). Despite its agricultural benefits, Imidacloprid poses significant environmental and public health risks. According to the prediction of admetSAR,Imidacloprid may cross the blood brain barrier. So, the present investigation was to assess the neurotoxic effect of Imidacloprid in adult zebrafish (*Danio rerio*). Following 10µg/L and 100µg/L exposure of Imidacloprid for 28 days,alteration in blood brain barrier integrity, redox homeostasis and proteostasis were observed. Reduced mRNA expression of cell adhesion proteins and dose respective increaseEvans Blue Dye extravasation indicates a compromised blood brain barrier. Imidacloprid exposure also resulted in increased reactive oxygen species level, perturbation in antioxidant system, increased expression of inflammatory cytokines and reduction in expression of neurotransmitter related genes. Accumulation of ubiquitin conjugated proteins and increased expression of heat shock proteins indicates a disruption in protein homeostasis. From the present study it is evident that Imidacloprid exposure at environmentally relevant concentration is compromising protein homeostasis in adult zebrafish brainthrough neuroinflammation and oxidative stress.

Keywords: Imidacloprid; Blood brain barrier; redox homeostasis; oxidative stress; proteostasis.

CP-055(P)

BIOMEDICAL WASTE: CONCERNS, MANAGEMENT AND CHALLENGES

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Abstract:

Biomedical wastes (BMWs) are refuse from diagnosis, treatment, immunisation centres, mortuary, blood bank, etc., biotechnology institutes and medical research labs, etc. BMW constitutes 15% used tissues, 15% rags, 10% plastic, 4% glass, 1.5% infectious wastes, 1% sharp metal and 53.5% unclassified (dressings, cotton, etc.). Collected at source in coloured bags, BMW classifies to four groups: yellow: anatomical waste, animal waste, discarded medicines, microbiological waste; red: recyclable contaminated waste; white: waste metal-sharps; and blue: glassware, metal implants. Government hospitals produce 0.5–4.0 kg waste/day/bed. As a large tertiary care hospital in Eastern India, the SCB MCH Cuttack produces 10 tonnes of BMW daily. Various BMW-associated health hazards are, pathogen entering through abrasions or accidental ingestion (of infectious wastes); intoxication, injuries or burns (from chemical wastes); ingestion of cytotoxic drug, chemical contaminated food (genotoxic wastes); headache, dizziness, vomiting, and possibly affecting genetics (radioactive wastes); and visually impacting objects (like anatomical wastes) affecting public senses. High-risk groups include healthcare professionals (doctors and nurses), paramedical personnel, patients and visitors/attendants, waste-handlers at transportation and disposal facilities. Mechanical (like compacting, shredding), land-filling (open dump, sanitary landfill, deep burial), encapsulation, inertisation, thermal (hot-air oven, autoclave, hydroclave and incineration), chemical (antiseptics and disinfectants), and biological (composting, vermicomposting and biodigestion) are conventionally employed methods. Land-filling and incineration are environmentally threatening. While land-filling chemically and biologically contaminate water and land mass, it transmits HIV and hepatitis like diseases, cause harm through injuries from contaminated metal sharps, and release environmental toxins, incineration generates GHGs (greenhouse gases). Technically sound waste management measures like filtering smoke from incinerators via dry and wet scrubbers, electrostatic precipitation with periodic maintenance, microwaving or nanotechnology, enhancing geo-tagged monitoring systems and comprehensive waste-handling trainings are suggested, with penalties for non-compliance.

Keywords: biomedical waste; biohazard; waste management; nosocomial infection; infectious disease

CP-056(AP)

THREE-YEAR TREND ANALYSIS & CHANGING EPIDEMIOLOGY OF INFLUENZA A INFECTIONS IN PEDIATRIC PATIENTS: INSIGHTS FROM A TERTIARY CARE HOSPITAL IN WEST BENGAL (2023–2025)

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Abstract:

Seasonal outbreaks of Influenza in regions like West Bengal often peak during monsoon and winter. Early detection through RT-qPCR and monitoring antiviral resistance via allelic discrimination PCR are critical for clinical management. This study investigates the trends of Influenza A infection in children from 2023 to 2025 at a tertiary care hospital in West Bengal.

Clinical specimens in the form of nasopharyngeal and/or oropharyngeal swabs were collected from suspected pediatric patients with symptoms consistent with Influenza-Like Illness (ILI) or Severe Acute Respiratory Infection (SARI) and nucleic acid extraction was performed from each sample using standard protocols. Detection of respiratory viruses, including Influenza A virus and its subtypes (H1N1 and H3N2), was carried out using RT-qPCR as part of a respiratory viral panel. Samples that tested positive for Influenza A (H1N1) were further analyzed using allelic discrimination PCR to assess the presence of mutations associated with antiviral resistance. All clinical and laboratory data were compiled and analyzed using Microsoft Excel (version 2019).

Between January 2023 to August 2025, a total of 4,046 suspected samples were screened for Influenza A at a tertiary care hospital. Out of the tested samples, 24 (11.32%) positive cases were found **in 2023**, of which, 13 (6.14%) H1N1 (46.15% male and 53.85% female) and 11 (5.19%) H3N2 (36.36% male and 63.64% female) were detected. The most affected group was <1 year, with most requiring hospitalization. **In 2024**, among 2,091 samples, 129 (6.17%) were H1N1 (59.69% male) and 39 (1.87%) were H3N2 (66.67% male) positive. The <1 year group was most affected by H1N1 (29%), while H3N2 mainly affected 2–<5 years (33%). Most cases required hospitalization, and some needed ICU care. **In 2025** (till August), out of 1,743 samples, only 1 case was H1N1, but H3N2 surged to 278 cases (16.03%), with 64.03% male. The >1 year age group was most affected (27%), followed by >1–<2 and >2–<5 years (26% each); the majority were hospitalized, with several ICU admissions.

These findings underscore the need for ongoing subtype-specific surveillance and preparedness for managing severe pediatric influenza, especially during seasonal peaks. The resurgence of H3N2 in 2025 warrants further investigation into its transmissibility, virulence as well as preparedness for increased healthcare burden in pediatric populations during seasonal peaks.

Keynotes: Influenza, H1N1, H3N2 Epidemiology, RT-qPCR

CP-057(AP)

MONITORING OF CONTAMINANTS IN SAFETY EVALUATION OF FOOD

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Abstract:

The monitoring of contaminants is a critical component in the safety evaluation of food, ensuring public health protection and compliance with regulatory standards. Contaminants, including chemical residues (such as pesticides, veterinary drugs, and heavy metals), biological agents (like pathogens), and environmental pollutants, can enter the food chain at various stages of production, processing, and distribution of the food. Microbiological analysis plays a vital role in the safety evaluation of food by identifying and quantifying harmful microorganisms that pose health risks to consumers. Pathogens such as *Salmonella, Escherichia coli, Listeria monocytogenes*, and *Campylobacter* are among the most common biological contaminants in food products. These microorganisms can be introduced at any stage of food production, from agricultural practices to food processing, and can survive or proliferate under varying environmental conditions. Effective monitoring programs involve the systematic collection, analysis, and interpretation of data to detect the presence and concentration of these contaminants. Advances in analytical technologies, such as mass spectrometry and molecular diagnostic techniques, have enhanced the sensitivity and accuracy of contaminant detection. Regular surveillance and risk-based monitoring not only help identify potential food safety risks but also guide corrective actions and inform policy decisions. This abstract underscores the importance of integrated monitoring systems in maintaining food safety, protecting consumers, and supporting global food trade.

CP-58(AP)

MAPPING OF THE ANTIBIOTIC RESISTANCE IN WASTEWATERS NETWORKS ACROSS GANGETIC ALLUVIAL PLAIN OF WEST BENGAL, INDIA

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Abstract:

Overburden of infectious diseases, overuse of broad-spectrum antibiotic, insufficiency of wastewater management infrastructure, prevalence of multidrug-resistant (MDR) bacterial isolates in the wastewater ecosystem has risen India into the limelight of Antimicrobial Resistance (AMR) issue. Only 6.18% of wastes generated in West Bengal can be treated efficiently. Rest of them are dumped directly of indirectly in the major riverine system of tis state through the ways of community sewage discharge canals. On this particular background of data deficiency to understand the link between sewage discharge load and extent of AMR,this study aimed to track differential distribution pattern of wastewater bacteria and extent of antibiotic resistance across sewer networks of Siliguri, Malda, Kolkata and Sundarbans of the West Bengal through culture independent and culture independent based community wastewater monitoring.

Wastewater samples from Kolkata emerged as the hub of MDR with highest titre of antibiotic resistance (93%) to major classes of antibiotics and their corresponding Antibiotic-Resistant Genes (ARGs) like- ctx-M, gyrA, tetM, blaTEM, mexA etc., driven by clinical and municipal inputs from urban setups. Up regulation of multiple antibiotic resistance pathways in the microbial profile of wastewater community confirmed a substantial selective pressure in this particular area. Siliguri and Malda wastewater exhibited moderate extent of resistance showing additional impacts from industrial and agricultural runoffs respectively. CAMP resistance pathways and Glutathione metabolism pathways were found to be enriched in these niches respectively further highlighting oxidative stress of bacterial community. In contrast, the Sundarbans exhibited a narrower yet more pronounced resistance spectrum, particularly against quinolones and tetracyclines, with genes such as *gyrA*, *mexA*, and *tetM* being detected. This pattern suggests that local environmental co-selectors, rather than direct anthropogenic discharges as observed at other sites, played a dominant role in shaping resistance dynamics. Overall, the results highlight how site-specific human influences collectively modulate the broader AMR landscape, reinforcing the value of wastewater-based monitoring in tracing antibiotic usage and the critical need for strengthening community-level sanitation practices.

Keywords: Wastewater monitoring; Community genomics; Culture dependent profiling; Antibiotic resistance; ARGs

CP-059(AP)

FUTURISTIC SPICES MADE SPICYER WITH PROBIOTICS

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Abstract:

Facing escalating concerns regarding food safety, including adulteration and contamination by harmful microorganisms, this study explored the potential of beneficial bacteria isolated directly from commonly consumed Indian spices. The research specifically focused on evaluating the antagonistic and probiotic capabilities of three distinct *Bacillus* isolates sourced from cumin and coriander against the pervasive and toxin-producing fungus, *Aspergillus flavus.*

Initial screening via a plate assay revealed a potent negative interaction, with the *Bacillus* isolates demonstrating a strong inhibitory effect on the growth of A. flavus. Further investigation using Scanning Electron Microscopy (SEM) provided visual evidence of this antagonism, showing significant damage to the fungal cells and spores following exposure to the Bacillus species.

To elucidate the underlying mechanism of this antifungal activity, Electrospray Ionization-Mass Spectrometry (ESI-MS) was employed to analyze the secondary metabolites produced by the *Bacillus* isolates. The results confirmed the presence of a diverse suite of antifungal small peptides, including macrolactins, bacilysocin, bacillibactin, iturins, fengycins, and surfactins. These findings suggest a multi-faceted chemical defence strategy employed by these bacteria. In addition to these antifungal compounds, ESI-MS analysis also detected the substantial production of vitamin B-12 by the *Bacillus* isolates, highlighting a potential dual-purpose benefit.

In vitro tests confirmed the probiotic potential of these isolates, as they exhibited robust tolerance to low pH and bile salts, crucial for survival in the gastrointestinal tract. Furthermore, the isolates showed appropriate susceptibility to common antibiotics and demonstrated no negative interactions with beneficial enteric bacteria. These characteristics validate their suitability for safe human consumption.

Collectively, these findings demonstrate that these native *Bacillus* isolates possess significant probiotic potential, offering a refreshing and health-promoting alternative for fortifying spices. Their antifungal mechanism, mediated by a cocktail of small peptides, provides natural protection against toxigenic fungi like *A. flavus*, while their ability to produce vitamin B-12 offers a nutritional advantage, contributing to food safety and enrichment.

Keywords: Spices, *Bacillus* isolates, *Aspergillus flavus*, probiotic, antifungal agents.

CP-060(P)

COVID AND ITS SPINE: HIDDEN STRUGGLES, HEALING PATHWAYS

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Abstract:

The Covid 19 pandemicbegan in Wuhan, China in December 2019. Soon after it spread worldwide in early 2020. It spread over 229 countries and territories like United states, India, France, Germany, Brazil, South Korea, Japan, Italy, Russia, Spain, Australia, Denmark, Panama, Morocco, and many other. Then WHO assessed the outbreak as a pandemic on 11 March,2020. In India the first wave of Covid 19 was prolonged, lasting from March, 2020 to about January ,2021, while the second wave was characterized by rapid death that begun around March-April ,2021. Then the third wave of the pandemic in India started in January, 2022 and lasted till March 2022. The beginning of the pandemic was marked several prominent variants like – Alpha, Beta, Delta and Omicron. Delta variant (March – June 2021) caused maximum deaths than other variants. The non vaccinated people succumbed to the injections, the infected one's added in prolonged hospitalization. The original Omicron strain was less severe than the previous variants. The overall mutated strain as maximum and this mutation was mostly in spike protein, which binds to the site ACE 2 receptor (lungs, heart, blood vessels, kidney) by the time Omicron arrived almost beyond 2 years. The virulence significance got reduced and infectivity increased and mutation w ere A67V, T951, G142D, ins214EPE, G339D etc. Covid19 is still functional in community but has become a weak pathogen and working with Rhino virus causing common cold. In future it will be a part of common micro flora with long term symptoms like throat infection, breathing problem, loss of memory. Though there is no specific requirement of further vaccination or antibody but healthy lifestyle, lot of antioxidants will be a secret to keep Covid19 in the bay. Though it does not mean that no new strain will come in future.

Keywords: Covid 19; Pandemic; Devastation; Omicron; Present Status; Role of antioxidants; Future of Covid

CP-061(RS)

BIOACCUMULATION POTENTIAL OF SELECTIVE PESTICIDES IN THE MAJOR CARPS OF WEST BENGAL

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Abstract:

Agricultural practices in India include involvement of extensive agrochemicals to enhance productivity and to control pests. The extensive use of pesticide leads to environmental contamination and ecosystem degradation. In spite of regulative measures, presence of organanochlorine and organophosphorous are found in all the environmental spheres. The predominately found pesticides are DDT, endosulphan, malathion and parathion. These pesticides show persistence in the environment often leading to bioaccumulation and biomagnifications along the food chain mainly in the aquatic environment. The bioaccumulation of persistent and toxic pesticides in aquatic ecosystem ranging from freshwater to estuarine habitats threats the food security and ecosystem health. Investigation was carried out in and around Amdanga village, North 24 Parganas, reveals the presence of pesticide residue in the major Indian carps namely *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Tenualosa ilisha*, and *Clarias magur* thus indicating the bioaccumulation potential of the identified pesticides. The order of accumulation is *Clarias magur* > *Catla catla*> *Cirrhinus mrigala*> *Labeo rohita*> *Tenualosa ilisha.* The highest accumulation is seen in liver as compared to gills. In our study site Endosulphan is obtained in highest amount and least is parathion. Regular consumption of pesticides through various food sources often leads into various types of cancer, neurological disorders, birth defects etc. The present study highlights the accumulation of pesticides in few major carps of economical importance and investigates the pesticide with highest concentration.

Keywords: Agrochemicals, degradation, bioaccumulation, biomagnifications

CP-062(AP)

RECENT CHALLENGES IN SUSTAINING BLUE CARBON ECOSYSTEMS, WITH SPECIAL REFERENCE TO MANGROVES

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Abstract:

Mangrove ecosystems are considered crucial for combating climate change due to their unparalleled carbon sequestration and carbon retention abilities. The carbon sequestration rates of these adorable blue carbon ecosystems have been reported to be an order of magnitude higher as compared to other ecosystems. Furthermore, the longevity of fixed carbon in these ecosystems is also significantly higher due to inimitable conditions in sediments. However, indiscriminative anthropogenic activities like substantially increasing pollution, urban-coastal development projects, and other factors prevailing in urban settings are posing a serious challenge in sustaining these invaluable ecosystems. Especially in urban setting, various sources including industrial effluents, vehicle emissions, untreated sewage disposal, agricultural runoff, construction waste, oil spills and many more similar activities are impacting health of mangrove ecosystems by substantially adding diverse pollutants to these carbon habitats. A higher concentration of pollutants like micro-plastics (plastic < 5mm size), heavy metals, hydrocarbonsand other pollutants has emerged as one of the most serious challenges. Such pollutants affect mangroves and associated aquatic life via disrupting root functioning, germination processes, plant-animal interactions and altering physicochemical fabric of habitats (including sediment structure, movement across the soil solutions, mineral recycling and increased toxicity) leading to malfunctioning ecosystems.Persistence of these pollutants with incremental biomagnifications have irreversible effects on mangrove ecosystems and may have long term habitat destruction. A comprehensive assessment of Mumbai mangrove ecosystems at various locations have revealed presence of wide array of high and low density plastics, micro-plastics and high concentrations of heavy metals indicating that the level of these pollutants is posing a multifaceted challenge to the sustainability of mangrove ecosystems in urban settings. Keeping in view that the level of these pollutants has reached to an alarming stage, a comprehensive assessment on nature and effects of these pollutants on mangrove habitats and possible strategies to mitigate their adverse effects, in order to sustain these extraordinarily resilient mangrove habitats, shall be presented.

Keywords: Mangroves, Novel pollutants, Microplastics, Heavy metals, Aquatic Ecosystem, Carbon Sequestration

CP-063(P)

CHEMICAL DIVERSITY AND THERAPEUTICAL POTENTIAL OF *Hedychium spicatum*

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Abstract:

Hedychium spicatum (Family: Zingiberaceae) is a medicinally and economically important plant valued for its rhizomes, which are traditionally used in treating pain, inflammation, asthma, vomiting, and bronchitis, and serve as a key ingredient in nutraceutical formulations such as Chyavanprash. The species is naturally distributed across the Himalaya (Jammu & Kashmir to Arunachal Pradesh), as well as in Myanmar, North Thailand, and southern China. To address challenges in availability of quality planting material and lack of information on factor determining the quality traits, a systematic study was undertaken to assess chemical diversity, and therapeutical potential of *H. spicatum* was assessed. Essential oil profiling revealed significant variability in compounds such as 1,8-cineole, α-/β-/γ-eudesmol, linalool, β-pinene, α-elemol, guaiac acetate, and cadin-4-en-10-ol, influenced by genetic and ecological factors. Cluster analysis grouped populations based on geographic and climatic similarities, providing insights into core populations and elite cultivars for conservation and cultivation. Following network pharmacology approach, therapeutic targets and active molecules were identified and. *In silico* pharmacokinetics analysis using drug-likeness and ADME analysis revealed that more than 50 % compounds exhibited high gastrointestinal absorption, compounds showed blood-brain barrier permeability and P-glycoprotein substrates that affect intracellular retention. Further, network pharmacology study was performed to evaluate the potential of active compounds of various disorders. Protein–protein interaction network recognised that NFKB1, MAPK1, PIK3CD, CYP3A4, and PRKCA as targets hub proteins involved in inflammation, cancer, diabetes and other metabolic syndromes. GO and KEGG enrichment showed significant associations with neuroactive ligand-receptor interaction, chemical carcinogenesis, sphingolipid signalling, and cancer-related pathways. The findings contribute to elite genotype identification, and identification of potential mechanism for therapeutical potential of the species.

Keywords: Medicinal Plant, Genomic Resources, genetic diversity, Chemical Fingerprinting

DS-001

SYNTHESIS AND FUNCTIONAL EVALUATION OF SELENIUM NANOPARTICLES USING *SALVINIA MOLESTA* MITCH. FOR ENVIRONMENTAL GREEN AND BIOMEDICAL APPLICATIONS

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Abstract:

Green synthesis of selenium nanoparticles (Se-NPs) using *Salvinia molesta* Mitch. (an aquatic weed) minimizes hazardous byproducts, aligning with principles of sustainable chemistry. The synthesis Se-NP comprehensively characterized through UV-Vis spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Transmission Electron Microscopy (TEM) confirmingtheir spherical, morphology, nanoscale dimension, crystalline structure. Functional assaysestablish its high potential for dye decolourization (e.g. methylene blue, MB),and their potential in industrial effluent treatment. It also hasbroad spectrum antimicrobial activity, high cytocompatibility and potent antioxidant ability which suggest promising biomedical applications. The simulated dye removal experiments with this weed when exposed to 0 - 30 mg L^{-1} MB over 15 days exhibits a rapid reduction with maximal efficiency at 30 mg L^{-1} within two days. The biosorption exceeded 50% which strongly influenced by the pH and the polyamine and glycosidic rich content also demonstrate its antimicrobial and antioxidant ability. High dye bioaccumulation induces tissue modification which reflect dye sequestration, catabolism and antioxidative response. A distinct polymorphism in oxidase enzyme activity was observed, serving as a biomarker for dose-dependent dye toxicity.It also contributesin photocatalytic degradation following the pseudo - first order kinetics. Phenol rich compounds in the extract act as a capping and stabilizing agent which enhancing nanoparticles functionality. The intrafraction between dye molecule and cell wall constituents indicated by binding energy analysis, confirmed the enhanced biosorption capacity of *Salvinia* biomass. Overall use of *Salvinia molesta* for both phytoremediation as well as green synthesis medium for nano particles offers a suitable and sustainable for low-cost strategy for addressing environmental pollutants such as azo dyes. Its demonstrated xenobiotic tolerance, coupled with the multifunctional properties of derived Se-NPs, as a promising candidate for integrated environmental and biomedical nanotechnological applications.

Keywords: Dye degradation; bio-fabrication; eco-friendly; cost effective; industrial effluent**.**

DS-002

CATALYTIC DEHYDROGENATION AND CASCADE SYNTHESIS OF N-HETEROCYCLES BY USING RUTHENIUM (II) AZO-OXIMECOMPLEXS

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Abstract:

Ruthenium (II) arylazooxime complexes of type [Ru(aaO)(PPh_3)(CO)Cl] have been synthesized by varying the aryl groups of the bidentateazo-oxime ligand of type aaOH. These have been characterized by several spectral techniques and Single Crystal X-ray diffractometry. Electrochemical and theoretical studies reveal that the azooxime ligand framework can act as an electron sink and this property has been smartly employed in electron transfer catalysis. The complexes can catalyze alcohol dehydrogenation with cascade synthesis of 2-substituted quinolines, quinazolinones and a large number of pharmaceutically relevant N-heterocycles. The catalytic reactions were carried out by varying the temperature, solvent and alkali to optimize the yield of the final product. Furthermore, theoretical and experimental techniques have been used to have an insight into the mechanism of catalysis.

Keywords: azooximes; tandem synthesis; N-heterocycles

DS-003

POTENTIAL OF *OCIMUM SANCTUM* LEAF EXTRACT TO CHECK SOME HUMAN HEALTH HAZARDS AND DISEASES

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Abstract:

The prophylactic and safety of *Ocimum sanctum*. Linn leaf juice in diabetes mellitus, infectious pneumonia and heat stroke among adult inhabitants of East and West Midnapur in West Bengal was conducted. Three hundred participants with age in the range of 45-60 years and comorbidity-free were recruited and divided into three groups: the experimental (n=100), the safety (n=100), and the control (n=100). Experimental group was orally administered Tulsi leaf juice once daily and 28 days continuously at 5 g/kg body weight with an empty stomach during winter and summer seasons. Another study was conducted to observe 500 volunteers in West Bengal, India, who were randomly grouped into Control and Experimental groups where the Experimental group received fresh Tulsi leaf juice daily in four seasons. Systematic measurements of health outcomes such as influenza-like illness incidence, stress, health status and safety were conducted. Results indicated that Tulsi supplementation decreased incidence of influenza-like illness by 60 to 70 percent, decreased stressfulness by about 30 percent, and improved health status by 15 to 20 percent relative to controls significantly ($p < 0.001$). The combined findings of these results show that Tulsi leaf juice is a safe and cheap acceptable form of natural intervention that could promote immunity, vitality and even preventive action in the health of the people across all seasons irrespective of seasonal variations. The safety group individual was monitored on side effects, weight variation, and changes in appetite. Telephonic and direct follow-up was done in terms of clinical outcomes and in terms of the incidence of the diseases. Statistical testing of the analysis revealed that Tulsi leaf juice was tolerated with no side effects or changes in appetite and body weight. Significantly, none of the experimental subjects had diabetes, pneumonia, or heat stroke, whereas the control group had a cumulative disease incidence of 16%. Comparative seasonal surveys revealed consistent prophylactic efficacy and absence of symptoms in the experimental group. These results indicate that daily intake of *Ocimum* sanctum. Linn leaf juice is safe, non-toxic, and effective as prophylactic therapy against metabolic, respiratory, heat-associated and seasonal health hazards in normal healthy adults.

Keywords: Ocimum sanctum. Linn. leaf juice, prophylactic therapy, diabetes mellitus, infectious pneumonia, heat stroke, immune stimulant, influenza virus, stress relief, prophylactic therapy, nutraceutical

YS-001

PHYTOREMEDIATORY RESPONSE OF *AZOLLA* SPP. TO CRYSTAL VIOLET: EFFECTS ON GROWTH, OXIDATIVE STRESS, AND PEROXIDASE ACTIVITY

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Abstract:

Phytoremediation offers an eco-friendly strategy for removing synthetic dyes from contaminated waters, yet plant tolerance and detoxification mechanisms under dye stress remain underexplored. This study investigated the phytoremediatory potential of *Azolla* spp. exposed to crystal violet (CV) at 0 (control), 20, 40, and 60 mg L^{-1} for 3 days. Post-exposure, residual CV absorbance, growth performance, oxidative stress markers, and peroxidase (POD) activity were assessed to elucidate both remediation efficiency and physiological stress responses. Absorbance measurements revealed efficient CV reduction at 20 mg L^{-1}, with progressively lower removal efficiency at 40 and 60 mg L^{-1}, suggesting concentration-dependent phytoremediation capacity. Growth parameters, including relative growth rate (RGR) and biomass accumulation, declined with increasing CV exposure, with severe inhibition at 60 mg L^{-1}, indicating toxicity at higher pollutant loads. Oxidative stress analysis showed elevated reactive oxygen species (ROS) levels in CV-treated plants, with intensity correlating with dye concentration, highlighting oxidative damage during dye uptake and detoxification.POD activity increased significantly under CV stress, peaking at 40 mg L^{-1}, which may reflect an optimal enzymatic defense response to oxidative burden. However, at 60 mg L^{-1}, enzyme activity declined, possibly due to structural damage or inhibition under extreme stress. These findings suggest that *Azolla* can actively uptake and metabolize crystal violet at low-to-moderate concentrations, combining biomass-based dye sequestration with enzymatic detoxification pathways. Overall, *Azolla* demonstrated notable phytoremediatory potential against crystal violet, supported by physiological tolerance, oxidative stress mitigation, and antioxidant enzyme activation. Nonetheless, high CV concentrations compromise growth and enzymatic defense capacity, limiting remediation efficiency. This highlights the need for optimizing pollutant loads and exploring integrated remediation systems to enhance dye removal and plant resilience.

Keywords: Mosquito fern; phytoremediation; giant blue; oxidative stress; peroxidase; dye detoxification

YS-002

MELATONIN-MEDIATED PROTECTION IN RICE UNDER ARSENIC STRESS: FROM VEGETATIVE TO GRAIN DEVELOPMENT

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Abstract:

Arsenic contamination in paddy fields, especially through arsenic-laden groundwater irrigation in regions like West Bengal (rice bowl of India) poses a serious threat to rice cultivation. To ameliorate arsenic-induced phytotoxicity in rice plants, exogenous supplementation of biostimulating agents, like melatonin, was pursued since melatonin is ubiquitous, safe and low-cost. The primary aim of this study was to ascertain the beneficial role of exogenous melatonin in alleviating arsenic stress, based on studies undertaken in two contrasting indica rice cultivars, viz., Khitish (arsenic-susceptible) and Muktashri (arsenic-tolerant) grown under arsenate contamination. Melatonin supplementation significantly curtailed arsenic bioaccumulation in both cultivars by regulating the expression of key arsenic transporters. This was accompanied by notable improvements in physiological growth attributes and significant reductions in oxidative stress biomarkers, with a stronger ameliorative effect observed in Khitish. Importantly, melatonin reduced stress-induced methylglyoxal accumulation by down regulating glyoxalase machineries, thereby minimizing cytotoxicity. Enhanced levels of osmolytes and non-enzymatic antioxidants were observed in Khitish, indicating cultivar-specific metabolic adaptations.Furthermore, melatonin restored the ascorbate pool by suppressing stress-induced ascorbic acid oxidase activity while reinforcing the ascorbate-glutathione cycle along with antioxidative defense machinery. Isozyme profiling corroborated with biochemical and transcript findings, highlighting pronounced varietal differences in melatonin responsiveness. Elemental analysis indicated the efficacy of melatoninin sustaining mineral nutrient homeostasis under arsenic stress, while enrichment of thiol-based metabolites highlighted enhanced arsenic chelation and detoxification capacity. Importantly, beyond the vegetative phase, melatonin supplementation preserved reproductive fitness by modulating grain development-related gene expression at grain-filling (20 days after pollination) and maturation (40 days after pollination) stages, thereby stabilizing grain yield-related attributes, particularly in Khitish. Collectively, this integrative physio-biochemical and molecular study demonstrates that melatonin acts as a multifaceted bioregulator of oxidative homeostasis, detoxification pathways and developmental resilience in rice subjected to arsenic stress. Altogether, these findings delineate melatonin as a robust, economical and ecologically sustainable bio-regulator of arsenic stress tolerance, particularly for susceptible rice genotypes, thereby contributing a viable strategy to enhance crop resilience in arsenic-affected agro ecosystems.

Keywords: Melatonin, Arsenic stress, Reactive oxygen species, Oxidative damage, Antioxidants, Grain development, Phytochelatin, Rice

YS-003

MICROBIAL SOLUTION TO INCREASE THE PRODUCTIVITY OF *Cucurbita maxima* and *Zea mays* IN THE BACKDROP OF RECLAIMED AGRICULTURE SOIL OF EAST KOLKATA WETLANDS

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Abstract:

Wetlands represent the convergence of land and water, showcasing a rich ecological diversity and serving numerous functions. Ramsar Convention had recognized East Kolkata Wetlands of international significance in August, 2002. However, inefficient management of these wetlands has resulted in their gradual deterioration. In this investigation, soil samples were assembled from the reclaimed farmlands in the Chowbaga regions of the East Kolkata Wetlands. The soil physico-chemical specifications were analysed throughout three cropping stages namely, initial phase, peak phase, and inter cropping phase of *Cucurbita maxima* and *Zea mays*. The metagenomic analysis of soil samples at various cropping stages was conducted to investigate the presence of residual bacterial flora and their interactions with soil properties. The plant growth-promoting characteristics of the key bacterial flora isolated from the rhizospheric areas of *Cucurbita* sp. and *Zea mays* were evaluated. Additionally, their capacity to produce biotechnologically significant enzymes such as lipase, lignin peroxidase, and amylase was also assessed. The reclaimed agricultural lands of East Kolkata Wetlands were found to possess high levels of heavy density metals, especially lead. Among the bacterial isolates, two of them demonstrated significant potential for lead mitigation, with the ability to adsorb around 5.24% and approximately 8.28% of lead, respectively. The selected bacterial isolates were utilized as a microbial consortium and applied to *Cucurbita maxima* and *Zea mays* cultivated in the reclaimed soil of the East Kolkata Wetlands, resulting in a reduction of lead content in the fruits of these plants by 92% and 10.7%, respectively. ANOVA studies have been done to decipher the significance of the impact of the bacterial consortia upon the treated plants with respect to the control plants. The possible use of PGPR has consistently grown, as it is found to work as a viable substitute for the ongoing reliance on chemical fertilizers and pesticides.

Keywords: East Kolkata wetlands, reclaimed agriculture land, PGPR, enzymes, lead

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