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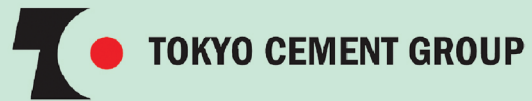


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5th and 6th of January 2024

University of Sri Jayewardenepura, Sri Lanka

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ENVIRONMENT

Symposium
2024



DEPARTMENT OF FORESTRY AND ENVIRONMENTAL SCIENCE
UNIVERSITY OF SRI JAYEWARDENEPURA , SRI LANKA

**28th International
Forestry and Environment Symposium
2024**

**Forest and Environmental Management towards
Economic Recovery and Resilience**

Proceedings of the International Forestry and Environment
Symposium Volume 28 (2024)

05th and 06th of January 2024
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PREFACE

International Forestry and Environment Symposium, orchestrated by the Department of Forestry and Environmental Science at the University of Sri Jayewardenepura, continues its legacy as the oldest and most esteemed symposium in South Asia dedicated to forestry and environmental discourse. This annual gathering provides a crucial meeting ground for researchers, academics, professionals, policymakers, and industry leaders to annually publish, discuss, and glean insights from the latest developments in forestry and environmental sectors.

Since its inaugural event themed "Forestry for Development" at Coral Gardens Hotel, Hikkaduwa, in 1995, the Symposium has garnered widespread recognition among academics and professionals in the forestry and environmental sectors, both within Sri Lanka and internationally. Today, it stands as an ideal platform that fosters connections with well-established research networks, showcasing exceptional research work and contributing to the visibility of outstanding contributions. Beyond being a knowledge-sharing platform, the International Forestry and Environment Symposium consistently makes a regional and national impact by disseminating knowledge and ideas across a wide range of sub-disciplines related to the fields of forestry and environmental sciences.

This year's symposium, themed "Forest and Environment Management towards Economic Recovery and Resilience," underscores the imperative of sustainable strategies that not only address environmental concerns but also contribute to economic recovery and resilience. The symposium sessions delve into various aspects of this theme, presenting research findings across 12 key areas. These include Forest and Natural Resource Management, Biodiversity Conservation and Management, Waste Management and Pollution Control, Environmental Economics and Resource Management, Climate Change and Disaster Management, Biomass and Sustainable Energy, Sustainable Tourism, Sustainable Land Use and Urban Development, Wood Science and Wood Based Industries, Environmental Engineering and Green Technology, Geology, Soil and Water Resource Management, and a Citizen Science Forum. The Symposium Proceedings encapsulate 238 abstracts of scientific studies contributed by both local and international researchers.

The Organizing Committee of the symposium extends sincere gratitude to the stakeholders who have supported this pre-eminent venture, ensuring its success. We also express our appreciation to all authors, reviewers, participants, session chairpersons, and the academic and non-academic staff of the Department of Forestry and Environmental Science, as well as the students, for their unwavering support in making this event a reality.

Symposium Organising Committee
Department of Forestry and Environmental Science
5th January 2024



Message from the Chief Guest
Senior Prof. Sampath Amaratunge
Chairman, University Grants Commission

It is with great pleasure that I extend my warmest greetings to the distinguished assembly at the 28th Forestry and Environment Symposium. Hosted by the University of Sri Jayewardenepura's Department of Forestry and Environmental Science, this annual gathering continues to be a beacon of knowledge and collaboration.

The chosen theme, "Forest and Environment Management towards Economic Recovery and Resilience," resonates deeply with the pressing global challenges we face. Much like last year's insightful discussions on "Economic Resilience and Environmental Sustainability: A Synergy for the Future," this symposium holds the promise of furthering our understanding of the interplay between economic resilience and environmental sustainability. Forests and the environment are invaluable assets that often face undervaluation in economic decision-making. The non-market values, including environmental services and livelihood benefits, deserve recognition to inform sound economic policies and sustainable land-use practices.

I commend the Department of Forestry and Environmental Science for its pivotal role in training professionals who contribute significantly to global environmental agencies. Through the commitment of its students, the department continues to make strides in advancing sustainable forest and environment management.

As we convene for this landmark symposium, I anticipate engaging discussions that will contribute to the shared goal of fostering sustainable forestry and environmental practices. May this event mark the beginning of a series of dialogues, propelling Sri Lanka towards a future of economic growth and prosperity.

Best wishes for the success of the 28th Forestry and Environment Symposium.

Senior Prof. Sampath Amaratunge,
Chairman,
University Grants Commission



**Message from Senior Prof. Pathmalal Manage
Vice Chancellor,
University of Sri Jayewardenepura**

It is my distinct pleasure to write the message for the 28th International Forestry and Environment Symposium, organized by the Department of Forestry and Environmental Science, Faculty of Applied Sciences at the University of Sri Jayewardenepura.

Under the theme "Forest and Environment Management towards Economic Recovery and Resilience," this symposium serves as a pivotal platform for the exchange of knowledge and ideas in the critical areas that shape our environmental and economic landscapes. The symposium will encompass key sessions covering a diverse range of topics, including Forest and Natural Resource Management, Biodiversity Conservation, Waste Management, Climate Change, Sustainable Energy, and many more.

Our world faces unprecedented challenges, and it is through collective efforts and shared expertise that we can address these issues and pave the way for a sustainable and resilient future. This symposium provides a unique opportunity for scholars, researchers, and practitioners to engage in meaningful discussions, share insights, and explore innovative solutions.

I would like to express my sincere appreciation to the Department of Forestry and Environmental Science for their dedication and hard work in organizing this event. Their commitment to advancing knowledge in these crucial fields is commendable, and I am confident that the symposium will be a fruitful endeavor for all participants. I encourage you to actively participate in the sessions, engage in productive discussions, and foster collaborations that will contribute to the broader goals of sustainable environmental management.

I wish you all a productive and enriching experience during the 28th International Forestry and Environment Symposium.

Senior Prof. M. M. Pathmalal,
Vice Chancellor,
University of Sri Jayewardenepura



**Message from Prof. Upul Subasinghe
Dean, Faculty of Applied Sciences,
University of Sri Jayewardenepura**

It brings me immense joy and pride to address the proceedings of the 28th International Forestry and Environmental Symposium 2024. As the Dean of the Faculty of Applied Sciences and the former Head of the Department of Forestry and Environmental Sciences, witnessing the success of this event amid such challenging times fills me with great enthusiasm and appreciation.

Amidst the complexities of this era, the symposium stands as a beacon of dedication and resilience, showcasing the unwavering commitment of the organizers. The University of Sri Jayewardenepura has always been dedicated to enhancing the skills of its students and fostering the exchange of ground-breaking knowledge. This year's theme, "Forest and Environment Management towards Economic Recovery and Resilience," encapsulates the pressing needs of our time. The amalgamation of economic stability and environmental stewardship not only empowers academia and industry but also fosters a collaborative environment where ideas and knowledge flourish.

I am continuously fascinated by the diverse range of abstracts and research presented each year which contributes unique dimensions to the discourse. The impact of this event reverberates beyond academic spheres, influencing industrial and cooperate landscapes and in leaving an indelible mark on the pursuit of sustainable practices.

To the diligent organizing committee, I extend my deepest appreciation for their unwavering dedication and perseverance in orchestrating this symposium. Their tireless efforts have undoubtedly laid the groundwork for a transformative and enlightening event. I wholeheartedly wish all the participants the best, confident that this symposium will serve as a catalyst for innovative ideas and solutions that will shape the future of forestry and environmental sciences.

Prof. Upul Subasinghe,
Dean, Faculty of Applied Sciences,
University of Sri Jayewardenepura

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Managing Risk in Fire-Prone Landscapes: An Australian Perspective

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Fire has been an integral part of the Australian landscape since the mid Miocene (~16Ma BP) (Kershaw and D'Costa 2002) with a fire adapted flora dominating many parts of the continent by the mid-late Tertiary (Bowman 2003). Indigenous cultural burning shaped this vegetation for at least the last 60,000 years, but with colonial settlement, these practises were disrupted, contributing to increased fuel loads and flammability, across much of south-eastern Australia (Morgan *et al.* 2020). Particularly after periods of drought, fire risk is extreme. In the recent past the Black Saturday fires in Victoria, 2009, the 2016 fires in Tasmania, which burnt through fire-sensitive vegetation of world heritage status in the Central Highlands and the 2019-20 Black Summer fires across south-eastern Australia are harbingers of what might be expected under hotter and drier climates associated with climate change. The scale and impact of these fires limit capacity for restoration and challenges fire management agencies to adopt risk reduction approaches.

A major challenge then, is balancing different types of risk. Human settlements in the urban-wildland interface are particularly at risk and protecting lives and assets has been the primary focus of fire management planning since the fires of 2009. The principal means of reducing fire risk is to conduct planned burns and reduce fuel loads, and to do this regularly around human settlements. Although much of the Australian flora is fire-adapted, fire adaptations evolve under specific “regimes” that include the frequency, severity, spatial extent and season of fire. Planned burning can disrupt natural fire regimes leading to changes in vegetation community composition and successional processes, and potentially to higher landscape flammability. Furthermore, recent wildfires have burnt up to 100% of some species habitat, penetrated into more sensitive non-fire adapted vegetation and have increased the extinction risk of vulnerable flora and fauna species.

Climate change is likely to reduce our capacity to conduct planned burns and exacerbate the potential for large-scale high intensity fires. Consequently, our challenge is to balance the social, economic and biodiversity risks associated with fire in the Australian landscape.



Theme Talk: Assessing Past Biodiversity using Plant Paleoecology

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Understanding past plant diversity provides an avenue for informing the conservation of current plant species and vegetation communities and has a range of applications that will be explored herein with examples from around the globe. One of the tools at our disposal to gain this understanding of past ecosystems and plant diversity is plant macrofossil analysis. It involves the study of subfossil plant remains preserved in sedimentary archives of Late Quaternary age.

Through plant palaeoecology we can examine the origin status of plant species. The determination of species as native or exotic can change the way they are managed in modern landscapes and have implications for management regimes. It also allows us to consider biogeographic patterns in light of the plant macrofossil data. Fossil evidence reveals taxa that have been locally extirpated from islands or island archipelagos, as well as taxa that have gone extinct since the arrival of humans. Data can also demonstrate range extensions of extant taxa, those existing elsewhere in the landscape today. The turnover of communities through time can be investigated in detail, whether these were caused by natural climatic or hydrologic changes, or directly through human agency.

A key aspect of palaeoecology is the provision of baseline data with which to compare. The data has the capacity to inform revegetation and restoration programs by providing species lists of taxa from particular points in time prior to human disturbance. This gives another valuable line of evidence in situations where historical data and remnant vegetation is limited. They also provide essential foundational knowledge that can be used to inform future environmental changes that may occur as a result of human-induced climate change. We can insights into how particular species, communities or ecosystems respond to changes of a similar magnitude or extent, that have occurred in the past.

(ID 305)**Abundance of Fungal Species in Healthy and Agarwood Resinous Tissues of *Gyrinops walla*****Hettiarachchige, R.P.^{1*}, Subasinghe, S.M.C.U.P.¹, Manamgoda, D.S.²**¹*Centre for Forestry and Environment, Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***ruwihettiarachchi6@gmail.com***Abstract**

Agarwood is a resinous substance embedded in stem tissues in *Aquilaria* and *Gyrinops* species, belonging to the Thymalaeaceae tree family. Agarwood resin formation is induced as a self-defence mechanism, mainly to protect from fungal attacks. Due to strong aromatic properties, agarwood tissues and resins extracted from those tissues become a highly priced non-timber forest product used in the fragrance and traditional medicine industries. *Gyrinops walla* has been recorded only in Sri Lanka in recent decades, which is the only member of the genus agarwood-producing species naturally grown in the country. Since fungal species induce the agarwood resin formation, this study aimed to identify the fungal diversity in the resin-embedded and healthy stem tissues of *G. walla*. Healthy and agarwood resinous tissue samples were collected from *G. walla* trees growing in Kirimetimulla, Olugala, Elpitiya, Morapitiya, and Weheragala of the low country wet zone of Sri Lanka. Five trees were sampled in each location. Those tissues were immediately sealed in polythene bags after collection to minimize contamination. Those were surface sterilized in the laboratory and cultured on Potato Dextrose Agar and Malt Extract Agar media. Once the colonies were formed, isolation was done by the single spore isolation method. It was possible to isolate 8 different morphotypes from Kirimetimulla, 9 from Morapitiya, 7 from Weheragla, 7 from Olugala, and 6 from Elpitiya. A total of 12 morphologically different isolates were identified from healthy and resinous *G. walla* tissues from all five locations by Macroscopic and microscopic analysis. Among them, *Aspergillus* sp., *Botryosphaeria* sp., *Lasiodiploidea* sp., *Fusarium* sp., *Trichoderma* sp., and *Penicillium* sp. were common in all locations. Studies are underway to identify the possibility of inducing agarwood resin formation by inoculating laboratory-grown pure cultures of the above species.

Keywords: *Gyrinops walla*, Agarwood, Fungal diversity, Fungal isolates, Induce

(ID 023)

Genus *Landoltia* (Araceae): A Newly Recorded Aquatic Genus from Sri Lanka

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Abstract

Members of the genus *Lemna*, commonly known as duckweeds, have the capacity to produce huge biomass with a broad range of potential applications and are popular as ornamentals in the aquatic plant industry. However, the species identity of the *Lemna* that occur in Sri Lanka is questionable as various literature recognize different species as occurring in Sri Lanka. There has been no detailed taxonomic study carried out on the genus *Lemna* in the recent past. The conservation and sustainable utilization of biodiversity solely rely on the correct identification of the species. Hence, the present study was carried out to identify the species diversity of *Lemna* occurring in Sri Lanka. Fieldwork was carried out from October 2022 to August 2023, covering the wet, intermediate, and dry zones of the country as the genus *Lemna* is recorded to occur in these zones. Qualitative and quantitative vegetative characters were recorded in the field and in the laboratory by the naked eye or by using a Stereo microscope. The quantitative data included the number of roots, root length, frond length and width, and number of veins while the qualitative data included the shape of the root tip, the presence of prophyllum, frond shape, the presence of papilla, frond symmetry and the nature of frond surface. Morphological data were subjected to Hierarchical Cluster Analysis, using the PAST software. Based on the results, four distinct clusters were recognised, of which three clusters resembled morphological characters of *Lemna* species. However, a distinct cluster that separated at a distance of 0.56 resembled morphological characters different to *Lemna*, viz., the presence of a prophyllum, turions and multiple roots, characters considered as absent in the genus *Lemna*. The literature survey reveals that these characters are unique to the genus *Landoltia*, Hence the study confirmed the presence of a new genus *Landoltia* for the first time in Sri Lanka. The results of the present study would be useful in initiating further studies on the identification of the species. Due to the minute nature of these plants, molecular studies are recommended for confirmation of their species identity.

Keywords: Conservation, *Landoltia*, *Lemna*, Morphometric analyses, Species diversity

(ID 159)

The Influence of Vegetation Characteristics in Regulating the Microclimate in the Knuckles Conservation Forest, Sri Lanka

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Abstract

Microclimatic variables, which vary spatially and temporally across landscapes, are largely influenced by vegetation characteristics. This study was conducted at the end of February 2023 in the northern region of the Knuckles Conservation Forest in Sri Lanka, with the aim of investigating the role of vegetation characteristics on microclimatic metrics in grasslands (GR) and sub-montane forests (SMF). Ambient temperature (T) and relative humidity (RH) were measured using sensors placed 2 m above the ground at randomly selected locations in sub-montane forests (n=9) and grassland patches (n=10). Canopy cover (CC), herbaceous cover (HC) and girth at breast height (GBH) were recorded at each site within 10×10 m quadrats centering the sensors. The study demonstrated a significant difference in the CC ($P<0.05$) and GBH ($P<0.05$) between the two habitats. Conversely, no significant difference was found in the HC between the habitats. The regression analysis showed that the contribution of HC to microclimate regulation was low ($R^2\approx 0.0$, $P>0.05$). In contrast, CC had a significant and positive influence on T min ($R^2=47.5$, $P<0.05$) and RH min ($R^2=50.0$, $P<0.05$), and a significant negative influence on T max ($R^2=45.4$, $P<0.05$), T range ($R^2=73.2$, $P<0.001$) and RH range ($R^2=40.6$, $P<0.05$). The presence of large trees also significantly contributed to these proxies showing a negative relationship with T max ($R^2=64.2$, $P<0.001$), T range ($R^2=79.1$, $P<0.001$), and RH range ($R^2=54.9$, $P<0.05$) and a positive relationship with RH min ($R^2=71.7$, $P<0.001$). This study demonstrates that increased canopy cover and GBH can play a significant role in buffering microclimate extremes, highlighting the importance of maintaining vegetation cover, which is particularly relevant in the face of predicted climate change.

Keywords: Microclimate, Sub-montane forests, Canopy cover, GBH, Sri Lanka

(ID 072)

Scaling Up Above-Ground Biomass for *Khaya senegalensis* from Tree Level to Stand Level Using Sentinel-2 Based Dataset

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Abstract

Khaya senegalensis is an emerging option for climate change mitigating strategies, however, quantifying the carbon sequestration potential of *Khaya* in Sri Lankan conditions remains a critical concern. Tree-level biomass models exist for *Khaya*, they lack in spatial representation, which is crucial for stand-level carbon stock estimates. This study developed stand-level models to representation of the stand variability, emphasizing the efficiency of remote sensing in capturing spatial features and spatial heterogeneity. Therefore, this study aimed to develop remote sensing-based stand scale above-ground biomass (AGB)/above-ground carbon (AGC) prediction models using the relationship between remote sensing-based vegetation indices and estimated AGB/AGC based on the field measurements. The field data were collected from 53 sample plots of *Khaya senegalensis* monoculture forest plantation located in the intermediate zone, Sri Lanka. The Conditional Latin Hypercube sampling (cLHS) method was used to identify the sample points. The tree biomass and carbon content were derived using a tree-level allometric model available in the literature, collecting substantial field data such as diameter at breast height (DBH), tree height, and stocking density. This tree-level carbon content was scaled up to the plot level, building the relationship between the total AGB of the plot and the plot structural variables (Stand Basal Area-BA, Stand Mean height-H, and Stand Density-SD). In this study, AGB was modelled with 7 vegetation indices derived using Sentinel-2 imagery. The Classification and Regression Tree (CART) model was fitted as the final model since AGB, and vegetation indices perform a complex and nonlinear relationship. The k-fold cross-validation method was used to validate the final model. The selected plot scale, field models have higher R^2 -adj and lower error statistics. Finally selected plot scale allometric model was $AGB = aBA^bSD^{b1} + \epsilon$ [RSE (4.781), RSS (1143), AIC (321.169), BIC (329.051), RMSE (4.644 Mgha⁻¹), MAE (3.342), R^2 -adj (0.9)] and remote sensing-based stand scale AGB model was based on the four vegetation indices namely, Normalized Vegetation Index (NDVI), Sentinel-2 Red Edge Position (S2REP), Enhanced Vegetation Index (EVI), and Normalized Difference Index (NDI) 45. Between AGB and vegetation indices were revealed higher variability and a more complex combination. This discloses when modelling AGB/AGC using remote sensing-based indices, tree-based machine learning algorithms are more appropriate than linear regression modelling. However, to generalize this model across Sri Lanka, further testing needs to be done with a large dataset.

Keywords: *Khaya senegalensis*, Biomass, Remote sensing, Allometric equation, Up-scaling

(ID 321)

Assessing the Temporal Variations in Light Interception and their Impact on Above-Ground Biomass Production in Wet Zone Rubber Plantations

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Abstract

Rubber (*Hevea brasiliensis*) is an important crop in Sri Lanka, primarily cultivated for latex production. However, the monoculture nature of rubber plantations has a significant impact on the overall above-ground biomass production that can lead to economic vulnerability due to fluctuations in rubber prices. This study aimed to find a novel method to investigate the temporal variations in the light environment in wet zone rubber plantations and their influence on above-ground biomass (AGB) production. The research involved the selection of rubber fields ranging from 4 to 33 years in the Salawa rubber plantation for comprehensive data collection. The hemispherical photography analysis method was used at a five-year age series to determine the canopy cover, which indicates the amount of light intercepted by the rubber trees and leaf area index (LAI). It was determined through hemispherical photographs captured using a Canon EOS 70D camera fitted with a fisheye lens. Image analysis was done using Adobe Photoshop and Hemi-view canopy analysis software (version 2.1). Then, the light interception was calculated by taking the difference between the total radiation above the canopy, corrected for intercepting surface orientation and the Total radiation below the canopy, corrected for intercepting surface orientation values. The amount of AGB was estimated using an allometric equation based on diameter at breast height and tree height. The light interception was then analysed in association with LAI to identify their influence on AGB by developing mathematical models. The findings indicated that younger rubber trees consistently captured more solar radiation over the study period compared to mature trees. From December 2022 to May 2023, there was a notable increasing trend in light distribution within the plantation, reaching its peak in May. Maximum light interception occurred in the 8-year-old rubber field during this period, reaching $7,512.63 \mu\text{mol m}^{-2} \text{s}^{-1}$ when the LAI peaked. However, despite a strong and positive correlation between cumulative PAR interception and LAI, light interception within the canopy displayed significant temporal heterogeneity across the study period, with May exhibiting the highest levels, followed by February, and the lowest in December. Notably, there was no consistent and predictable relationship between cumulative light interception and AGB across the rubber fields during the six-month study period. Therefore, these findings emphasize the need for further research and a complex approach to understanding the relationship between environmental variables and rubber cultivation for the selection of methodologies in plantation management.

Keywords: *Hevea brasiliensis*, Hemispherical photography, Above-ground biomass, Temporal variations, Light interception

(ID 011)

**Improvement Needs to Promote Scientific Agricultural Practices in Agroforestry
Home Gardens with Special Reference to Weligama, Sri Lanka**

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Abstract

Agroforestry home gardens are production models with high diversity. It has become a hotspot in scientific research because only few studies have attempted to review scientific agroforestry practices. Therefore, the present study attempts to find out improvement needs to promote scientific practices in agroforestry home gardens with special reference to Weligama Divisional Secretariat (DS), Sri Lanka. Currently ongoing “Haritha Dayak” home gardening development project conducted by Ministry of Agriculture in this area. Three Grama Niladari (GN) divisions were selected through reconnaissance survey conducted with agriculture instructors based on the availability of the highest number of agroforestry home gardens. The primary data were collected from randomly selected 30 households from each GN division (n=90) by personal interviews through the use of a structured questionnaire. Their concern on improvement needs to promote scientific agriculture practices was measured by 5-point Likert scale ranging from 1 to 5 where 1=Not concern, 5=highly concern. Descriptive and Wilcoxon signed rank test analysis were used to analysis data. The results revealed that majority of households have highly concern on market opportunities (40%), access to off farm employment (36.7%) and contribution to household economy (48.9%). Households pay moderate concern on access to quality agricultural inputs (43.3%) and opportunity to improve scientific knowledge (42%) and not concern (42.2%) about research and development on scientific agricultural practices of agroforestry home gardens. Access to market, access to off-farm employment, contribution to household economic/Production objective are significant ($p < 0.01$) with highly concern. There is significant ($p < 0.01$) difference between availability of research and development on scientific basis of agroforestry home garden and not concern. There is no significant ($p > 0.01$) difference between access to agriculture input and moderate concern. This study promotes the need for strong national policy and more research which emphasis scientific agricultural practices in agroforestry home gardens.

Keywords: Home garden, Scientific practices, Strategies, Market

(ID 039)

Quantitative Analysis of Forest Cover Dynamics: A Comparative Study of Nordic and South Asian Countries

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Abstract

This comprehensive study delves into a thorough comparative analysis of the changes in forest cover across Nordic and South Asian countries spanning a 26-year period from 1990 to 2019. This analytical approach enables the discernment of significant patterns and extraction of meaningful insights crucial for understanding the complex interplay of environmental, socio-economic, and policy factors in shaping forest dynamics in Sri Lanka and other South Asian countries. The research relies on meticulously gathered secondary data from reputable sources such as the World Bank and FAO. The data is then systematically organized and subjected to comprehensive analysis using various graphical representations, facilitating the identification of significant patterns and the extraction of meaningful insights. During the study period, the Nordic region exhibited a remarkable trend, with all countries experiencing substantial increases in forest land cover. Iceland, in particular, stood out with an astonishing 168% change in forest coverage from 1990 to 2019. Denmark and Finland maintained relatively stable forest coverage percentages of 13% and 2%, respectively, over the same period. In contrast, South Asian countries like Bangladesh and Sri Lanka showed negative trends in forest coverage, with respective decreases of 2% and 8% from 1990 to 2019. Conversely, Bhutan and India displayed substantial growth in forest cover, marking impressive increases of 8% and 10%, respectively, over the same timeframe. Interestingly, all Nordic countries consistently demonstrated a net annual gain in forest cover, except during a brief interlude from 2000 to 2004. In contrast, all South Asian countries, except India and Bhutan, experienced net annual forest losses throughout the study period. Notable variations in net annual gains were observed, such as Denmark and Finland recording net annual losses of forest cover during the period from 2000 to 2004. Furthermore, Bhutan and India consistently exhibited net annual gains in forest cover throughout the entire study period. India, in particular, demonstrated the highest net annual gain of forest cover from 2000 to 2004 with a value of 3,710.41 km²/year, maintaining substantial gains from 2015 to 2019 at 2,131.20 km²/year. Bhutan exhibited a net annual gain in forest cover, with an average annual gain of 79 km²/year from 1990 to 2014, and a reduced net annual gain of 16 km²/year from 2015 to 2019. Conversely, Pakistan, Bangladesh, and Sri Lanka consistently witnessed net annual losses of forest cover, though with varying rates of decline. Sri Lanka displayed fluctuations in net forest cover, with rates ranging from 24 km²/year to 118.40 km²/year during the periods from 2005 to 2009 and from 2000 to 2004, respectively. Nepal recorded the highest average value of net annual loss of forest cover amounting to 422.40 km²/year during the period from 2000 to 2004. This research serves as a valuable resource for shaping effective environmental policies and fostering collaboration for sustainable development.

Keywords: Forest cover, Nordic, South Asia, Loss/Gain of forest

(ID 094)

Cytotoxicity of Indigenous Medicinal Plants Kothala Himbutu, Kottamalli and Polpala on The Vero Kidney Cell Line; In-Vitro Study Using MTT Assay

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Abstract

Despite significant breakthroughs in the pharmaceutical industry, there's a growing interest in natural medicines across the world. Many individuals around the world who suffer from various illnesses employ a variety of native herbal plants to have a therapeutic effect. The use of these plants may have negative consequences on the health of patients, especially on the kidneys. The present study was focused on investigating the nephrotoxic effects of indigenous medicinal plants; Kothala Himbutu, Kottamalli and Polpala on the Vero kidney cell line. Four dilution series in each (5.0, 10.0, 15.0, and 20.0 g, of Kottamalli; 1.0, 2.0, 3.0, and 4.0 g of Kothala Himbutu; 3.0, 6.0, 9.0, and 12.0 g of Polpala in 125 ml of Mill-Q water) were exposed to Vero; monkey kidney epithelial cells (5×10^3 cells/well). Cell viability was measured using MTT assay and the cell viability percentage and the CC₅₀ values was calculated. In the MTT assay the cell viability percentages in the cells exposed to Kottamalli, Kothala Himbutu and Polpala were ranged from 72.06 to 98.73%, 79.04 to 98.00%, and 50.80 to 95.00% respectively. Significantly lower cell viability percentages were recorded in the cells exposed to positive control than in the cells exposed to the plant extracts in the MTT assay ($p < 0.05$). Hence, the results of the present study indicated the water extracts of the Kottamalli, Kothala Himbutu, and Polpala plants do not reduce the cell viability and do not cause nephrotoxicity directly. However, further studies are needed to confirm the nephrotoxic effects of medicinal plants.

Keywords: Nephrotoxic effects, Indigenous medicinal plants, Vero kidney cells, cell viability, plant extracts

(ID 109)**Assessing Changes and Fragmentations of Forest Cover in the Northern Province, Sri Lanka****Bharathy, P.*, Suthakar, K.***Department of Geography, University of Jaffna, Jaffna, Sri Lanka***bharathyp@univ.jfn.ac.lk***Abstract**

Forest cover change and fragmentation have become a global concern and are linked to the decline of the ecosystem's integrity. It also negatively affects biodiversity, forest degradation, and the spatial pattern of the landscape. Human population increase and accompanying activities like agricultural expansion, resettlement, deforestation, and infrastructural development all contribute to forest cover changes and forest fragmentation. Geospatial technologies, such as remote sensing (RS) and geographic information system (GIS), have expanded the potential for investigating, monitoring, analysing, and reporting on important biodiversity changes. This study aims to assess and quantify the extent and pattern of forest cover changes and forest cover fragmentations in the Northern Province since 1990. From 1990 to 2020, multi-temporal satellite images (Landsat: TM, ETM, OLI) and digital image processing were used to assess and spatially describe forest cover changes. Forest fragmentations were measured by number of patches, patch size coefficient of variance (PSCoV), class area, edge density, mean shape index and average weighted mean shape index using Patch Analyst in the ArcGIS environment. The study shows that large amounts of forest cover have decreased over the last 30 years in the Northern Province. The lands for agriculture, homestead, and scrub increased by 9.16%, 13.33%, and 4.4%, respectively during the last 30 years, while forest cover decreased by 24.07%. As a result, the Northern Province's Forest is more fragmented. The total forest patches increased by 53,536 patches over the 30 years, the mean patch size (MPS) reduced from 21.75 in 1990 to 5.79 in 2020 and PSCoV decreased by roughly 85.95% from 7663.14 ha in 1990 to 1077.03 ha in 2020. Forest cover in Northern Province has not been disturbed much by three decades (1980-2009) of civil war, however, there were significant changes in forest cover after the war due to increasing resettlements in new places, development initiations, indiscriminate forest logging, land grabbing and agricultural expansion. The trend of fast deforestation and increasing forest fragmentation in the Northern Province effects on natural habitats of wildlife, biodiversity and the livelihood activities of the people. In this setting, it is critical to adopt appropriate policies to balance the environment via sustainable land use planning. The findings of this research provide a solid foundation for the necessities of sustainable development planning in Northern Province.

Keywords: Remote Sensing and GIS, Satellite images, Forest cover change, Fragmentation, Northern Province

(ID 160)**Spatio-Temporal Changes and Fragmentation Patterns of Sinharaja Forest Peripheral Area Using Morphological Spatial Pattern Analysis****Madhushanka, M.P.S.^{1*}, Jayasinghe, K.D.P.P.²**

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Abstract

Forest fragmentation is a landscape process that significantly impacts the spatial structure and ecological dynamics of natural ecosystems. As human populations continue to grow, this phenomenon has emerged as a pressing challenge. Consequently, high rates of forest degradation and fragmentation, especially in tropical regions, have become more prevalent. In recent decades, human activities have intensified in the peripheral areas surrounding the Sinharaja forest reserve, leading to forest fragmentation. The advancement of remote sensing-based approaches has provided valuable insights into forest cover change analysis. The objective of this research was to analyze the fragmentation patterns in the peripheral areas of the Sinharaja forest using Morphological Spatial Pattern Analysis (MSPA). MSPA is a method used for landscape pattern analysis related to forest fragmentation and other natural land cover classes. The study spans 24 years, from 1995 to 2019, using Landsat imagery. A forest cover map was created using Normalized Difference Vegetation Index (NDVI) analysis. Its accuracy was checked done by the accuracy assessment and assessing with the Google Earth images. The accuracy was 85.4% and 89.5% in 1995 and 2019 respectively. The study aimed to quantify the spatial and temporal changes, the fragmentation pattern of forest cover, and its associated ecological impacts. Various landscape indices such as Largest Patch Index (LPI), Number of Patches (NP), Patch Density (PD), and Shannon's Diversity Index (SDI) were applied to characterize the spatial pattern and assess the connectivity of forested and non- forested areas. SDI was analyzed using Leco's plugin after confirming accuracy for forest and non-forest patches through the validation procedure. The results revealed that forested areas decreased from 186 km² in 1995 to 180 km² in 2019, with the northern and northwestern parts of the peripheral zone being more susceptible to fragmentation. The core forest patches in the area increased over the 24-year period, while non-forest areas expanded by 3.23%. LPI for forest patches decreased from 1.88% to 2.06%, and SDI increased from 0.31 to 0.37 during this time frame. These findings indicated that the forest patches in 2019 became smaller and exhibited higher diversity compared to 1995. Overall, the results suggested that the peripheral areas of the Sinharaja forest reserve are vulnerable to forest fragmentation. MSPA contributes to our understanding of the landscape and fragmentation patterns in the area, which are essential for conservation and sustainable forest management. Additionally, this study demonstrated the effectiveness of using geospatial tools to quantify forest fragmentation even with limited data availability.

Keywords: Ecological impacts, Forest fragmentation, Landscape metrics, Morphological Spatial Pattern Analysis.

(ID 037)

Phytochemical Screening and *In Vitro* Antimicrobial Activity of *Desmodium triflorum* Against *Escherichia coli*, *Enterococcus faecalis*, and *Klebsiella pneumoniae*

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Abstract

Emergence of multidrug resistant microorganisms become a major threat to treat gastroenteric diseases. Phytomedicines, derived from diverse medicinal plants in Sri Lanka, offer potent antimicrobial agents against microorganisms, making them a valuable alternative to antibiotics in treating gastroenteric diseases. This study aims to control gastroenteric diseases causing microorganisms by *Desmodium triflorum* plant extracts. Crude plant extracts were obtained with maceration; using Hexane, Dichloromethane (DCM), Ethyl acetate, Acetone and Methanol solvents separately. Antimicrobial activity of plant extracts was investigated by Kirby-Bauer disk-diffusion method against *Klebsiella pneumoniae*, *Escherichia coli*, and *Enterococcus faecalis*. Zone Of Inhibition (ZOI) was measured and calculated mean ZOI were interpreted based on CLSI zone diameter breakpoints. All extracts from *D. triflorum* showed significant difference ($P \leq 0.05$) in antimicrobial activity against tested microorganisms. DCM extracts of *D. triflorum*, showed remarkable *in vitro* antimicrobial activity by suppressing *E. faecalis* with the highest mean of ZOI (9.333 ± 0.577 mm). Minimum inhibitory concentrations (MIC) of DCM extract from *D. triflorum* were determined by microbroth dilution method. *D. triflorum* showed MIC of $1 < \text{MIC} > 0.5$ mg/mL for *K. pneumoniae*, $2 < \text{MIC} > 1$ mg/mL for *E. coli*, and $2 < \text{MIC} > 1$ mg/mL for *E. faecalis*. Preliminary phytochemical analysis revealed the presence of terpenoids in hexane extract, alkaloids, terpenoids, saponins in DCM extract, alkaloids, saponins in ethyl acetate extract, alkaloids, saponins in acetone extract, and phenols, tannins, alkaloids, saponins, terpenoids, flavonoids in methanol extract obtained from *D. triflorum*. DCM extract of *D. triflorum* was subjected to GC–MS analysis to identify the likely compounds responsible for the antimicrobial properties. Ten compounds in *D. triflorum* were identified as potential contributors to its antimicrobial activity. The highest percentage of total observed as n-Hexadecanoic acid which is 3.927%. Present study concludes DCM is the most effective solvent for solubilizing antimicrobial compounds. The highest inhibitory action of *D. triflorum* was demonstrated against *E. faecalis*. Isolated active compounds from *D. triflorum* will be a potential source for the synthesis of novel drugs to control the pathogenicity of *E. faecalis* by addressing multidrug resistance in gastroenteric microorganisms.

Keywords: *Desmodium triflorum*, Multidrug resistant, Antimicrobial activity, DCM extract, GC-MS analysis

(ID 244)

Detecting and Mapping Individual Coconut Tree Crowns Using Deep Learning from UAV Imagery at the Oluvil Coastal Fringe in Ampara District, Sri Lanka

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Abstract

Large stands of coconut trees (*Cocos nucifera*) are grown at the coastal fringe habitats which are vulnerable to coastal and riverine erosion. Detecting coconut trees using Unmanned Aerial Vehicle (UAV) imagery is a useful way for monitoring coastal habitat vulnerabilities such as coastal erosion and can be used for sustainable land management prior to implement any coastal development program. Therefore, this study proposes a method to identify individual coconut tree, to map their spatial distribution, and to visualize healthy conditions of tree crowns at the Oluvil coast using high-resolution UAV imagery coupling with deep learning (DL). We created a mission plan flying UAV at 100 m above terrain level and flight paths were set with 80% front and 90% side overlap between adjacent images for maintaining high accuracy during the orthomosaic process. A total of 357 images were obtained using a Phantom 4 Pro UAV in a series of parallel flight lines at an average Ground Sampling Distance (GSD) of approximately 3.5 cm/px. The training sample was built by drawing 50 circular crowns of individual coconut trees and DL object recognition models were computed using ArcGIS Pro 3.1 software. Vegetation health of coconut tree crowns was detected using Visible Atmospherically Resistant Index (VARI) and the healthy condition of each coconut tree was mapped. The results showed that the 0.5 km² of the study area consists of 1597 coconut trees. The average accuracy of detecting coconut trees by the DL model is 98%. Out of the detected coconut trees, 174 (10.8%) were indicated as healthy trees, 549 (34.3%) were moderately healthy, 620 (38.8%) showed declining health and 254 (15.9%) needed inspection for the healthy condition. UAV and DL is an excellent platform for identifying individual coconut trees and mapping their healthy state which could be used for sustainable tree planting programs at vulnerable coastal areas.

Keywords: Individual coconut tree, Detection, UAV, Orthomosaic, Deep learning, VARI

(ID 232)**Genotypic Variation of Native Sweet Potato (*Ipomea batatas* L.) Accessions Compared to Improved Varieties in Sri Lanka****Safwa, M.F.Z.¹, Shyamalee, H.A.P.A.², Ranawake, A.L.^{1*}**¹*Department of Agricultural Biology, University of Ruhuna, Matara, Sri Lanka*²*Agricultural Research Station, Matara, Sri Lanka***lankaranawake@hotmail.com***Abstract**

Genetic diversity of native *Ipomea batatas* accessions provides a valuable resource for breeding programs, enabling the development of new cultivars with improved traits, nutritional content, and overall crop resilience. This study examined the significance of diversity among seventeen native *I. batatas* accessions compared to five improved varieties. The experiment was carried out at the field of Agriculture research station, Thelijjawila, according to a randomized complete block design with three replicates. Twenty-one qualitative and twelve quantitative characters were measured according to the recommendation of International Potato Center. Twelve quantitative agro-morphological characteristics were analyzed using IBM SPSS 25 statistical software. Principal component (PC) analysis and cluster analysis and correlation analysis were performed to evaluate the accessions' morphological diversity and yield components. According to Duncan's Multiple Range Test (DMRT) grouping, all the evaluated characteristics were significantly different among accessions. The PC analysis revealed four PCs representing 76.55% of total variance among accessions exceeded the eigen value one. PC1, PC2, PC3 and PC4 explained 31.92%, 20.88%, 13.81% and 9.94% variability, respectively. PC1 was positively contributed with total yield, best four storage root yield, storage root width, root cortex thickness and vine diameter. Mature leaf length, petiole length, vine internode length and main vine length contributed for PC2 and number of leaves per plant contributed for PC3 while storage root length contributed for PC4. According to hierarchical agglomerative clustering using Ward linkage, four distinct clusters were identified at cluster distance ten. Cluster II comprised accessions with the highest storage root diameter and root cortex thickness. The 2D scatter plot diagram suggested a moderate variation among evaluated accessions distributed in three quadrants of the diagram. This genetic variation can be utilized in breeding programs to enhance resilience to changing environment conditions and contributes to improve yield, quality, and adaptability to diverse environments. Moreover, understanding and conserving the genetic diversity of *I. batatas* ensures a sustainable foundation for future breeding efforts, supporting long-term food security.

Keywords: Agro-morphological characteristic, *Ipomea batatas*, PCA, Sri Lanka

(ID 262)

A Forest Restoration Success: Public-Private-People Partnership Driven Five-Year Intensive Restoration Methodologies for a Heavily Degraded Rainforest

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Abstract

Deforestation and degradation of tropical forests is a significant contributor to the loss of biodiversity. Restoration could potentially mitigate the impacts of deforestation, yet the identification of best restoration methodologies and the allocation of adequate financing for restoration is a huge challenge. IUCN in collaboration with Biodiversity Sri Lanka and the Forest Department successfully completed a five-year pilot project in partnership with 14 private sector companies to overcome this challenge. The overall aim of the project was to restore 12 hectares of degraded rainforest patch in the Kanneliya Conservation Forest, Galle District, using principles of restoration ecology to enhance its biodiversity and ecosystem services. The site selected for restoration was invaded by *Dicranopteris linearis* (Burm. f.) Merr. herbaceous fern. This type of vegetation is characteristic of disturbed habitats having poorly drained, infertile soils on steep slopes in lowland wet zone of Sri Lanka. The new intensive restoration methodology has been developed to restore degraded *D. linearis* invaded area based on the progress achieved through the adaptive approaches introduced between second to fifth years of project period. Key interventions included, total removal of *D. linearis*, establishment of soil conservation measures, application of organic and inorganic fertilizers, maintenance of an on-site plant nursery, collection of locally available seeds and seedlings, plant acclimatization, establishment of dry season watering mechanism, increasing of planting hole size, physical protection of plants using barriers, introduction of native legume species and other nursing plants and continuous monitoring of plant growth. Two native shrub species (*Melastoma malabaricum* and *Hedyotis fruticans*) are naturally proliferating wherever *D. linearis* is removed. These shrubs play a major role in restoration as they provide initial shade and enrich soil carbon in degraded sites. The sudden emergence of saplings of native species were observed in the intensive restoration areas. Twenty-one native plant species have been naturally colonised, in addition to 69 species of planted species. Planted native tree species showed 253% growth attainment of height within the 18-month time gap observed in the intensive restoration area compared to that of general restoration area where the height attainment was 196%. Sixty-seven new faunal species which were not recorded at the site previously, have colonised the restoration site. Intensive restoration methodologies developed for this restoration project accelerated the growth of adopted native trees and increased the plant survival rate. Buildup of social capital including trend in the private sector for restoration is an offshoot of the project.

Keywords: Biodiversity, *Dicranopteris linearis*, Kanneliya, Intensive forest restoration

(ID 194)**Factors Influencing Rubber Latex Extraction in the Wet and Intermediate Zones of Sri Lanka****Cooray, S.^{1*}, Talagala, T.S.², Subasinghe, S.M.C.U.P.¹**¹*Centre for Forestry and Environment, Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Statistics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***sachini.s.cooray@gmail.com***Abstract**

Rubber (*Hevea brasiliensis*) is one of the main foreign income-generating crops in Sri Lanka. However, rubber latex extraction can be influenced by various factors. Therefore, this study aimed to analyze the spatio-temporal variation of latex extraction in the wet and intermediate zones of Sri Lanka to identify the factors influencing rubber latex extraction. First, secondary data on rainfall, number of tappable and immature rubber trees, uprooted trees, fertilizer application, use of latex stimulants, presence of pests and diseases, labour turnover, number of holidays, and trade union actions were collected for the past 10 years from four rubber estates, viz. Halpe, Pelmadulla, Udapolla, and Keppetigala, are managed by two regional plantation companies. Then the annual and monthly fluctuations of latex extraction were visualized using R software. Spatio-temporal visualization using static, dynamic, and interactive graphics was also used in R software to examine the relationships between the selected factors. Finally, the variable importance analysis under the Random Forest machine learning algorithm was employed to examine the hierarchy of various factors under climatic zonal wise. The results revealed both positive and negative relationships between latex extraction and the selected factors. Factors including the number of tappable trees, stimulation (Ethephone) applications, and labour turnover-related factors demonstrated a positive impact on latex extraction, while rainfall, the number of immature trees, uprooted trees, pests, and diseases had a negative influence. Labour turnover-related factors and tappable trees revealed high importance ranking in both wet and intermediate zones. Based on both qualitative and quantitative statistical analysis of the results obtained in the present study, seasonal variations in rubber latex extraction, and similar trends across both climatic zones were unveiled. Results also revealed that latex extraction experiences seasonal fluctuations, particularly during the wintering period from December to February in traditional rubber-growing areas. In the Sri Lankan context, a significant decline in rubber latex extraction was observed during the month of April, which can be attributed to the occurrence of various cultural and religious festivities. These findings highlight the importance of considering seasonal variations and cultural influences with a better understanding of the spatio-temporal dynamics of latex extraction in both climatic zones. Considering the range of factors in conjunction with these variations and implementing effective management practices, can enhance the outcomes of rubber latex extraction, making rubber cultivation more sustainable and profitable.

Keywords: *Hevea brasiliensis*, Spatio-temporal variation, Latex extraction, Factors, Climatic zones

(ID 240)

Characterization of *Nephelium lappaceum* and *Schleichera oleosa* Seed Oils for the Potential Applications in Cosmetics and Dietary Supplements**Thathsara, K.A.H., Chinthaka, S.D.M.****Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***sdmchin@sjp.ac.lk***Abstract**

Sri Lanka has a rich diversity of oil-bearing seeds that go to waste without proper utilization. *Nephelium lappaceum* and *Schleichera oleosa* are such two species that belong to Family Sapindaceae. Plant seed oils offer an exciting avenue for use in cosmetic and dietary supplements due to their chemical constituents, mainly due to their fatty acid (FA) composition and constituents in unsaponifiable matter. This study aims to characterize these seed oils by FA composition, constituents in unsaponifiable matter, and other physical properties. The oil was extracted using soxhlet extraction. Acid value, iodine value, and smoke point of oils were determined. Gas chromatography-mass spectrometry was employed to identify fatty acid methyl esters and constituents in the unsaponifiable matter. Thermogravimetric analysis was performed to assess the thermal behavior of seed oils. The following values were obtained for *N. lappaceum* and *S. oleosa* respectively: crude oil yields $50.31 \pm 0.01\%$ and $69.52 \pm 0.01\%$, ash contents $2.28 \pm 0.09\%$ and $1.87 \pm 0.24\%$, acid values 9.25 ± 0.94 and 2.47 ± 0.35 mg KOH/g, iodine values 7.61 ± 1.12 and 8.43 ± 0.11 g I₂/100 g and yields of unsaponifiable matter $3.48 \pm 0.01\%$ and $0.47 \pm 0.01\%$. The saturated fatty acids (SFA) presented in *N. lappaceum* were Palmitic(C16:0) 5.14%, Stearic(C18:0) 6.75%, Arachidic(C20:0) 36.32% and Behenic (C22:0) 2.44% acids and unsaturated fatty acids (UFA) were Oleic(C18:1) 36.39%, Linoleic (C18:2) 1.72%, Gondoic (C20:1) 6.56% and Erucic (C22:1) 0.26% acids. *S. oleosa* oil contained Palmitic 1.80%, Stearic 3.29%, Arachidic 59.37% and Behenic 3.56% acids as SFAs and Oleic 15.77%, Linoleic 0.93%, Gondoic 10.32% and Erucic 1.78% acids as UFAs. This study found that both *N. lappaceum* and *S. oleosa* oils contained unusually high levels of very long chain ($\geq C20$) fatty acids (45.58% and 75.03% respectively). Triglycerides with very-long-chain fatty acids are proven to provide excellent emollient and moisturizing properties. Therefore, both oils offer very high potential in cosmetic applications. The presence of significant levels of various phytosterols, squalene and phytol in the unsaponifiable fraction of both oils also offers enhanced cosmetic and health benefits such as moisturizing, anti-inflammatory, and antioxidant properties etc. Therefore, findings of this study also highlight the very high potential of both seed oils in dietary supplement applications as well.

Keywords: *Nephelium lappaceum*, *Schleichera oleosa*, Unsaponifiable matter, Very long chain fatty acids, Cosmetics and dietary supplements

(ID 182)**Isolation of Salt-Tolerant Enzyme-Producing Bacteria from Marine Environments in Sri Lanka for Industrial Applications****Razan, M.F.¹, Sadeepa, H.D.D.^{1,2}, Manage, P.M.^{2*}**¹ *School of Science, Business Management School (BMS), Colombo, Sri Lanka*² *Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***pathmalal@sjp.ac.lk***Abstract**

Microbial enzymes have been used in our day-to-day lives since ancient times. In the current world, microbial enzymes are widely used in industries owing to their environmentally friendly nature and cost-effectiveness. Halophiles are industrially important bacteria due to their high stability in high salt concentrations. Amylases, cellulases, proteases and lipases are the most widely used halophilic hydrolytic enzymes in food production, detergent industry, pharmaceutical industry, biofuel production, paper production, etc. Each of these enzymes plays a vital role in industrial production. Thus, the current study focused on the isolation of salt-tolerant enzyme-producing bacteria from marine environments in Sri Lanka for industrial applications. The water samples were collected from Negombo Lagoon and Panadura Beach in Sri Lanka and transported to the laboratory in ice boxes. Subsequently, the water samples were enriched in quarter-diluted Nutrient Broth (NB) medium. The morphologically different bacterial isolates were isolated by the standard spread plate method. All isolated bacterial isolates were screened for the production of amylase, cellulase, protease and lipase using Starch Agar, CMC agar, Skimmed Milk Agar and Phenol Red Agar plate assays respectively. Then, the growth temperature and salt concentrations for enzyme-producing bacteria were optimized. A total of morphologically different 44 bacterial colonies were isolated from both sample sites 25 bacterial colonies from the Negombo Lagoon sample and 19 bacterial colonies from the Panadura Beach sample. A total of 21 bacterial isolates were positive for amylase production 3 from Negombo lagoon and 18 from Panadura beach samples while 26 bacterial isolates were positive for cellulase enzyme 9 from Negombo lagoon and 17 from Panadura beach samples. Moreover, 15 out of 25 bacterial colonies isolated from the Negombo lagoon sample were positive for Protease enzyme while only 5 colonies from the Panadura beach sample were positive for protease. A total of 22 bacterial isolates were positive for amylase production 14 from Negombo Lagoon and 8 from Panadura beach. As a whole, almost 95% of isolated bacteria were positive for at least one enzyme activity. As per the results, the optimum growth temperature was recorded in a range of 30⁰ C to 35⁰ C while the optimum growth was reported in a range of 3% to 12% of NaCl concentration. Thus, marine environmental bacteria can be considered as a potential halophilic enzyme producer and may be utilized in industrial settings successfully. Further studies are in progress to determine the optimum conditions for enzyme activity.

Keywords: Halophiles, Halophilic bacteria, Industrial applications, Marine bacteria. Enzyme producing bacteria

(ID 190)**Above-Ground Biomass Partitioning of Selected Fewer Common Trees with Timber Value****Hansamali, A.P.U.*, Subasinghe, S.M.C.U.P.***Centre for Forestry and Environment, Department of Forestry and Environment, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**[*uma.hansamali@gmail.com](mailto:uma.hansamali@gmail.com)***Abstract**

Information on the allocation of above-ground biomass between stems and branches is important in managing the structure and function of the forest ecosystem. Therefore, this study aimed to estimate the above-ground biomass partitioning between the main stem and branches of selected, less-used five tree species, which bear timber value, which are *Alstonia* (*Alstonia scholaris*), *Hulanhik* (*Chukrasia tabularis*), *Hurimara* (*Albizia odoratissima*), *Lunumidella* (*Melia azedarach*), and *Ketakela* (*Bridelia retusa*), growing in roadsides and home gardens. Data were collected from three mature trees of each species grown in Moratenne Division in Muwankanda Estate of Lalan Agri Division, Lalan Rubbers Pvt. Ltd. Breast height diameter (dbh) and stem height of the selected trees were measured after felling. Tree stems and large branches, viz., branches with a base diameter larger than $1/3^{\text{rd}}$ of the stem diameter, were divided into 3-meter sections and the length and bottom, middle, and top diameters were measured for each section to estimate its volume using Newton's formula. The final section of each component was assumed as a cone to estimate its volume. The total volume of the stem and branches were separately estimated by adding section volumes. Then, two samples representing the top and bottom sections of each component were taken to the laboratory and oven-dried at 105°C until a constant weight was obtained. The dry weight (biomass) of each component was estimated by converting the sample dry-weight-volume ratio to its volume. The dbh measurements for the tree species *Alstonia*, *Hulanhik*, *Hurimara*, *Lunumidella*, and *Ketakela* ranged from 25-34 cm, 30-52 cm, 20-43 cm, 25-60 cm, and 25-46 cm, and the stem biomasses ranged from 100-230 kg, 200-900 kg, 160-220 kg, 100-400 kg, and 50-225 kg respectively. The lengths of branches of the tree species ranged from 8-13 m, 11-19 m, 8-16 m, 4-11 m, and 10-15 m, and their branch biomasses varied between 15-55 kg, 200-900 kg, 10-35 kg, 20-140 kg, and 70-105 kg, respectively. The findings illustrated that the stem biomasses were higher than the branch biomasses of all the species. The highest branch biomass stem biomass partitioning percentage was observed in *Ketakela*, and the least was in *Hurimara*. The findings of this study contribute to the understanding of above-ground biomass partitioning and the timber value of the selected tree species.

Keywords: Above-ground biomass, Biomass partitioning, Stem biomass, Branch biomass

(ID 292)

Changes in Leaf Construction Cost and Functional Traits of Two Tropical Dry Forest Species**Gunasekera, T.S.S.¹, Alahakoon, A.M.T.M.¹, Geekiyanage, N.^{1*}, Weerasinghe, L.²**¹*Department of Plant Sciences, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka*²*Department of Crop Sciences, University of Peradeniya, Peradeniya, Sri Lanka***nalaka.geekiyanage@agri.rjt.ac.lk***Abstract**

The adaptation of plants to different light conditions in their environment at various stages of growth can be better understood through Leaf Construction Cost (LCC) and the associated leaf functional traits. In this study, we evaluated the LCC along with several leaf morphological and physiological traits of two tropical forest species, *Terminalia arjuna* and *Madhuca longifolia*. These traits included leaf nitrogen, phosphorous, protein, and ash contents, as well as heat of combustion (Hc), efficiency of photosystem (Φ PSII), quantum yield (Fv/Fm), leaf mass per area (LMA), leaf dry matter content (LDMC), leaf vein density (VD), and leaf thickness (LT). The evaluation done in seedlings, saplings, and mature plants of these species, grown under two light levels (30% and 100%) to different heights (short, medium, and tall) in a shade house at the Faculty of Agriculture, Rajarata University of Sri Lanka. Our findings revealed that LMA ($P<0.01$), LDMC ($P<0.01$), and LCC ($P<0.01$) were significantly lower in saplings grown under 30% light conditions compared to seedlings grown under 100% light conditions. This suggests that leaves in low light conditions adjust their light interception and photosynthetic rates. Seedlings grown under 100% light conditions exhibited higher LT ($P<0.01$) and VD ($P<0.05$) compared to saplings grown under 30% light conditions. This indicates that to optimize growth rate and reduce investment in vascular tissues, saplings develop thin leaves with shorter water transportation distances. Mature plants, on the other hand, showed significantly lower nitrogen, protein, and phosphorous contents, which could be attributed to the presence of more dead tissues and a slower growth rate. Interestingly, mature trees exhibited significantly higher Φ PSII and Fv/Fm, indicating their ability to withstand high photo inhibitory damages. By contrast, saplings had lower LCC due to lower Hc ($P<0.05$) and higher ash content ($P<0.01$). In conclusion, the LCC of these species aligns with a strategy of investing less and gaining more resources, as plants allocate their resources according to their functional requirements during their growth and development.

Keywords: Leaf mass per area, *Madhuca longifolia*, Nitrogen content, *Terminalia arjuna*, Vein density

(ID 287)

Household Wildfire Risk and the Community Preparedness: A Case Study of Rural Villages of Central Highlands of Sri Lanka

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Abstract

Belihuloya forest reserve, an environmentally sensitive zone serves as a vital catchment in the central highlands, spans altitudes ranging from 589 m to 1,237 m. The range is home to a diverse array of flora and fauna, hosting numerous endemics, indigenous, and threatened species. The region faces recurrent threats from bush fires during May to August, driest and windiest season that significantly impact local agriculture, tea cultivation, and the tourism. The objectives of this study were to conduct scoping study on heavily bushfire affected villages of central high lands of Sri Lanka, to find out the bushfire vulnerability levels of villages and their properties and to identify the status of early warning, community preparedness and fire management. Case study approach was used, followed by in-depth interviews with community members in three GN divisions; *Wiharawela*, *Passaramulla*, and *Kubalgama* in *Imbulpe* DS division and with institutions such as Disaster Management Centre, Department of Forest, Sri Lanka Army, and Tourism Service providers. As per the results of our study, *Imbulpe*, *Passaramulla*, *Wiharawela*, and *Medagedaragoda* GN divisions encountered bushfires in *Hagala* forest, *Helamalkadiya*, *Wewkadura*, and *Kabaragala* forests areas. The villages encounter annual bushfires resulted from unconfirmed causes, including land preparation for Chena cultivation, hunting, camping sites, and other human interventions. Bush fire threat of human lives and properties are high but no recorded incidents on casualties keep them away from preparedness. Highly protected and sensitive forest reserves recorded as highest vulnerable. However, those residing in the forest buffer zone experienced significant impacts and property exposure. A lack of preparedness for bushfire incidents was identified, characterized by the absence of an alarming system, lack of awareness, complacency, and inefficient communication among villagers. However, the community involvement and the participation of Sri Lanka army were noted as key bushfire management strategies.

Keywords: Bushfire, Management Strategies, Vulnerability, Preparedness

(ID 044)

A Comparative Analysis of *Piper longum* and *Piper sarmentosum* Utilizing Thin-Layer Chromatography and Gas Chromatography-Mass Spectrometry in Exploring the Potential in Sri Lankan Traditional Medicine

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Abstract

Piper longum (Thippili) is a promising medicinal plant utilized in traditional medicine in Sri Lanka. *Piper sarmentosum* (Gas thippili) is an underutilized plant species that is gaining popularity as a substitute for *P. longum* due to its ease of cultivation and high abundance. No previous studies have been conducted comparing both species' phytochemical profiles in Sri Lanka. This study aimed to compare the phytochemical composition of different parts of two species using chromatographic analysis. Plant materials grown under the same environmental conditions were collected from the Bandaranayake Memorial Ayurvedic Research Institute, Nawinna. Fruits, stems, roots, and leaves were collected from both species and were subjected to sequential extraction with hexane, dichloromethane, ethyl acetate, and methanol. The extracts were then subjected to thin-layer chromatography (TLC) development under optimized mobile phases. Volatile compounds in the fruits and leaves were isolated as concrete and essential oils, respectively, and analyzed using Gas Chromatography-Mass Spectrometry (GC-MS). Based on the results of TLC, the toluene: ethyl acetate (93:7) system gave better separation for non-polar compounds extracted from hexane. Toluene: ethyl acetate (70:30) and toluene: ethyl acetate: formic acid (70:25:5) systems showed a better separation for moderately polar compounds extracted into dichloromethane and ethyl acetate, respectively. The system of ethyl acetate: methanol: water (75:15:10) was utilized to better separate polar compounds extracted into methanol. According to the TLC fingerprints obtained, both similarities and differences were observed in different parts of the two species. GC-MS analysis of fruit concrete from *P. longum* and *P. sarmentosum* revealed notable differences in the volatile constituent profiles of the two species. *P. longum* fruit concrete was found to contain primarily aliphatic hydrocarbons, including Hexadecane, Heneicosane, and Eicosane. In contrast, *P. sarmentosum* fruit concrete contained a mixture of aliphatic hydrocarbons (Dodecane, Heptadecane, Heptacosane, Nonadecane) and phenylpropanoids (Myristicin). The essential oil extracted from *P. longum* leaves contained higher amounts of β -Pinene, α -Pinene, β -Myrcene, and β -Caryophyllene than the essential oil extracted from *P. sarmentosum* leaves, which contained Myristicin as the major compound (52.74%), followed by trans-Caryophyllene and Germacrene D. Therefore, based on the TLC fingerprints, it can be concluded that *P. longum* and *P. sarmentosum* have both similarities and differences in the phytochemical composition while differences in the volatile compounds of fruits and leaves suggests that the two species may have different therapeutic effects, and thus, could be effectively utilized in the herbal medicine of Sri Lanka.

Keywords: *Piper sarmentosum*, *Piper longum*, Sequential extraction, TLC, GC-MS

(ID 084)

Studies on Bamboo *Dendrocalamus asper* Seed Viability Changes with the Storage Age in Sri Lanka

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Abstract

Dendrocalamus asper is an introduced bamboo species grown in wet/intermediate climatic areas of Sri Lanka. It has many uses in both economic, environmental contexts. Propagation through seeds is well adapted practice among medium to large scale groves. The Sowing medium plays an important role in the production of good quality seedlings. Therefore, this study aims to determine the best nursery media for seed germination and evaluate the performance of seeds yearly which were kept in a refrigerator (4° C) from 2018 to 2023. Seven sowing media (Treatments) were set up as river sand alone, river sand+topsoil (1:1), river sand+coir dust (1:1), compost only, topsoil only, coir dust only, and river sand+compost (1:1) as the first experiment in 2018 to determine the best sowing media for seed germination. Germination pots were set up in a completely randomized design (CRD) with twenty replicates using 10 seeds per each treatment. Germination percentages were recorded in 12, 15 and 18 days after seed sowing. Treatment differences were tested by ANOVA and significant means were separated using the Duncan multiple range test. The results revealed that treatment with river sand with topsoil (1:1) and Treatment only with river sand were shown best media for seed germination. The corresponding values were 40.98%, 44.29%, and 47.97% for river sand with topsoil (1:1) and 38.74%, 39.84%, 44.11% for medium with river sand only. Thereafter best sowing media treatment with river sand with topsoil (1:1) were used to test the seeds germination percentage using cool stored (4° C) seeds in year 2019, 2020, 2021, 2022 and 2023 and the figures were reported descriptively after 12, 15 and 18 after sowing. Average seed germination percentage 18 days after seed sowing dropped to 45.10% in 2019. The germination percentages for 2020 were 37.1%, 40.20%, and 41.5%, in that order. The experiment was conducted again in 2021, with germination rates of 35.40%, 36.90%, and 37.90%. It was 34.22%, 35.22%, and 36% in 2022, respectively. Although 36% germination was recorded at the end of 15 days, only 21% survived at the end. Rest of the plants were died due to the poor vigor and poor performance of seeds. After 18 days, the experiment conducted in 2023 showed that 17.50% of the seeds had germinated. The research findings showed that seed viability of (*Dendrocalamus asper*) has gradually declined with time in Sri Lanka.

Keywords: Bamboo, *Dendrocalamus asper*, Germination percentage, Sowing media, Viability

(ID 104)**Investigating a Methodological Framework to Develop Forest Resilience Index using Multisource Remote Sensing Satellite Data****Priyadarshani, G.G.H.^{1*}, Welikanna, D.R²**

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Abstract

Sri Lanka is considered rich in forests, as they cover 29.9% of the total land area of the country. However, most of the forests in Sri Lanka are under threat due to climate and land use changes. Therefore, possibilities to investigate the temporal resilience of the forests using satellite imagery could be advantageous. Forest resilience is the capacity of forests to recover from disturbances, resulting in undesired shifts from their original state to alternative stable states. This study aimed to analyze the resilience of Wilpattu National Park and Kanneliya Rain Forest using a time series of Landsat 8/9 and Sentinel 1 satellite imagery from 2017 to 2022. The study proposes a Forest Resilience Index (FRI), generated using three existing indices, the NDVI (Normalized Difference Vegetation Index), LAI (Leaf Area Index), and RVI (Radar Vegetation Index). NDVI employs reflection of light in visible and near-infrared (NIR) wavelengths, LAI is one-sided green leaf area of a canopy or plant community per unit ground area and the RVI is microwave metric use to evaluate vegetation cover. Polynomial curve fitting was associated in order to develop the FRI index using NDVI and RVI. Fundamentally the FRI is believed to be proportional to the physical vegetation peripeties revealed by NDVI, LAI and RVI. First order polynomials were resulted in the regression models. Specifically, the resulting FRI for Wilpattu National Park is $0.7827 \text{ NDVI} + 0.2173 \text{ RVI}$, while for Kanneliya Rain Forest, it is $0.7853 \text{ NDVI} + 0.2147 \text{ RVI}$. The resilient level using the proposed FRI ranges from 0 to 1 indicating low to high resilience. Validation was successfully conducted using the generated FRI for the Upper Wilpattu area. The forest resilience index values, indicating the resilient dynamics from the year 2017 to 2022, ranging from 0 to 0.56 for Wilpattu National Park and from 0 to 0.63 for Kanneliya Rain Forest. Probability density of the resulting NDVI, RVI, LAI and FRI suggest the occurrence of a particular vegetation status is more or less the same. Though the LAI index in the proposed study is not fully incorporated to the FRI, the study discusses the possibilities. Multisource remote sensing data integration can help to develop and improve the monitoring of the forest status. In conclusion, this analysis has contributed to a more comprehensive understanding of the temporal variability and resilience dynamics observed in the forests of Sri Lanka.

Keywords: Forest Resilience Index, LAI, NDVI, RVI, Time Series Analysis

(ID 069)**Review of Utilizing the Phytochemicals of *Ocimum sanctum* and *Plectranthus amboinicus* for Novel Herbal Product Development in Sri Lanka****Uyangoda, I.S.S.C.*, Munasinghe, M.L.A.M.S.***Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***isurusakbo@gmail.com***Abstract**

Ocimum sanctum (OS) and *Plectranthus amboinicus* (PA) are two highly abundant medicinal plants in the Lamiaceae family. Despite their widespread availability and documented ethnomedicinal uses, scientific awareness of their pharmacological potential is restricted in Sri Lanka. Consequently, their utilization in herbal products remains limited. The present review investigates the scientific evidence on phytochemical constituents in those species and their potential in novel herbal product development in Sri Lanka. The review was conducted based on indexed journal articles published in the last 15 years. Based on the available data, OS's main phytochemicals involved in pharmacological activities are eugenol, methyl eugenol, rosmarinic acid and apigenin. Eugenol, the main component in OS essential oil, demonstrated 97% inhibition of the COX-I enzyme responsible for plants' anti-inflammatory properties. It has significant antifungal activity, particularly against *Candida* species. According to several studies, the essential oil of OS prevents morphological changes in *C. albicans*, reduces the secretion of hydrolytic enzymes crucial in the infection's early stage, and downregulates the genes connected with the infection. Rosmarinic acid, the principal constituent in ethanolic extracts of OS, exhibits anti-ageing properties by inhibiting collagenase, elastase, and hyaluronidase. OS could be a renewable source of eugenol and rosmarinic acid with high potential to be utilized in antifungal, anti-inflammatory topical applications and anti-ageing cosmeceuticals in Sri Lanka. PA contains phenolics, volatile compounds, and abietene diterpenoids as its predominant phytochemicals. Its essential oil, rich in volatile compounds like carvacrol and thymol, displays promising activity against bacteria and fungi, with minimum inhibitory concentration (MIC) values around 50 µg/mL in various studies. Furthermore, PA essential oil exhibits anti-inflammatory capabilities comparable to the conventional drug Diclofenac. Additionally, its phytochemicals possess a wide range of biological properties, effective in treating respiratory, cardiovascular, oral, skin, digestive, and urinary diseases. Hence, the phytochemicals of PA present valuable potential as sources for novel anti-inflammatory and antimicrobial herbal products, especially for skin and respiratory disorders. Based on data, phytochemicals in OS and PA have the potential to be used in a variety of novel herbal products. Both plants have higher growth rates and can be easily cultivated. Thus, developing novel herbal products that utilize the phytochemicals of OS and PA could be highly feasible and cost-effective. This review provides valuable insights and stimulates future research to focus on utilizing OS and PA phytochemicals in novel, sustainable herbal product lines, contributing to improved healthcare and well-being in Sri Lanka.

Keywords: *Ocimum sanctum*, *Plectranthus amboinicus*, Phytochemicals, Herbal products, Pharmacological

(ID 177)

Antifungal Activity of Some Natural Plant Extracts Against Causal Agent of Anthracnose Disease of Chilli

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Abstract

Anthracnose caused by *Colletotrichum* species is a common postharvest disease of chilli fruit in Sri Lanka. The aim of the study was to isolate the chilli anthracnose disease causing *Colletotrichum* species and control the organisms by the application of natural plants extracts. Two *Colletotrichum* isolates ISO 1 and ISO 2 were isolated from chilli anthracnose diseased fruits and they were identified as *Colletotrichum capsici* and *Colletotrichum gloeosporioides* respectively based on the morphological features. Crude extracts of five spices, viz. *Cassia* sp., *Lantana* sp., *Ricinus* sp., *Cinnamomum* sp., and *Catharanthus* sp. were made using cold water, hot water and ethanol extraction and they were tested for their anti-fungal effects against the two *Colletotrichum* isolates isolated from chilli anthracnose diseased fruits. Pathogenic variations of the fungal isolates in terms of pathogenicity and virulence were determined by *In vitro* inoculation assays using healthy chilli fruits. All five spices studied showed significant anti-fungal activity at three extraction methods *In vitro*. The cold-water extract of *Cassia* sp., *Cinnamomum* sp., and *Catharanthus* sp. exhibited good anti-fungal activity against all two tested fungi. In the case of the hot water extracts, *Catharanthus* sp., and *Lantana* sp. showed the best anti-fungal activity against all two tested fungi. Ethanol extracts of *Cassia* sp., *Ricinus* sp., and *Catharanthus* sp. showed more than 10% inhibition against ISO 1. Of the three extraction methods, cold water extraction was generally more effective than other extraction methods. Cold water extract of *Cinnamomum* sp. inhibited the growth of ISO 1 and ISO 2 respectively 87.78% and 86.34%. Against two isolates cold water, hot water and ethanol extracts of *Catharanthus* sp. was effective in imposing more than 10% inhibition. Recommended dosage (1.8 gL⁻¹) of the fungicide Homai (Thiophanate-methyl 50%+Thiram 30% WP) completely inhibited the mycelial growth of two isolates in vitro. Virulence of the *Colletotrichum* sp. varied significantly in terms of rapidity and extent of disease spread.

Keywords: Anti-fungal effects, Pathogenic variations, Anthracnose, Postharvest disease

(ID 038)

Industrial Perspective of Thermo-Stable Proteinase Enzyme Producing Bacteria Isolated from Maha Oya Hot Spring, Sri Lanka

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Abstract

The microbial enzymes are eco-friendly and cost-effective alternatives for chemical catalysts that adversely affect the ecosystem. Among the commercially available enzymes, proteases are the most demanded enzyme and contributes nearly 60-65 % of the world enzyme market. Therefore, this study aimed on isolation and characterization of thermo-stable proteinase producing hot spring bacteria. For the present study, water samples were collected from surface and bottom of Maha Oya hot springs. Temperature, Electrical Conductivity (EC), pH, and Dissolved Oxygen (DO) were measured at the site. The standard pour plate method was performed to isolate bacteria and primarily screened for proteinase production by Skimmed Milk Agar (SMA) plate assay. Secondary screening was performed using the Folin-Ciocalteu's Phenol reagent method. Optimum temperatures and pH for enzyme activity were measured for crude enzyme extracts of most potential candidates. Molecular-level identification of bacterial isolates was performed using the 16S rRNA gene sequencing method. Briefly, genomic DNA was extracted from pure bacterial isolates and PCR amplification of V3 and V4 regions of 16S rRNA gene was done using 27F and 1492R bacterial domain specific primers. Then, the DNA sequencing was done at Macrogen, Korea. The resulted sequences were aligned with available sequences at NCBI using BLASTn tool and GenBank accession numbers were obtained. Temperature, EC, pH, and DO of the surface and bottom of the springs varied from 51.7-52.4° C, 1487-1,507 µS/cm, 8.05-8.07, and 2.01-2.05 mg/L respectively. Three morphologically different, proteinase producing bacterial isolates were observed (Mh₁1, Mh₁2 and Mh₂7) at the primary screenings and bacterial isolate: Mh₁1 which was identified as *Bacillus cereus* strain VBE03 (Accession number: ON819722) showed the highest enzyme activity of 209.205 U/mL at optimum temperature of 60° C, and optimum pH of 9. Hence, the bacterial isolate: Mh₁1 would be successfully used for industrial settings operate at temperatures around 60° C and alkaline conditions.

Keywords: Hot springs, Enzymes, Proteinase, Biotechnology, Thermophiles

(ID 184)

Isolation of Endophytes with Antimicrobial Activity from Selected Indigenous Medicinal Plants Against Amoxicillin-Resistant Environmental Bacteria

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Abstract

The continuous discovery of novel antimicrobial compounds and antibiotic-producing microorganisms is an obligatory process to overcome the antibiotic resistance of pathogenic bacteria that arises as a consequence of the misuse of antibiotics. Thus, this study is mainly focused on the isolation of endophytic bacteria and fungi with antimicrobial activity against amoxicillin-resistant environmental bacteria. The endophytes were isolated from the selected indigenous medicinal plants, namely *Acalypha indica* (Kuppameniya) and *Cyanthillium cinereum* (Monarakudumbiya). Fresh samples of the selected plants were collected from their natural habitats, and the plant parts were surface-sterilised using 70% ethanol. The endophytic bacteria and fungi were then isolated on Nutrient Agar (NA) and Potato Dextrose Agar (PDA) media respectively at room temperature. The isolated endophytic bacteria and fungi were screened for their antimicrobial activity against four previously isolated amoxicillin-resistant environmental bacteria, namely *Acinetobacter baumannii*, *Staphylococcus aureus*, *E. ludwigii* and *E. pyrinus*. As per the results, a prominent inhibition of *Staphylococcus aureus* was shown by four endophytic isolates (KpR-02B, MnS-01B, KpS-01F and MnR-04F). The AR bacteria *E. ludwigii* was prominently inhibited by two endophytic isolates (MnS-01B and MnR-04F), while *E. pyrinus* was also prominently inhibited by two endophytic isolates (MnF-03B and MnR-04F). Thus, the indigenous medicinal plants, Kuppameniya and Monarakudumbiya, can be considered as a potential source of antimicrobial compound-producing endophytes against amoxicillin-resistant environmental bacteria, which can be developed as a drug for antibiotic-resistant pathogenic bacteria.

Keywords: Antimicrobial activity, Antibiotic-resistant bacteria, Indigenous medicinal plants

(ID 158)

Pestiferous Occurrence and Suppression of *Heortia vitessoides* in Agarwood: A Review**Subasingha, S.M.A.B.^{1*}, Perera, A.G.W.U.², Diyabalanage, R.S.^{3,4}, Subasinghe, S.M.C.U.P.¹**¹Centre for Forestry and Environment, University of Sri Jayewardenepura, Nugegoda, Sri Lanka²Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka³Instrument Centre, University of Sri Jayewardenepura, Nugegoda, Sri Lanka⁴Ecosphere Resilience Research Center, University of Sri Jayewardenepura, Nugegoda, Sri Lanka^{*}bhagyaamashi@gmail.com**Abstract**

Agarwood is a resinous wood highly prized in perfumery and pharmaceutical industries. It is produced in the stem, branches, and roots of the *Aquilaria* and *Gyrinops* species of Thymalaeaceae family. *Aquilaria* species are commonly distributed and maintained as plantations in the Asian region which are often attacked by various pests and pathogens. Among them, *Heortia vitessoides* (Lepidoptera: Crambidae), stands out as the most destructive defoliator in *Aquilaria* plantations. *H. vitessoides* larvae feed gregariously and voraciously on foliage, thereby reducing agarwood production, and causing substantial economic losses. Defoliation occurs in varying degrees accounting for 30-70% of planted acres of *Aquilaria* species monthly, leading to their stunted growth and mortality. Various control methods have been introduced to protect agarwood plantations against *H. vitessoides* infestations. Biological control measures involve the use of fungi (*Beauveria bassiana*, *Metarhizium anisopliae*), predators (*Canthecona furcellata*), parasitoids (*Trichogramma pintoi*), and cytoplasmic polyhedrosis viruses. Chemical insecticides (avermectin, spinosad, etc.) have also been widely used, which have caused residues in agarwood, deleterious impacts on the environment as well as to non-target organisms, especially the natural enemies of *H. vitessoides*, thereby encouraging secondary pest outbreaks. Molecular control includes knockdown of β -N-acetylglucosaminidase gene to disrupt their molting process and suppression of juvenile hormone diol kinase gene to delay the pest's pupation. Soil management tactics (moisture content/substrate type modifications, soil cultivation practices, and mulching) have been investigated aiming at suppressing soil-pupation behaviors to reduce the populations' emergence success. Trembler grid lamps and trap plants have also been employed to lure pests away from their host plants. In addition, the role of plant-derived volatiles in guiding *H. vitessoides* females toward their host plants for oviposition has been studied to facilitate the designing of attractants for pest control. Apart from the heavy use of insecticides, none of the above methods are known to be effective in controlling this pest. In view of the above shortcomings of long-practiced control measures, efficient and eco-friendly control measures against *H. vitessoides* are urgently needed, and use of their pheromones might be a better alternative. Identification and isolation of sex pheromones from *H. vitessoides* have so far not been reported and would be a challenge, largely due to the nanogram-quantities of pheromone released and their proneness in degradation (oxidation, isomerization, and polymerization). Appropriate structural modifications of these natural pheromone compounds, however, can overcome those practical hurdles by developing synthetic analogues (viz. parapheromones), which are more economical, thus replacing natural pheromones in pest control. Hence, organic synthesis of pheromones would lead to introducing a species-specific sustainable way of protecting agarwood from *H. vitessoides* attacks and to safeguard their economic value while preserving environmental value and biodiversity.

Keywords: *Heortia vitessoides*, *Aquilaria*, Defoliator, Control methods, Sex pheromone, plant extracts

(ID 111)

**The Impact of Harvesting Interval on Bush Architecture and Stem Wood Production of
Cinnamomum verum J. Presl**

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Abstract

Given its great economic worth and excellent land use efficiency, Cinnamon is one of the best crops for Agroforestry. The design of the plant and proportion of stem wood of Cinnamon plants directly determine the economic and ecological returns from an Agroforestry system. Therefore, the experiment was designed to investigate how harvesting intervals affect the architecture of Cinnamon bushes and stem wood production. Cinnamon seedlings in a Randomized Complete Block Design were used in the experiment. Plants were harvested according to two harvesting intervals, six and eight months. Suitable parameters such as, the number of stems per plant, plant height, average stem diameter, and stem wood percentage were measured. Data was analyzed using SAS software with a statistical analysis at 5% significance levels. Results revealed that the effect of harvesting interval was significantly affected ($P < 0.05$) on the number of stems per plant and plant height. The highest number of stems per plant (3.1) and plant height (221.92 cm) were given by Cinnamon plants harvested in eight-month intervals. However, the effect of the harvesting interval was not significant ($P > 0.05$) on average stem diameter and stem wood percentage. The highest average stem diameter (27.18 mm) was given by eight-month interval harvesting while the six-month interval showed the highest stem wood percentage (28.18%). The findings suggest that the two distinct harvesting intervals have varied effects on the percentage of stem wood and bush architecture of Cinnamon. The findings may be greatly aided in designing, maintaining, and obtaining the economic and ecological returns from the Cinnamon-based agroforestry systems.

Keywords: Agroforestry, Cinnamon, Harvesting interval, Plant architecture, Stem wood production

(ID 138)**Species Distribution Modeling and Climate Change Impact Assessment for *Indianthus virgatus* (Roxb.) Suksathan and Borchs. in India and Sri Lanka****Bhat, V.S.K., Pandi, V.****Manipal Centre for Natural Sciences, Manipal Academy of Higher Education, Manipal, India**[*vivek.pandi@manipal.edu](mailto:vivek.pandi@manipal.edu)***Abstract**

Species distribution modeling (SDM) is a fundamental tool for conservation, offering insights into the ecological requirements and potential habitats of a species. In the context of our study, we delved into SDM for *Indianthus virgatus* (Roxb.) Suksathan and Borchs. a monotypic plant species renowned for its striking disjunct distribution pattern, endemic to the wet evergreen, moist slopy hills of India and Sri Lanka. In the Indian context, the distribution of *I. virgatus* is characterized by its presence in the Central Western Ghats, Southern Western Ghats, and the Nilgiris. According to the 2020 Red List, *I. virgatus* is classified as critically endangered in Sri Lanka, while its status in India remains unknown. What sets this species apart is not only its ecological significance as a monotypic species but also its compelling evidence of socio-economic and pharmacological importance. Using *MaxEnt* 3.4.4, we integrated environmental data and occurrence records to predict the potential distribution of *I. virgatus*. Occurrence data were sourced from herbarium collections, botanical surveys, and literature. Environmental variables, encompassing climate, topography, and land cover, were incorporated into the model. The model highlighted specific ecological niches in these regions crucial for the species' survival. The monotypic nature and limited distribution of *I. virgatus*, this study underscores the urgency of preserving these habitats. Furthermore, we assessed the impact of *IPCC* climate change scenarios on *I. virgatus* distribution. Our analysis demonstrated that changing environmental conditions may pose additional threats to this critically endangered species, particularly in Sri Lanka. These findings hold significant implications for *I. virgatus* conservation, offering valuable insights into habitat preferences, distribution, and the critical need for adaptive conservation measures in the face of climate change. This study provides a foundation for targeted conservation strategies and land management practices, ensuring the continued survival of this unique plant species.

Keywords: Monotypic taxa, MaxEnt, Conservation, Angiosperms, Critically Endangered

(ID 168)

A Situational Audit on the Agricultural Seed Systems: A Case Study in Imbulpe Divisional Secretariat Division, Sri Lanka

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Abstract

A seed system is a network of processes, organisations, and market dynamics contributing to the development, production, dissemination, and regulation of seeds. It is the foundational component for agricultural productivity and biodiversity, influencing crop yields, farmer resilience, and the adaptability of agriculture to changing environmental conditions. Seed systems can be structured and regulated (formal), community and farmer-based (informal), or a combination of these two. This paper explores the components of seed systems in the Imbulpe area of the Ratnapura district, exploring how they interact at local and regional levels to move seeds from breeders to farmers and the impact on agricultural practices. Seeds serve as custodians of preserving genetic diversity and a determinant of future agriculture. However, there are significant challenges that threaten the efficacy and sustainability of seed systems. Our research objectives were to identify the nature of the existing seed system in the Imbulpe area, understand the governance and controls in place, and explore the gaps and opportunities to improve the existing seed system to help preserve genetic diversity. Data was collected through questionnaires facilitated via interviews and focus group discussions with a target of fifty farmers, as well as consultations with local agrarian services institutions in the area. The questions covered existing seed systems and modifications done to improve or correct these systems. The formal seed system in the Imbulpe area involved agrarian services and key seed merchants, such as Hayleys and CIC. Informal seed systems were primarily used by subsistence farmers and those growing vegetables and fruits alongside large paddy fields where seed saving, exchanging, and selling among farmers defined systems used. Formal seed systems offered several qualities in seed which are helpful to farmers in terms of productivity, consistency, and reliability. High germination rates, genetic purity and uniformity, disease and pest resistance, and adaptability and resilience were found to enhance productivity for farmers. These were backed by soft services such as quality assurance and certification of seeds, access to new seed varieties, as well as technical support and guidance where appropriate. It is recommended that additional research work be done to determine the level of governance necessary to support the informal seed system in place, by allowing the seed quality to be assessed before distribution. Local farmers should be helped to devise their own voluntary protocols to ensure that their seeds are disease free and viable by using seed quarantines and test germinations. In conclusion, we found a healthy informal seed system within the Imbulpe area that could be improved with awareness through extension programs.

Keywords: Seed systems, Value chain analysis, Agricultural development, Food security, Resilience

(ID 219)

Olfactory Responses of Adult *Cryptolaemus montrouzieri* (Coleoptera: Coccinellidae) to the Host, *Paracoccus marginatus* and Host-Associated Plant Odours: Evidence from Y-Tube Olfactometer Trials

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Abstract

Insect predators have shown potential in suppressing populations of certain pest species when used in augmentative biological control programs, owing to their efficient host-location abilities. *Cryptolaemus montrouzieri*, a predator of papaya mealybug (PMB) *Paracoccus marginatus*, was examined with the objective of assessing the behavioural responses of the predator to a variety of odour cues associated with PMB and papaya plants. Papaya plant odour, unparasitized mealybugs, complex interactions between plants and mealybugs, the presence or absence of parasitized prey, and the impact of conspecific competitors were included in the spectrum. A dual-choice Y-tube olfactometer was employed as the experimental apparatus. *C. montrouzieri* adults were significantly attracted to clean airflow compared to no airflow. Both sexes exhibited significant attraction to PMB-infested papaya leaves compared to uninfested papaya leaves, and a similar observation was made when comparing PMB-infested papaya leaves and clean air (control) ($p < 0.05$). Adults did not exhibit a significant preference for newly infested and mature, previously infested papaya leaves. Adult males exhibited a significant preference for PMB-infested papaya leaves compared to parasitized mealybug-infested leaves ($\chi^2 = 7.73$, $p < 0.005$); however, this trend was not observed in adult females. *C. montrouzieri* did not exhibit a significant preference towards conspecific competitors containing odour sources. Additionally, adult females exhibited a stronger preference for PMB-infested papaya leaves compared to dried papaya leaves containing older PMB infestations ($\chi^2 = 4.09$, $p = 0.043$). A significantly higher proportion of males (78.6%) exhibited a preference for PMB-infested papaya leaves than females (66.6%) ($t = -2.65$, $p = 0.038$). However, a significantly lower proportion of males (31.7%) displayed a preference for parasitized PMB-infested papaya leaves than females (41.7%) ($t = 2.78$, $p = 0.032$). The results of this study expand the understanding of the responses of *Cryptolaemus montrouzieri* to the host, papaya mealybug, and related plant odours.

Keywords: Coccinellids, *Cryptolaemus montrouzieri*, Host odours, *Paracoccus marginatus*, Y-tube olfactometer.

(ID 226)

Microbial Ecology Associated to the Coral Recruitments Dynamics in Southern Sri Lanka

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Abstract

Coral reefs are made by coral organisms, and they produce their mineral substrate. Coral reefs are formed of colonies of coral polyps held together by calcium carbonate. The coral reefs ecosystems were lost due to the summation of both natural and anthropogenic activities. Coral recruitment is a critical process. Helps maintain coral populations and facilitates recovery after a disturbance by ultimately influencing abundance and species composition. This study was carried out to find recruitment patterns of reef building corals and other associated organisms and microbial ecology at the time with relation to coral recruitment. Five tiles were deployed in each 3 locations after one-month preconditioning (Depth~4 m). Tiles were collected back within 3-week intervals. Bacteria colonization and direct counts were observed using culture media plates and epifluorescence microscopy respectively. Epiphytic organisms were observed in tiles and counted to determine coverage analysis. Coral Crustose algae (CCA) were dominant among them. According to results, after 6 weeks of deploying, newly recruited corals were observed and identified as *Pocillopora* sp. and *Goniastrea* spp. Coral recruitment did not show difference between study sites ($p>0.05$, $p=0.145$) but showed positive relationship with time ($p<0.05$; $p=0.032$, $R^2=79.4$). And total bacteria count ($p<0.05$, $p=0.000$). And virus count ($p<0.05$, $p=0.013$) in tile and water column showed the significant difference between study sites. Paraviwella showed highest bacteria and virus count in water column and highest bacteria count in tiles while Waligama showed highest virus count in tiles. It may be due discharges from Tangalle harbor may contaminate with water and due to basin topography of Paraviwella reef area bacteria and viruses remained in high concentrations. Pathogenic bacteria in tiles (*Vibrio* sp. *Escherichia coli* and *Shigella* sp.) were not significantly different between sites and do not show any relationship with coral recruitment. CCA cover did not differ between study sites but showed a positive relationship with coral recruitment. Terracotta tiles were able to recruit coral within a low time period like 2 to 3 months. Out of all sites Polhena was the most suitable site with relatively faster for coral recruitment.

Keywords: Coral recruitment, Terracotta tiles, Microbial ecology, Virus, CCA

(ID 259)**Spatiotemporal Habitat Use of Family Viverridae in Kumana National Park, Sri Lanka****Rodrigo, B.K.P.D., Gunathilaka, W.D.C.N., Jayasekara, E.G.D.P., Mahaulpatha, W.A.D.****Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***mahaulpatha@sjp.ac.lk***Abstract**

Viverrids (Civets) are medium-sized mammals belonging to the order Carnivora. There are three species of civets in Sri Lanka namely, Common Palm Civet (*Paradoxurus hermaphoditus*), Ring-tailed Civet (*Viverricula indica*) and Golden Palm Civet (*Paradoxurus aureus*). A study was conducted in Kumana National Park (KNP) during August 2022 and March 2023 to examine the activity patterns and spatial habitat use of viverrids. Habitat types within the park were identified based on a preliminary survey and analysis. Trail cameras (29 trap stations) equipped with passive infrared sensors were deployed following a systematic approach within four square kilometre plots in KNP. A total of 44 footages of viverrids were documented across the survey period. The time and date of each Viverrid footage were employed for the activity analysis using kernel density estimation. The habitat preference was calculated using the relative abundance index (RAI). Vegetation, physical and food abundance parameters at each camera station were obtained to assess the occupancy (ψ) of civets within the study area. Throughout the study, all civet species were present and the RAI of Ring-tailed Civet within the study site had the highest value (RAI=1.74) among the Viverridae family. Golden Palm Civet was rarely observed within the park exhibiting a low relative abundance (RAI<1). The study findings indicated that all civet species showed predominantly nocturnal behaviour in the dry zone (Activity>0.20). Interestingly, the ring-tailed civet exhibited a higher preference for the tropical thorn habitats which provided the food and cover from the predators. In contrast, the other civet species preferred the seasonal grasslands. The occupancy analysis unveiled the ring-tailed civet has a significant correlation with the Canopy cover (CC) and the Euclidian Distance to the Water (edw). According to these findings, the most significant vegetative and physical parameters for selecting a habitat by the Viverrids in the wild were the canopy cover and the Euclidean distance to the water. The current study provides insight for the activity patterns and habitat associations of the civets present in a dry zone national park. The current study can be used as a supplement for in-situ and ex-situ conservation programs aimed at rehabilitation and reintroduction of the civets.

Keywords: Activity, Camera trapping, Civets, Kumana, Occupancy

(ID 286)

Odonata Diversity in a Rapidly Changing Landscape: A Case Study in a Land Near Hambantota Port Construction Site

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Abstract

Human-driven alterations of natural landscapes, particularly through infrastructure development, can exert significant ecological impacts on its ecosystem. Odonata, commonly known as dragonflies and damselflies, play an important role as biological indicators reflecting the health of the ecosystems they inhabit. The Hambantota port project, in Sri Lanka, offered a unique opportunity to examine the early ecological responses to land-use changes. Therefore, this preliminary study aimed to assess the diversity and evenness of Odonata species in a transitional habitat created by the clearing of previously inhabited land for the port construction site in Hambantota, covering an area of 0.02 km². Block count method was used as the sampling method and sweep nets were utilized to collect species for a sampling period of four weeks from November to December 2020. Species identity, abundance, and habitat characteristics were recorded. The collected data were subjected to the calculation of Shannon-Wiener Diversity Index (H') and Pielou's Evenness Index (J). A total of 69 Odonates, representing 12 different species belonging to two families, family Coenagrionidae (68%) and family Libellulidae (32%) were recorded. Notably majority of recorded species belong to the family Coenagrionidae with *Pseudagrion microcephalum* being the highest occurrence species (33%) while *Pseudagrion rubriceps ceylonicum* (1.4%) exhibited the lowest occurrence. This study unveiled a rich diversity of the Odonata community, indicating a high species diversity with a Shannon-Wiener Diversity Index (H') of 2.105. Moreover, the calculation of Pielou's Evenness Index (J) of 0.402, suggests moderate evenness in species distribution. Despite the prior human occupation of the area and ongoing construction activities in proximity, the Odonata community manifested a robust species diversity within the area. This balance in species distribution during the early stages of habitat transition can likely be attributed to the presence of newly formed water bodies resulting from land changes, serving as suitable habitats for Odonata. These results underscore the adaptability and resilience of Odonata species in the face of transitional and disturbed environments.

Keywords: Odonata, Dragonflies, Damselflies, Diversity, Species richness

(ID 096)**Distribution Patterns of *Impatiens* in Sri Lanka: Exploring Niche Breadth, Range Size, and Elevational Dynamics****Ruwanmalie, W.A.P.U.¹, Piumal, R.J.¹, Viduranga, W.A.A.D.M.²,
Kathriarachchi, H.S.^{1*}**¹*Department of Plant Sciences, University of Colombo, Colombo 03, Sri Lanka*²*Department of Ecology and Conservation Biology, Texas A and M University, USA***hashi@pts.cmb.ac.lk***Abstract**

In Sri Lanka, *Impatiens* (Family Balsaminaceae) is represented by 23 native species, of which 16 are endemic. Additionally, 3 exotic *Impatiens* are widely cultivated as ornamentals. According to the National Red List 2020, of the native species, 6 are vulnerable (VU), 9 are endangered (EN), 2 are critically endangered (CR) and *I. walkeri* is listed as critically endangered possibly extinct CR(PE). The present study aimed to analyse the current distribution of *Impatiens* species across floristic regions and along an elevational gradient in Sri Lanka. Species occurrence data were obtained from reputable repositories such as the National Herbarium, international herbaria, various national and international floristic databases. A georeferenced map was meticulously constructed to evaluate the spatial distribution of these species across distinct floristic zones and along an elevation gradient using ArcGIS Pro and R 4.2.2 version. Heat map analysis and Jaccard clustering based on the distribution of species in different floristic zones were used to detect niche specialty. The central mountains, encompassing the Ramboda-Nuwara Eliya and Adam's Peak floristic zones, exhibited the highest species richness of Sri Lankan *Impatiens*. Jaccard analysis delineated three primary clusters, none of which included the point endemic species, *I. janthina* and *I. jacobdevlasii*. Notably, regression analysis revealed a strong correlation ($R^2=+0.7751$) between niche breadth and range size, emphasizing the significance of colonizing adaptability in *Impatiens* species' occupancy patterns. *Impatiens acaulis* recorded the broadest niche breadth and the largest range size among the species. The optimal elevation range for the majority of *Impatiens* species was found to be between 1000 and 1200 meters above. *Impatiens acaulis* and *Impatiens cornigera* showed distribution patterns that were largely independent of elevation variations. In contrast, *I. macrophylla* and *I. leptopoda* exhibited a limited distribution preference especially for highland regions. The findings of the study are expected to be incorporated to conservation attempts of *Impatiens* species in Sri Lanka.

Keywords: *Impatiens*, Elevation, Niche, Range, Sri Lanka

(ID 122)

Diversity and Distribution of Freshwater Crabs in Sri Lanka

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Abstract

Freshwater Crabs plays a key role in biodiversity and ecological balance of crustaceans found in Sri Lanka. Geographical location of the island with the combination of tropical climate and diverse ecosystems provides an ideal habitat for these creatures. This study is based on the described freshwater crabs found in Sri Lanka and focus on their geographical distribution and the diversity. The data comprises from 1961 to date with a combination of datasets from field surveys and existing literature. These field surveys were conducted in diverse habitat types including, wetlands, rivers, streams, isolated regions, etc. literature consist of taxonomical identifications through morphological examinations and genetic analysis. Geospatial techniques in Geographic Information Systems (GIS) were used to map the distribution, diversity, and potential hotspot within the country. 51 described species of freshwater crabs from seven different genus of *Ceylonthelphusa*, *Clinothelphusa*, *Mahatha*, *Oziotelphusa*, *Pastilla*, *Perbrinckia*, and *Spiralothelphusa* were mapped. The findings represent a diverse distribution across Sri Lanka, especially in the wet zone and the montane regions. All seven genera were found in the wet zone of the country, while only genus *Spiralothelphusa* and *Oziotelphusa* showed an expanded distribution to intermediate and dry zones. Wet zone of Sri Lanka consists of the highest diversity and vulnerability becoming the hotspot of freshwater crabs. Although the distribution map shows an evident lack of data in Northern Province, Eastern Province, and eastern parts of the Southern Province. Furthermore, the findings of current study provide a comprehensive overview of the distribution, diversity, and hotspot of freshwater crabs in Sri Lanka bridging the knowledge gap for future studies on the patterns of habitat preferences and modelling, significance, and the ecological importance, expanding field surveys through regions in northern and eastern parts of the country where the data is extremely limited, conservation initiatives with sustainable management strategies.

Keywords: Freshwater crabs, Sri Lanka, Geographic distribution, Hotspot, Decapod crustaceans

(ID 127)

Examination of Demarcation Criteria of Environmentally Sensitive Areas in Sri Lanka**Samarasinghe, S.S.T.^{1*}, Jayasekara D.², Mahaulpatha, W.A.D.²**¹*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**mahaulpatha@sjp.ac.lk**Abstract**

Sri Lanka is home to a rich biodiversity across a wide array of ecosystems and is listed among 36 biodiversity hotspots. Being a party to the Conservation on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), designating Protected Areas (PAs) is considered the key approach to the conservation of biodiversity of Sri Lanka. Accordingly, 26.5% of the total land area of the country has been designated as PAs. Only the species covered under the schedules of the Flora and Fauna Protection Ordinance receive legal protection outside PAs. Therefore, a strategic approach is required to conserve the biodiversity not covered under schedules and which exist outside PAs. In this context, Environmentally Sensitive Areas (ESAs) have been introduced as Other effective area-based conservation measures (OECM) and the National ESA policy provides an ESA selection criterion. The research aimed to examine the appropriate criteria for determining the boundaries for selected ESAs. A case study approach was chosen and three cases from Kala Oya Basin were analysed: Gangewadiya in Wanathawilluwa Divisional Secretariat Division (DSD), Kala Oya Riverine and Manawekanda, in Ipalogama DSD. Gangewadiya ESA covers 2290 ha of land as 17.2% and 100% within two Grama Niladari Divisions (GNDs). Kala Oya Riverine ESA is comprised of different types of borders which are administrative, natural, and social. Manawekanda ESA covers 856 ha: 95%, 3.95%, 0.7% 0.35% of respective GNDs. Criteria for identifying and declaring the respective ESAs are having globally/nationally threatened species, endemic, indigenous, wild crop relatives, migratory species assemblages, unique ecosystems, and lending itself to management by a local body or community group. These ecosystems provide basic ecosystem services and services critical for ensuring connectivity of important habitats/key biological elements/improving ecological viability of existing PAs. These cases indicate though GPS boundaries have been drawn in maps to identify ESAs based on ecological boundaries, species, and habitat distribution, it is difficult to apply management strategies based on GPS boundary of the ESAs and it requires a strategy in demarcating the boundaries of ESAs. The boundaries can be defined with reference to natural, customary, surveyed, or administrative boundaries and physical demarcation is not necessary as coordinates can translate to link with those boundaries. Therefore, the ESAs can be demarcated as OECM using GND boundaries or other natural, customary, surveyed, manmade, or admin boundaries that encompass GPS locations of the map.

Keywords: Other effective area-based conservation measure (OECM), Environmentally Sensitive Areas (ESA), Customary boundaries, Administrative limits, Biodiversity

(ID 097)

A Preliminary Study on Sri Lankan *Impatiens*: Phylogenetics and Morphological Evidences

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Abstract

Genus *Impatiens* (Family Balsaminaceae) having 23 native species in Sri Lanka, displays a high endemicity of nearly 70%. The objectives of the present study were to assess the phylogenetic placement of Sri Lankan *Impatiens* and to elucidate the morphological characters supporting their relationships. Based on the sequence availability, Internal Transcribed Spacer (ITS) region was used for a total of 57 species, including seven Sri Lankan *Impatiens* species. Maximum likelihood and neighbour joining analysis were performed to produce the phylogenetic trees using *Hydrocera triflora* as the outgroup. Selected morphological characters were obtained using published literature and herbarium records with special emphasis on floral characteristics to produce the cladogram. Analysis was conducted using R 4.2.2 version. Likelihood and neighbour joining analysis produced congruent phylogenetic trees. Results revealed that, Sri Lankan *Impatiens* taxa forms a monophyletic separate cluster revealing their phylogenetic distinctiveness. Sri Lankan group show a close relationship with *Impatiens* native to China and India providing insights to their biogeographic affinities. Furthermore, morphological data supported the relationships derived from molecular phylogenetic analysis. Two distinct species clusters were identified in both the phylogram and cladogram; *I. henslowiana* and *I. grandis* constituted one cluster, while *I. leptopoda* and *I. flaccida* comprised the other. These preliminary results provide baseline information to investigate character evolution, floral adaptations, more resolved phylogeny, and biogeography of old-world *Impatiens* species.

Keywords: *Impatiens*, Phylogeny, ITS, Morphology

(ID 092)**Effect of Salinity on the Morphological and Physiological Parameters of Quinoa
(*Chenopodium quinoa* Willd.), Amarillo Marangani Variety****Silva, A.I.L., Wimalasekera, R.****Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***rinukshi@sci.sjp.ac.lk***Abstract**

Quinoa (*Chenopodium quinoa* Willd.) is a genetically diversified Andean crop, which has drawn attention from all over the world for its nutritional and health benefits as well as its adaptability to a variety of conditions, including marginal agroecosystems that are stressed by drought and nutrient-poor, salinized soils. Salinity is the main factor that inhibits crop growth at both the cellular and whole plant levels. Where high salinity groundwater is utilized for irrigation, soil salinity poses a significant concern in growth and development of plants. The aim of the present study was to investigate the effects of salinity on morphological and physiological parameters of quinoa variety Amarillo Marangani. Salt stress was imposed by application of 0 mM NaCl, 200 mM NaCl and 300 mM NaCl to the plants grown in pots (12 cm×12 cm). (Five plants per treatment) with 95% of field capacity of water. Tree height and stem diameter as morphological parameters and relative water content (RWC %) and stomatal density as physiological parameters were measured through 34 weeks of treatment period and analysed statistically using Minitab 17. Based on the morphological findings, plants grown under 300 mM NaCl showed the least growth in average height of 56.16±1.42 cm compared with the average heights of plants grown under 200 mM NaCl (62.33±2.85 cm) and 0 mM NaCl (66.50±2.59 cm). The stem diameter under 300 mM NaCl showed a mean value of 3.40±0.11 mm compared with 200 mM NaCl (3.93±0.07) mm and 0 mM NaCl (4.2±0.07) mm respectively. Plants grown under 300 mM NaCl showed a significantly lower average RWC% value of 71.16±0.42 compared with the mean RWC % of 77.39±0.63 and 87.02±1.03 at 200 mM NaCl and 0 mM NaCl respectively. Comparing the values of stomatal density in different salinity conditions, plants grown under 300 mM NaCl has the lowest average stomatal density 54.64±1.36 than the plants under 200 mM NaCl 62.33±1.13 and 0 mM NaCl 74.20±1.59. The results emphasized that high salt concentrations in soil affected the plant growth morphologically and physiologically but considerable growth at salt concentration of 200 mM in the Amarillo Marangani variety.

Key words: Quinoa, Amarillo Marangani, Salinity, Growth parameters

(ID 145)

Lianas are Increasing in the Tropics: A Consolidated Evidence from Southeast India

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Abstract

Lianas are one of the most conspicuous elements of tropical forest ecosystems, comprising up to 50% of the woody species density and richness. Therefore, they are expected to majorly determine the tropical forest structure, function, and dynamics. Are lianas increasing in dominance in tropical forests has been a focused question in several recent studies. While the studies from neotropical sites agree with this claim, results from Afro-tropical sites have produced a contrasting trend. At this crucial juncture, we present the evidence for increasing liana abundance and biomass in the seasonally dry tropical forest sites of Southeast India based on over 30 years of long-term monitoring from six 1 ha permanent plots. During the initial inventory, all lianas ≥ 1 cm DBH were enumerated and tagged using serially numbered aluminium metal tags. At decadal intervals, each 1 ha permanent plot was re-invented for liana censusing. The liana density has increased by ~30% from the initial inventory. The results also revealed the decrement of trees by more than 35% during the same censusing interval. Similarly, the liana basal area and biomass increased significantly during the study period. While the underlying ecological mechanisms favouring lianas are still unclear, this crucial evidence from the present study will further strengthen the liana increment hypothesis in the tropics. The ecological implications of increasing liana dominance are also discussed.

Keywords: Forest dynamics, Population density, Long-term monitoring, seasonally dry tropical forests, Above-ground biomass

(ID 116)

Development of Propagation Techniques for Keekiridiya (*Eclipta prostrata* L.): A Valuable Medicinal Plant**Nakandalage, N.*, Jayawardhana, W.R.S., Ariyasoma, U.M.U.R., Pradeepika, N.G.J.***Department of Crop Science, University of Ruhuna, Matara, Sri Lanka***niluka@crop.ruh.ac.lk***Abstract**

Due to its miraculous chemical qualities, *Eclipta prostrata* L. has long been used extensively in traditional herbal remedies. Owing to over-harvesting caused by the rise in demand, *Eclipta prostrata* could be in danger of extinction. Therefore, this experiment was held to implement an artificial propagation method and maintain the preservation of biodiversity and natural habitats of *Eclipta prostrata* L. Three separate experiments were conducted with five replicates per treatment. Experiment one comprised four sub-experiments (Effect of different water soaking methods, alternative wetting and drying treatments, Sulfuric and Nitric acid treatments, and Gibberellic acid treatments) to select the most promising seed treatment method/s. Experiment two was to select the suitable nursery media for *Eclipta prostrata* seeds and cuttings using five different media (coir dust, compost, coir dust:sand-1:1, compost:sand-1:1, cow dung:sand-1:1). Experiment three was planned to study the most suitable transplanting media for seedlings, rooted cuttings, and direct seeding of *Eclipta prostrata* using five different transplanting media (topsoil:compost:sand-1:1:1, topsoil:compost:sand-1:2:1, topsoil:compost-1:1, topsoil:compost-1:2, topsoil only). All the experiments were carried out using a Completely Randomized Design with factorial arrangements where necessary. Parameters were taken three weeks after seed establishment in experiment one and four weeks after establishment in experiments two and three. Data was analysed using ANOVA with an appropriate statistical analysis system. Results revealed that the highest germination percentage was observed in seeds treated with Gibberellic acid (900 ppm in 14 hours dipping period) (90%) followed by seeds soaked in water for 12 hours (80%). Nursery media of cow dung:sand-1:1 showed higher seed germination (77%) and the highest seedling height (5.8 cm) for seeds and significantly ($P \leq 0.05$) highest height increment (2.1 cm) for cuttings of *Eclipta prostrata*. All seedlings, rooted cuttings, and direct seeding of *Eclipta prostrata* had the maximum number of leaves, branches, and height increment in the transplanting medium topsoil:compost:sand-1:1:1. Therefore, it can be concluded that *Eclipta prostrata* seeds treated with Gibberellic acid (900 ppm in 14 hours dipping period) could be used as the most promising seed treatment method and cow dung:sand-1:1 could be used as the most suitable nursery media to obtain healthy and vigorous seedlings. The most suitable transplanting media was topsoil:compost:sand-1:1:1 and compared to direct sowing and cuttings, *Eclipta prostrata* seedlings had superior growth characteristics. The research could be very helpful in overcoming the various constraints in *Eclipta prostrata* propagation and ensuring a steady supply of planting materials for the species' commercial production.

Key Words: *Eclipta prostrata*, Nursery media, Propagation, Seed treatments, Transplanting

(ID 139)

Floristic Diversity, Composition and Conservation Importance of Flora in the Salgala Forest Reserve in Kegalle District, Sri Lanka**Imbuldeniya, T.D.^{1*}, Wijetunga, A.S.T.B.², Fernando, M.T.R.¹**¹*Department of Plant and Molecular Biology, University of Kelaniya, Kelaniya, Sri Lanka*²*Department of Biological Sciences, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka***tharindikaimbuldeniya11@gmail.com***Abstract**

Salgala forest (Ketagilla Mukalana) reserve (SFR) is a small, isolated lowland wet evergreen forest situated in Kegalle district was declared as a government reserve in 1817 due to its rich plant and animal diversity. This FR is under threat of degradation due to different anthropogenic activities. For conservation and protection measures, a prior knowledge on the floristic composition and diversity of the forest is crucial. This study was carried out to assess the species diversity and composition of FR along an elevational gradient (high elevation- above 300 m, mid elevation- between 250 m-300 m, and low elevation- between 200 m-250 m). The stratified random sampling was carried out due to the heterogeneity of terrain. Therefore 7 plots with the dimensions of 10 m×10 m were used for measuring overstory trees having girth at breast height (GBH), GBH≥30 cm and height≥1.5 m. Total 49 sub-plots (7 sub-plots per one major plot) of sizes 2 m×2 m (4 plots) and two plots of sizes 1 m×1 m were used to assess the diversity of understory vegetation including the herbaceous plant species (GBH<30 cm, height<1.5 m). The Hutcheson's t-test was used to analyse diversity variation in standing vegetation along the three elevations categories. In this study, a total of 51 plant species were identified belonging to 38 families and 47 genera. Out of the species recorded, 28 (55%) were identified as endemic species while 23 (45%) are indigenous. Also, *Zeuxine regia* and *Anoechtochilus regalis*, which are nationally vulnerable plants were identified in SFR. Species belonging to family Annonaceae were identified dominantly in overstory vegetation while species belonging to Stemonuraceae and Asparagaceae were dominated in understory vegetation. For the standing vegetation, mid elevation has recorded the highest diversity value for Shannon Weiner diversity index (H') (H'=3.5390), while the high elevation has recorded the least diversity value (H'=2.7659). The elevation and slope-related factors including soil erosion, surface water runoff, soil nutrition depletion due to the irregular surfaces with frequent rock outcrops and amount of sunlight received were affected to diversity reduction with increasing elevation. Therefore, differences in plant growth requirements, competitive pressures, human disturbances could be the cause of variance in the vegetation composition that currently exist in these seven sampling sites. Hence, more studies on diversity and composition variations in different landscapes are importance to get the idea of conservation practices in the Salgala FR.

Keywords: Endemic species, Hutcheson's t-test, Shannon Diversity Index, Slope effect

(ID 162)**Breeding Phenology, Pairing Patterns and Parental Behaviour of *Dinopium* flamebacks in Sri Lanka****Chathurya, E.D.J.¹, Fernando, T.S.P.², Seneviratne, S.S.^{1*}**¹*Avian Sciences & Conservation, Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*²*Department of Zoology, The Open University of Sri Lanka, Nawala, Sri Lanka***sam@sci.cmb.ac.lk***Abstract**

Understanding the breeding ecology is crucial for managing and conserving species and their habitats. Insights into the breeding ecology of *Dinopium* Flamebacks in Sri Lanka remain incomplete, despite considerable studies of other aspects, especially of their systematics, evolution, and dispersal. This study focused on investigating the breeding ecology of *Dinopium* Flamebacks in Sri Lanka. The study was conducted from June 2022 to February 2023 in three distinct study areas in Eppawala (dry zone), Kaduwela (wet zone), and Talaimannar (arid zone), each covering 2 km². Nests were studied using a USB-android endoscope camera, and observations were conducted in the morning from 06:00 to 09:00 and in the evening from 16:30 to 18:30. Active nests were monitored from hatching to fledging, including observations of pairing patterns of the parent birds. To understand pairing patterns, observations were made regarding the plumage colour of male and female birds at each active nest, with colour variations noted and recorded using a standardized colour index. Previously documented eBird data from active nest sites (www.ebird.org) were also used for the analysis. The study identified a breeding peak from August to October, with the nesting season extending from late July to February. Nestlings underwent a development period of 25 days (25.4 ± 0.894) within the nesting chamber, and fledglings left the nest between 24 to 26 days after hatching. The observed fledging success rate was 66.6% (8 out of 12 nestlings successfully fledged), indicating their ability to successfully rear their hatchlings in the observed nesting sites. The male was primarily involved in the night shift, while both parents shared the day shift. Males and females were both responsible for nourishing the nestlings. Short breaks during the day allowed parents to leave the nest for feeding. Our visual observations indicated a diet primarily consisting of soft-bodied insects, such as ants, regurgitated directly into the nestlings' mouths. This study also observed parental pairing patterns in 15 active nest sites. Males tend to have redder plumage in hybrid pairs, likely driven by social preferences for the red colour in females. Breeding seasons were influenced by the climatic zone and environmental factors. *Dinopium* Woodpeckers require a stable and dry environment to successfully nourish their young. Sporadic heavy rains made increased nest failures, probably due to dampness, predator pressure and interruption to the feeding intervals. This knowledge can inform land use management practices, such as harvesting and irrigation to minimize disturbance during critical nesting periods.

Key words: *Dinopium*, flamebacks, Breeding ecology, Pairing patterns, Behaviour

(ID 123)

Behavioral Responses of Asian Elephants (*Elephas maximus*) to Tourist Vehicles in and around Minneriya National Park

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Abstract

Nature based tourism is major source of revenue for wildlife rich countries. The congregation of elephants on the lake beds of Kaudulla and Minneriya National Parks in Sri Lanka is a major draw for tourists. However, tourism-related disturbance to wildlife is a cause for concern among wildlife managers. We examined the behavioural changes of Asian elephants in the Minneriya and Kaudulla National Parks in relation to the presence of tourist vehicles. The data collection was done July to October 2023 using vehicle-based observations. Focal animal sampling was conducted on adults and juveniles of both sexes in the presence and absence of tourist vehicles. A total of 180 individuals were observed. Both adult males and females showed a high representation of alert, stress, aggressive and vocalization in the presence of vehicles. Both juvenile males and females showed fear behaviours in the presence of tourists. Adult females displayed a higher frequency of alert (Average 104.5) and stress (Average 75.4) behaviours than males. Adult males showed a high representation of alert and stress behaviours when they were <10 m from the tourist vehicles. Females showed a high representation of alert, stress, fear and aggressive behaviours when they were <10 m from vehicles. Similarly, both juvenile males and females showed high representation of fear behaviour near tourist vehicles. In the case of state behaviours, females devoted a lower proportion of time locomoting (16.5%) in the presence of tourist vehicles. Our study shows that the presence of tourist vehicles influences the behaviour of Asian elephants. Hence, we recommend that tourist vehicle numbers and behaviour be managed to minimize their impact on the behaviour of wild elephants.

Key Words: Asian elephants, Behaviour, National parks, Tourism

(ID 204)**Acute Toxic Effects of Commercial Glyphosate on Embryonic Development of Zebrafish (*Danio rerio*)****Imanthi, K.P.A.^{1,2}, Pathmalal, M.M.^{1*}, Wanigasuriya, J.K.P.³, Perera, P.P.R.^{2,4}, Jayasundara, N.⁵**¹*Centre for Water Quality and Algae Research, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*³*Department of Medicine, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*⁴*Centre for Kidney Research, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*⁵*Nicholas School of the Environment, Duke University, North Carolina, USA***pathmalal@sjp.ac.lk***Abstract**

Glyphosate is a widely used herbicide and its potential effects on human health and aquatic biodiversity have been a subject of concern and scientific investigation. Glyphosate has been shown to have the ability to cause abnormalities or malformations in developing fish embryos upon ingestion through water and food. This study was focused on evaluating the early embryonic effect of glyphosate on fish embryos using zebrafish (*Danio rerio*). Zebrafish have external fertilization, transparent embryos, and shorter embryonic development time as a model organism. Commonly used commercial glyphosate product Anu 71 (Ammonium salt of glyphosate 71% SG) was selected and zebrafish embryos were exposed to a concentration series of 1.0 µg/L⁻¹, 1.5 µg/L⁻¹, 2.0 µg/L⁻¹, 2.5 µg/L⁻¹, 3.0 µg/L⁻¹, 3.5 µg/L⁻¹, 4.0 µg/L⁻¹ after 1 hour of post-fertilization(hpf). Distilled water was used as the control. Fertilized eggs were carefully chosen under light microscope (10×4) observation and 30 eggs were added into each concentration. Hatching rate, hatching time, heart rate, mortality rate and morphological abnormalities were observed up to 96 hpf. After 1 hour of exposure, mortality of embryos in 3.0 µg/L⁻¹ and 3.5 µg/L⁻¹ solutions was 3.33%, and in 4.0 µg/L⁻¹ solution it was 6.66%, while in control it was 0%. After 72 hpf the highest hatching rate of 26.6% was recorded in 1.0 µg/L⁻¹ and the lowest of 10% was in 4.0 µg/L⁻¹. In contrast, the control showed 46% hatching at the same time. All embryos were hatched after 96 hpf without any morphological abnormalities. Heart rate decreased from 132.6±1.34 bpm to 113.3±1.06 bpm with increasing concentrations and in control it was 155.9±2.02 bpm. As higher glyphosate concentrations alter the hatching rate, hatching time and heart rate of fish embryos, it can ultimately cause loss of survival in natural environments and lead to a diversity loss.

Keywords: Embryonic development, Glyphosate, Hatching rate, Mortality rate, Zebrafish

(ID 216)

Phylloplane Fungi Associated with Capsicum Varieties (*Capsicum annum* L.) of Sri Lanka and their Antagonistic Activity on the Causative Agent of Capsicum Anthracnose Disease**Diwankara, U.T., Deshappriya, N.****Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***nelum@sci.sjp.ac.lk***Abstract**

Capsicum (*Capsicum annum* L.) is a vegetable cash crop cultivated in Sri Lanka. Anthracnose disease caused by *Colletotrichum* species is an economically important disease causing about 50% yield losses. Synthetic fungicides used to manage anthracnose disease cause environmental and health problems and thus less hazardous alternative strategies should be sought. Phylloplane fungi are being investigated as one such viable alternative, and therefore this study aimed to isolate and identify the phylloplane fungi from commonly cultivated capsicum varieties in Sri Lanka and evaluate their ability to control the causative agent of capsicum anthracnose disease. A fungal species associated with anthracnose symptoms in capsicum fruits was isolated and pathogenicity was confirmed using Koch's postulates. The isolate was identified as a *Colletotrichum* species based on morphological characteristics. The genomic DNA extracted from the *Colletotrichum* culture was subjected to PCR amplification of the Internal Transcribed Spacer (ITS) region with ITS1/4 primers, and the resulting PCR products were sent to Macrogen, Korea for sequencing. The obtained sequence was compared with the GenBank database using the BLAST tool, which confirmed its identity as *C. plurivorum* (Percent identity 100.00%, E value 0.0). Leaves from two-month-old, healthy, capsicum varieties of C.A.8, Hungarian yellow wax, and Muriya were collected randomly from the mid area of fields in the Colombo, Kalutara, and Nuwara-Eliya districts. Leaf wash and leaf imprint methods were used to isolate phylloplane fungi from collected samples. Thirty-six phylloplane fungi were isolated and identified using morphological characteristics up to the genus level. The most dominant fungal genera isolated were *Aspergillus*, *Penicillium*, and *Trichoderma* with 28.57, 9.90, and 9.90 percentage abundances respectively. Dual culture plate assays were conducted to evaluate the effect of phylloplane fungi on the colony growth of *C. plurivorum*. Amongst all isolates, eleven phylloplane fungi significantly inhibited ($P \leq 0.05$) the colony growth of the pathogen in dual culture assays. The highest percentage of inhibition was shown by *Trichoderma* sp.1 (82.67%). Using the sticky tape method, the antagonistic structures formed by the effective phylloplane fungi in dual culture plates were observed. *Trichoderma* sp. formed loops and coils around the hyphae of the pathogen, and these structures may have a role in the control of the colony growth of the pathogen. The study showed that phylloplane of capsicum varieties in Sri Lanka have diverse fungal flora and some of them had the ability to control the colony growth of *C. plurivorum* significantly. These findings will serve as a basis for further in-depth studies of their development as biopesticides against *C. plurivorum*.

Keywords: Phylloplane, Capsicum, Anthracnose disease, Biopesticides, *Trichoderma* sp.

(ID 125)**Evidence for Presence, Home Range Mapping, and Conservation Threats of Fishing Cats (*Prionailurus viverrinus*) in Kirala-Kele Sanctuary, Southern Sri Lanka****Chathuranga, W.G.D.*, De Silva, M.P.K.S.K., Wijeweera, W.P.S.N.***Department of Zoology, Faculty of Science, University of Ruhuna, Matara, Sri Lanka***chathurangawgd@zoo.ruh.ac.lk***Abstract**

The fishing cat (*Prionailurus viverrinus*) is a medium-sized globally vulnerable wild cat present in South and Southeast Asia. It is considered the second-largest wild cat inhabiting hill country wet zone and dry zone forests in Sri Lanka. Only a handful of studies have been conducted about them in Sri Lanka due to the practical difficulties in studying behavioural attributes and rarity. Present study was conducted in the Kirala Kele Sanctuary (KKS) (5°58'38" N, 80°31'27" E) which covers an area of 1800 ha of Matara District, Southern Sri Lanka. Sampling was done weekly from August 2023 to October 2023. A random sampling method was used along the road network of the KKS to monitor the presence, population size, home range, and conservation threats. Camera traps were used to recognize the presence of fishing cats and their behaviour. Meanwhile, GPS locations of the scat and pug marks were used to identify the home range distribution and habitat utilization. Further, community-based interviews were used to detect the potential threats to the fishing cats in the KKS. A total of 576 camera trapping hours by three camera traps recorded the presence of only two fishing cats in the KKS between 07.00 p.m. and 05.00 a.m. Camera traps recorded their regular behaviours such as feeding, roaming, and defending. Scat samples (N=57) were found on the road network adjacent to the wetlands together with sparse forests, stream-line forests, and grassland areas. Mapped GPS locations of scat, and pug marks proved that fishing cats use distinctive paths as their daily trails during the same time intervals of the night while showing their home ranges in KKS. Community-based interviews and personal observations revealed that overfishing, usage of the sanctuary as a huge garbage dumping ground, unauthorized settlements in the area, and public unawareness are crucial threats to fishing cats. They have become a nuisance to the surrounding community due to their predatory attacks on domestic and farm animals. Restoration of wetland habitats, enhancement of fish densities in the wetlands, and conservation awareness programs focusing on fishing cat distribution sites are priorities to ensure their survival. Camera trapping and observations at the adjacent human settlements and genetic level studies are in progress to further recognize the conservation priorities.

Keywords: GPS mapping, Habitat utilization, Protected areas, Scat analysis, Species distribution

Financial assistance from the University Research Grant (Grant No: RU/SF/RP/2022/22) is acknowledged.

(ID 222)

Monitoring of the Airborne Pollen Diversity at the University of Sri Jayewardenepura Premises**Abeyrathne, U.K.G.¹, Munasinghe, M.L.A.M.S.^{1,2*}**¹*Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Centre for Plant Materials and Herbal Products Research, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***mayuri@sci.sjp.ac.lk***Abstract**

Studying airborne pollen grains and other microscopic organic particles present in the atmosphere is critical in understanding pollen and spore dispersion, and their seasonal distribution. This has substantial implications for environmental and allergenic research studies. In this study, pollen sampling was carried out using a self-modified gravimetric (Durham type) pollen sampler for six months, from July 2022 to December 2022. The pollen trap was placed and two microscopic slides were installed at a height of 1m above ground level at the garden of the Department of Botany, University of Sri Jayewardenepura, to investigate the airborne pollen species within the premises. One microscopic slide was coated with Vaseline, while the other was coated with Glycerin jelly with basic fuchsin. The slides were replaced weekly to analyse the quantity of pollen dispersed around the sampler. The collected pollen grains were mounted with glycerin jelly with basic fuchsin and observed under a light microscope using 400x magnification. Pollen concentrations were obtained by counting ten longitudinal transects, which resulted in the screening of about 23.5% of the total surface of the slide and converted to pollen grains/cm² of the implication surface of the slide. In this study, 639 pollen grains/cm² were recorded in a microscopic slide coated with Glycerin jelly with fuchsin while 676 pollen grains/cm² were recorded in a slide coated with Vaseline. As the most abundant pollen type, pollen grains of Poaceae (including genera of *Sporobolus*, *Chrysopogon*, *Heteropogon*, *Eleusine*, etc.) comprised 62.44% of the total pollen content and the highest count occurred in December, with 30.3% of the total pollen content in the Glycerine slide. In the Vaseline slide, Poaceae showed 65.98% of the total pollen content and the highest number of Poaceae pollen in December (37.9%). Pollen type A (12.6% and 10.8%), and *Casuarina equisetifolia* (3.7% and 2.8%) were the other dominant species in both Glycerin and Vaseline media slides, respectively. *Acacia auriculiformis*, *Azadiracta indica*, *Hibiscus rosa-sinensis*, *Syzygium spp.*, *Dendrophthoe sp.*, *Alternanthera sp.*, and *Eleocarpus serratus* and genera of family Asteraceae, Menispermaceae and Arecaceae, were the other identified pollen types recorded in the period of study. The highest number of pollen grain concentrations from the total pollen contents (Glycerine sample: 41.47% and Vaselline sample: 50.16%) were recorded during December. This study helps to extend the knowledge of airborne pollen diversity at the University premises of Sri Jayewardenepura.

Keywords: Aeropalynology, Airborne pollen, Gravimetric sampler, Pollen diversity, Pollen concentration

(ID 298)**Habitat Preference and Behaviour of Critically Endangered Hog Deer (*Axis porcinus*) in Honduwa Island Sanctuary in Southwest Sri Lanka****Madhumadhawa, R.C.^{1*}, Fernando, B.V.P.¹, Perera, P.K.P.¹, Atapattu, K.N.², Jayasinghe, C.², Withanage N.²**¹*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Statistics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**rcmadumadawa@gmail.com**Abstract**

The hog deer (*Axis porcinus*) represents a globally endangered cervid species indigenous to South and Southeast Asia. The Sri Lankan hog deer population is classified as critically endangered, with its habitat restricted to the southwestern region of Sri Lanka. Despite the identified preference of hog deer for riverine, and tallgrass lands, limited research exists on habitat preferences and behavior of the local population. This study aimed to address this gap by conducting a comprehensive camera trap survey in an isolated population on an island sanctuary in the Bentota River. The study site (11.4 ha) hosts an introduced, semi-captive, population of hog deer. The camera trap survey was undertaken to evaluate the behavior, habitat preferences, and other autecological features of the hog deer population on Honduwa Island. A drone survey identified two principal habitat types; secondary forest vegetation and invasive-dominated marshy vegetation. Six camera traps were strategically placed according to a predetermined random grid layout generated by the R-software random number generator. The camera trap deployment strategy involved 11 iterations, with each iteration spanning 7 camera trap nights. Within each iteration, 3 camera traps were strategically positioned for each identified vegetation type. Following each iteration, the camera traps were systematically relocated. This sampling session spanned 448 camera trap nights in both habitats to capture data on the hog deer's presence. The recorded data were analyzed with Mann-Whitney U-tests using the R-software package. Examination of capture rates at individual camera trap locations revealed a noticeable preference towards secondary forest vegetation, with a mean capture rate of 129. In contrast, the invasive-dominated marshy vegetation exhibited a considerably lower mean capture rate of 21.4. The same camera trap images revealed that hog deer are comfortably co-occurring with species like porcupine (*Hystrix indica*), Indian pangolin (*Manis crassicaudata*), common rats (*Rattus rattus*), and fishing cats (*Prionailurus viverrinus*). In terms of population dynamics, the study population showed a female-skewed group composition with a February to April fawning season. Further, this isolated population showed dawn-dusk activity peaks the same as their mainland counterparts. The studied population showed predominantly solitary with occasional small groupings of females. In conclusion, the hog deer population in this study shows similar behavioral patterns, activity patterns, and relatively comparable habitat preferences to other natural populations outside of isolated, semi-captive, conditions.

Keywords: Hog Deer, *Axis porcinus*, Ecology, Camera trapping, Habitat preferences

(ID 237)

Fungal Diversity of Capsicum (*Capsicum annuum* L.) Rhizospheric Soils from Five Different Agroecological Zones of Sri Lanka**Srimali, P.U.N.E.¹, Deshappriya, N.^{1*}, Attanayake, R.N.², Manamgoda, D.S.¹,
Munasinghe, M.L.A.M.S.¹**¹*Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Plant and Molecular Biology, University of Kelaniya, Kelaniya, Sri Lanka***nelum@sci.sjp.ac.lk***Abstract**

Capsicum annuum L. is a vegetable cash crop widely consumed around the world. The excessive use of agrochemicals throughout its cropping cycle has led to many environmental and health hazards which necessitates research for alternatives to chemical use. Some rhizospheric fungal species are known to improve plant health and productivity. Thus, this study aimed to investigate the culturable fungal diversity and composition associated with the rhizosphere of commercially grown capsicum varieties across the country to determine their species diversity. Rhizospheric soil was collected from capsicum varieties Muriya, HYW, and CA8 cultivated in five different agroecological zones i.e., DL1b, IM3c, WL3, WL1a, and WU2a, in Anuradhapura, Kandy, Kalutara, Colombo, and Nuwara Eliya districts respectively. From each zone, ten healthy, two-month-old capsicum plants were collected randomly. The soil adherent to the root system of each plant was collected and 10 g composite soil samples were prepared for each zone and used for fungal isolations onto potato dextrose agar (PDA) by dilution plate method. The isolated fungi were grouped based on morphology, and 45 representative isolates were selected for molecular characterization. The genomic DNA of these isolates was subjected to PCR amplification of the Internal Transcribed Spacer (ITS) regions and Sanger sequencing. Resulted sequence contigs were identified based on 99-100% similarity to sequences of the NCBI database through BLASTn searches ($E < 1e-50$). The results showed that 45 isolates belonged to 29 different species in 14 genera, 13 families, and seven orders. The most dominant phylum was Ascomycota, with 95.56% relative abundance, with the most abundant fungal genus being *Penicillium* (33.33%). The dominant species reported among all the agroecological zones were *Penicillium raperi*, *Penicillium soli*, *Trichoderma asperellum*, and *Aspergillus terreus*. Seven species were isolated from more than one zone whereas twenty-two fungal species were unique to individual zones reflecting the variation in fungal community composition across the five zones studied. Alpha diversity indices (Shannon H', Simpson 1-D, and Inverse Simpson 1/D) were computed using R Software to assess the fungal diversity within the studied agroecological zones. Zones WL3 and WL1a, both cultivated with capsicum variety HYW, showed the highest diversity, species richness, and species abundance as compared to the other zones assessed. Further characterization of these diverse fungal species will provide insights into their potential use as bioinoculants for optimizing growth and disease control in capsicum cultivations.

Keywords: *Capsicum annuum* L., Rhizosphere, Fungal diversity, Agroecological zones, ITS

(ID 087)

A Comparative Morphological Study of *Loxococcus rupicola* (Thwaites) H.Wendl. & Drude and Related Two Taxa: *Oncosperma fasciculatum* Thwaites and *Areca concinna* Thwaites in Sri Lanka

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Abstract

Loxococcus rupicola (Thwaites) H.Wendl. & Drude is an endemic, monotypic palm in the family Arecaceae. It is mainly confined in forests of Southwestern and Central parts of Sri Lanka between 300 and 1,500 m in small populations on cliffs and rocks. The holotype of *L. rupicola* remains undesignated by its original author. There is a taxonomic uncertainty of identifying those morphological variants in the wild due to the morphological confusion between *L. rupicola* and other related taxa; *Areca concinna* and *Oncosperma fasciculatum*, due to shared morphological characteristics. Hence, this genus needs to be studied in detail for typification problems, together with the morphological variations of its varieties. The present study focused on reviewing protologues and other available taxonomic literature to identify key morphological characters to delimit the taxonomic boundaries of *L. rupicola* and related taxa. This research was carried out as an herbarium-based comparative morphological study, considering 51 morphological characters. Based on the morphological data captured from herbarium specimens housed at the National Herbarium, Peradeniya (PDA), a Multiple Correspondence Analysis (MCA) was performed. The results of the analysis showed three taxa seem to be clearly differentiated into three morphological clusters. By applying MCA only on the observations of *Loxococcus rupicola*, it does not seem to be fit into clear groups and therefore, cannot comment on the variabilities observed, especially in their inflorescence during the morphological study. The type localities and geographical distribution of three species were plotted in maps using ArcGIS by extracting locality data from herbarium specimens to identify their hotspots. Locating the geographic distributions of *L. rupicola* will help with future *in situ* conservation and management approaches and species distribution modelling. The relationships found in the morphometric study of herbarium specimens provide insights to the phylogeny of endemic *Loxococcus* species in Sri Lanka. A lectotype for *L. rupicola* could not be defined because the original collections were not coming from a single gathering. Hence, selecting a suitable lectotype for the taxon, considering historical literature, is also important from a nomenclatural standpoint. The results reveal the importance of combined multidisciplinary data analysis along with the molecular study for the genus *Loxococcus*.

Keywords: Endemic, Herbarium, Lectotypification, Morphological characters, Type material

(ID 246)

Predicting the Spread of Invasive Alien Plant Species by Shared Socio-Economic Pathway Model; A Case Study of Exotic Plant Invaders that Threaten Wet Lowlands of Sri Lanka**Ranwala, S.M.W.*, Naorunna, S.P.***Department of Plant Sciences, Faculty of Science, University of Colombo, Sri Lanka***ranwala@pts.cmb.ac.lk***Abstract**

Species distribution modelling has received increased attention and popularity at present. There is no doubt that understanding of the spatiotemporal spread of Invasive Alien Plant Species (IAPS) aid in planning of IAPS control and land use management. This study focuses on determining the potential spread of four IAPS [*Tibouchina urvilleana* (DC) Cogn., *Miconia crenata* (Vahl) Michelang. syn. *Clidemia hirta* (L.) D.Don, *Miconia calvescens* DC. and *Dillenia suffruticosa* (Griff. ex Hook.f. & Thomson) Martelli.] that threaten biodiversity of wet lowlands of Sri Lanka using the Shared Socioeconomic Pathways (SSP). Nineteen bioclimatic variables from present day to year 2100 obtained from WorldClim V2.1 database and species occurrence data obtained from the Ministry of Environment were subjected to SSP -585 model of MaxEnt version 3.4.4 to map the future spread. Linear and quadratic feature classes for the Area Under Curve were assessed against a value of 0.8 for higher accuracy. Five thousand iterations were conducted for each species and the importance of bioclimatic variables were measured using jack-knifing. Logistic outputs of the model were checked for 10 replications. Distribution maps of IAPS varied among species exhibiting the highest spread into new areas by vegetatively spreading shrub *T. urvilleana*. Temperature variables were more important for its spread. Precipitation based bioclimatic variables heavily contributed to the potential distribution of woody *D. suffruticosa* which spread by seeds and vegetative means. Both temperature and precipitation variables governed the model of the seed producing shrub *M. crenata* and woody *M. calvescens*. In almost all most cases, the probability of the potential distribution was >50%. The decisive role of present-day species occurrence data in scenario building of SSP and the requirement of consistent sampling of IAPS occurrence data was reflected by the results. Understanding the distribution pattern of plants to climate change is crucial. However, unlike native or endemic species, rapid spread of IAPS is strongly driven by various anthropogenic activities and direct disturbances to the environment. Hence, it is more likely that species distribution models that incorporate both climate data and ecological quality of specific ecosystems provide more realistic spatiotemporal distribution for IAPS. Furthermore, the functional traits of IAPS also act as key determinants of the success in colonization, environment tolerance and establishment of IAPS. Hence biological aspects including biotic interactions should also be given attention in predicting the potential spread of IAPS enabling the results to be used for a variety of applications.

Keywords: Invasive alien plant species, Distribution, Shared Socioeconomic Pathways, MaxEnt.

(ID 250)

The Dung Beetle Diversity is Differently Affected by Land Use Types: A Case Study from Landuyaya, Belihuloya, Sri Lanka

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Abstract

Land use change is known to affect ecological processes and biodiversity, especially in highly diverse and fragmented areas. Scientific evidence on this can help sustainable land use management. As dung beetles (Scarabaeinae) are easy to survey, sensitive to habitat changes, and perform a variety of ecological tasks, they make an ideal biological indicator to study the relationship between land use change, diversity, and ecosystem function. This research was conducted in the Landuyaya, Belihuloya, Ratnapura, Sri Lanka to determine species richness and abundance of dung beetles in three different land use types, i.e., forest patches, agricultural lands, and home gardens. Sampling was conducted using baited pitfall traps to collect live dung beetles. A total of six traps were deployed for each collection effort for each land use type. These traps were left open for 48 hours, before being removed. Beetles were collected and identified using reference specimens. A total of 40 individuals from nine species were recorded in all land use types. From the collection, 20 individuals from seven species in forest patches, 16 individuals from five species in home gardens, and 01 individual in cultivation areas were identified. Tunneller beetle *Onthophagus unifasciatus* was dominant in all three land use types. The highest Shannon and Simpsons diversity index values (1.53 and 0.73) were recorded from forest patches in Landuyaya, whereas cultivation received the lowest Shannon diversity index value (0.95). The low levels of human disturbance, the presence of food sources from wild animals, and the lack of agrochemical use in the forest patches may contribute to the higher abundance and species richness of dung beetles in these areas. Human disturbance can fragment habitats causing loss of canopy cover and increased ground temperature which are critical environmental factors for Dung beetles, according to previous research. It also reduces the availability of food sources. Pesticides can also kill dung beetles directly and indirectly by harming their food sources. The results of this research could be used to communicate the negative impacts of land use change for Dung beetles, their importance, and promote better land use management strategies.

Keywords: Abundance, Dung beetles, Land use types, Species richness, Species diversity

(ID 276)

Impact of Naturally Occurring Water Types and pH on the Emergence and Survival of *Aedes albopictus* Mosquitoes in Southern Sri Lanka

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Abstract

Mosquitoes play a major role in significant disease outbreaks in humans and animals in many parts of the World. A better understanding of mosquito fauna in diverse ecological conditions including physico-chemical parameters is important in risk assessment of vector-borne diseases. Thus, this study was designed to identify the impact of naturally occurring water types and pH on *Aedes albopictus*, one of the dengue disease vector mosquitoes in Sri Lanka. Five different water types, *i.e.*, marine, brackish, pond, rain, and distilled water; as well as pond water with three different pH values (pH 6, pH 7, and pH 8) were used for this study. Twenty eggs each of *Aedes albopictus* under different water types and pH levels were used to identify the survival and completion of their life cycle through larvae to the emergence of adult mosquitoes. Control setups were also used together with the experiment setups. pH and salinity of the different water types were also measured for all the water types. During this study, a total of 560 eggs were monitored and four replicates each were used for the analysis under different water types and pH values. Measured pH values were highest in marine water (pH 8.96-9.20), and it was lowest in rainwater (pH 5.05-5.70). Conductivity levels were also highest in marine water (4,880.76-5,530.60 $\mu\text{S/m}$) and it was lowest in distilled water (0.00–0.02 $\mu\text{S/m}$). According to the observations, the highest hatching percentage was reported in brackish water (18 ± 1.83) and pond water under pH value 8 (8.25 ± 5.62). Meanwhile, the lowest hatching percentage was reported in pond water with pH 6 (3 ± 3.56). The highest adult emergence was also given in brackish water (17.8 ± 2.2) and pH value 7 (7 ± 00). However, the lowest adult emergence was observed under pH value 6 (2.5 ± 00). Especially, no larvae or adults emerged from marine water. There was a significant difference in larvae hatching and adult emergence in different water types and under-selected pH values ($p < 0.05$). The findings of this study are crucial in the recognition of the impact of water types and pH on the emergence and survival of *Aedes albopictus* mosquitoes in Sri Lanka.

Keywords: Adult emergence, Hatching success, Mosquito survival rate, Physico-chemical parameters, Water quality

(ID 284)**A Behavioral Study of an Isolated, Semi-Wild, Critically Endangered Hog Deer (*Axis porcinus*) Population in Honduwa Island Sanctuary in the Wet Zone of Sri Lanka****Harischandra, G.P.¹, Perera, P.K.P.², Chandrasekara, C.M.K.N.K.³, Dayawansa, N.^{1*}**¹*Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*²*Department of Forestry and Environment Science, University of Sri Jayawardenepura, Nugegoda, Sri Lanka*³*Department of Geography, University of Colombo, Colombo 03, Sri Lanka***nihal.dayawansa@sci.cmb.ac.lk***Abstract**

Hog deer (*Axis porcinus*) is the rarest deer species in Sri Lanka. According to the 2012 red list, they are classified as a critically endangered species in Sri Lanka. The ecology and behaviour of Hog deer in Sri Lanka are poorly studied compared to other cervids. There were 30 individuals of isolated, semi-wild Hog deer population in Honduwa island during the study period. The objectives of this study were to determine the major behaviour patterns and activity budget of the hog deer population in Honduwa island sanctuary in Galle district, Sri Lanka. Behavioural observations were carried out during three sample periods 08.00-10.00 (morning), 12.00-14.00 (afternoon), and 16.30-18.30 (early evening) during daytime from July 2022 to April 2023. Focal animal sampling (2864 minutes observation time) and scan sampling (1740 minutes observation time) methods were employed to study behaviour. Four major behaviour patterns were identified: Foraging, comfort, play, and reproductive. Foraging behaviour activities were significantly higher (One-way ANOVA, $p=0.016$) during morning and early evening than that of early afternoon. In morning hours, time spent on browsing was significantly higher than grazing ($p<0.05$). However, in the evening, grazing was higher than browsing. Time spent of feeding during evening hours was higher than mid-day perhaps as they are known to be naturally crepuscular. Comfort behaviour pattern showed a significant difference between time zones ($p<0.05$) with the highest comfort behaviour was shown during mid-day as resting behaviour was predominant when the ambient temperature was high during the mid-day where sitting on the ground was prominently observed under shady, cool and wet areas. Compared to adults and sub-adults, fawns spent a higher time on play behaviour. Among the courtship behaviours observed, chasing, guarding, and lip-licking were the most frequently observed behaviours. The population exhibited a bimodal activity pattern, with feeding being the primary recorded activity. Although the species richness of flora was 41, the diet breadth of hog deer was narrow with 08 species of plants. Observations in the wild and cafeteria test revealed that grasses were the preferred forage followed by *Dilena suffruticosa*, *Artocarpus heterophyllus* and *Ipomoea batatas*. Interestingly, invasive plant species *Dilena suffruticosa* comprised a significant part of their diet. Scarcity of natural food in the island seems to be a major limitation for the hog deer population. Efforts should be made to strengthen the natural food availability in the island, including the conversion of part of other habitats to grasslands.

Keywords: Hog deer, Critically endangered, Behaviour, Activity budget

(ID 296)

Range Expansion of an Aquarium Escape: Tinfoil Barb (*Barbonymus schwanenfeldii*) in the Mahaweli River of Sri Lanka**Wijesinghe, M.¹, Hemachandra, I.V.D.², Dayawansa, P.N.^{2*}**¹*Department of Wildlife Conservation, Battaramulla, Sri Lanka*²*Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka***nihal.dayawansa@sci.cmb.ac.lk***Abstract**

Originally from Southeast Asia, Tinfoil barb (*Barbonymus schwanenfeldii*) is a Cyprinid fish established well over a long period in Sri Lankan aquarium trade. However, its first record from natural waters was in 2015 from Amban Ganga, a tributary of Mahaweli river. The abundance and distribution of Tinfoil barb in Mahaweli river basin and its schooling behaviour were studied from 2018 to date. Cast netting, direct bank counts during high water transparency, and local fisher catch examination were employed. Literature survey and Structured Interview Surveys (SIS) were conducted to identify range expansion backwards in time and its introduction into the river network. Spatial distribution of Tinfoil barb was mapped, analysed, and processed using ArcGIS 10.5 software. Minitab 17 was used for statistical analysis. According to SIS, Webadagama off the south-eastern boundary of Wasgamuwa National Park was recognized as the potential point of escape to the wild around 2013. The first point of discovery of the species is 27 km northwest and downstream from Webadagama. At present, *B.schwanenfeldii* is spread across 49.22 km² in Mahaweli river basin. Time Series Analysis revealed that the initial rapid rate of increase in the area of occupancy (2015-2018: $r=0.276$) has reduced over time (2018-2021: $r=0.065$ and 2021-2023: $r=0.061$), forecasting a limitation in expansion further downstream or upstream. However, lateral expansion across tributaries (Radavige oya, Heen ganga, Kiri Oya) was evident. Downstream expansion exceeds upstream expansion. By 2018, the species had reached 44.9 km downstream and 14.4 km upstream. It has now reached 80.1 km downstream and 46.5 km upstream. Tinfoil barb has invaded the dynamic meta-ecosystems from main river occupying villu ecosystems (Handapan-villu: Flood Plains and Beruwila-villu: Somawathiya NPs) recently. Mixed schools of Tinfoil barb and other native fish (*Dawkinsia singhala*, *Dawkinsia srilankensis*, *Rasbora daniconius*) were recorded with an average ratio of native fish: *B. schwanenfeldii*-33.60:1.58 in 2018, and 39.36:9.65 in 2022 from Amban and Mahaweli rivers. Exclusively Tinfoil barb schools were observed in two of 11 sampling locations in 2022. A significantly negative relationship was revealed between the abundance of Tinfoil barb and native fish during past 5 years (Linear Regression: $P<0.001$). An omnivorous and detritivorous species with high fecundity and reaching almost 0.35m in size this schooling fish poses a threat to native freshwater species of Sri Lanka.

Keywords: Tinfoil barb, Aquarium escapes, Invasive, Freshwater fish, Mahaweli river

(ID 060)

The Effect of Short-Term Exposure to Bisphenol-A and Its Analogue, Bisphenol-S on Growth, Survival and Sex Differentiation of Developing Zebrafish (*Danio rerio*)**Shanika, K.P.W.D., Rajapaksa, G.****Department of Zoology and Environmental Management, University of Kelaniya,
Kelaniya, Sri Lanka***gayani.kln.ac.lk***Abstract**

Bisphenol A (BPA) is a commonly used industrial chemical that poses a significant threat to aquatic ecosystems due to environmental leaching. BPA is categorized as a xenoestrogen, which causes adverse impacts on the growth, development, and physiology of organisms. In response to increasing health concerns about BPA, Bisphenol S (BPS) was introduced as a safer alternative. However, the endocrine disruptive ability and environmental occurrence of BPS have raised concerns about its safety. Therefore, a comparative assessment on the biological effects of BPA and BPS is crucial in evaluating the relative safety of BPS. Hence this study was conducted to investigate the comparative effects of short-term exposure to BPA and BPS on the growth, survival, and sex differentiation of juvenile zebrafish (*Danio rerio*). Here, zebrafish of age 21 days post fertilization (dpf) were exposed to environmentally relevant higher concentrations of BPA (100 µg/L), BPS (100 µg/L) and treatment control (5% v/v ethanol) for 21 days, in triplicates. The length gain, weight gain, specific growth rate (SGR), survival rate and sex differentiation were determined at the end of the treatment. According to the results, the length gain, weight gain and SGR of fish under both BPA and BPS treatments were significantly higher than that of the treatment control. Of the bisphenols, BPA-treated fish showed a significantly higher weight gain and SGR than that of BPS treatment ($p < 0.05$), while no notable difference in length increment was observed between BPA and BPS treatments. Considerably lower fish survival rates were shown under both bisphenol treatments than in the treatment control ($p < 0.05$), while no significant difference in fish survival was observed between BPA and BPS ($p > 0.05$). The sex ratio (male: female) of the treatment control was 1:1.14 while, statistically insignificant, yet female-biased sex ratios of 1:2.07 and 1:2.33 were observed for BPA and BPS respectively ($p > 0.05$). In conclusion, both BPA and its analogue BPS have exerted negative effects on the growth and survival of juvenile zebrafish upon environmental exposure. Further both bisphenols and to a higher extent BPA showed increased weight gain, and SGR in zebrafish. Based on the observations, BPS cannot be recommended as a safe alternative to BPA, as both bisphenols significantly affect the growth, survival and to a lesser extent the sex differentiation of zebrafish in a comparable manner. Further cellular and physiological assessments are recommended in the zebrafish model to evaluate the relative safety of BPA substitutes.

Keywords: BPA, BPS, Growth, Survival rate, Sex ratio

(ID 082)

Identification of *E. coli* O157 Strain, *Salmonella* sp., and *Shigella* sp. in Negombo Lagoon, Sri Lanka**Bandara, S.M.T.V.¹, Wijerathna, P.A.K.C.^{1,2}, Liyanage, G.Y.^{1,3}, Manage P.M.^{1*}**¹*Centre for Water Quality and Algae Research, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*³*Department of Aquatic Bioresources, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***pathmalal@sjp.ac.lk***Abstract**

Negombo Lagoon is one of Sri Lanka's largest, shallow, basin-like estuaries running parallel to the western coast. Lagoon is fed by many channels which carries effluent water with massive loads of micro-organisms. *E. coli* O157 is a particular serotype of *Escherichia coli*, which is capable of producing intimin and shiga toxins that causing severe human diseases including Hemolytic Uremic Syndrome. *Salmonella* sp. and *Shigella* sp. are the causative agents for Salmonellosis and Shigellosis. Plenty of tourism and fishing activities in lagoon resulting a severe risk of entering pathogenic *E.coli* O157 strains, *Salmonella* sp. and *Shigella* sp. into the human gastrointestinal tract and cause severe diseases. Thus, this study aims to identify the presence of *E. coli* O157 strain, *Salmonella* sp. and *Shigella* sp. in the Negombo lagoon to ensure safe water quality. In this study, water samples were taken from ten selected locations from Negombo lagoon and the screening of *E.coli* O157 was done through optimized PCR protocols using virulent genes *eae*, *stx1* and *stx2*. The *eae* gene responsible for the enterohemorrhagic activity while the *stx* genes responsible for produce shiga toxins; that can damage to cells, particularly in the lining of the intestines. Thus, *eae* and *stx* genes are the most important and widely used genes in detection of *E. coli* O157 strain. The presence of *Salmonella* sp. and *Shigella* sp. was observed through microbiological tests using Peptone Broth and Xylose Lysine Deoxycholate agar and further differentiated through biochemical tests; Lysine Decarboxylase Test, Urease Test and Kligler Iron Agar Test. The results of PCR analysis of isolated *E. coli* from the lagoon confirmed that near the Negombo fish market showed positive results for the *eae* gene while areas near the inlet of the Hamilton canal and the middle of the lagoon showed positive results for the *stx2* gene, confirming the presence of the *E. coli* O157 strain. The *stx1* gene wasn't detected in lagoon waters. The *Salmonella* sp. was detected in all sampled locations, and *Shigella* sp. was detected in 8 out of 10 locations. The existence of these pathogenic strains poses a potential risk to human health and these results confirm regular monitoring and legislation for wastewater discharge into lagoon is vital to maintain safe microbiological and water quality in Negombo Lagoon, Sri Lanka.

Keywords: Negombo lagoon, *E. coli* O157, *Salmonella* sp., *Shigella* sp., Water quality

(ID 297)**Breeding Success of a Small Flock of Greater Flamingos (*Phoenicopterus roseus*) Harbored in Captivity in an Ex-Situ Conservation Center in Hambantota, Sri Lanka****Nisandara, A.W.S.^{1*}, Senanayake, G.G.P.², Adikari, A.S.¹, Dayawansa, N.¹**¹ *Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*² *Birds Research Centre and Birds Park, Hambantota, Sri Lanka***siluninisandara@gmail.com***Abstract**

The Greater Flamingo (*Phoenicopterus roseus*) is the largest flamingo species in the world widely distributed in many geographical areas. It is a migratory species of bird in Sri Lanka. Although false nesting behaviour has been recorded in Sri Lanka, breeding has never been recorded in the wild. This study examined the breeding behaviour pattern of Greater Flamingos in a captive environment at Birds' Research Centre and Birds' Park, Hambantota, Sri Lanka. Observations were conducted on a flock of eight flamingos during daytime, from June to August 2022. Sexual dimorphism was present, and a balanced sex ratio was evident. Greater Flamingos naturally breed in saline environments; however, the study conducted in the Birds' Park revealed that breeding can happen at low salinity levels. The artificial mud nest mounds established in the flamingo enclosure of the bird park resulted in successful breeding. Three focal pairs laid eggs in mound nests and the clutch size were one. Females contributed over 50% of incubation time during the day. Aggressive encounters between focal pairs were evident ($16.39\% \pm 0.16\%$) as the nest spacing was inadequate compared to natural nest spacing. Role reversals, changing incubation partners, and false incubation behaviours were noted, possibly influenced by nesting stress. The hatching success rate was 33% as only one pair which showed strong pair bonding was successful in rearing a chick. Parental care was given by both focal animals. Both male and female of the successful focal pair secreted crop milk to feed the chick during the early weeks of development. The focal male produced more crop milk to feed the chick more frequently (69.36%) than the female (30.64%). Also, the male fed the chick indirectly by secreting crop milk onto the female's head, and crop milk would flow into the chick's throat through its bill kept in contact with the female's bill. In contrast, the female fed directly into the chick's bill. Feeding intervals extended as the chick matured, showcasing adaptability in parenting. It engaged in self-maintenance activities such as preening and feeding, with parental intervention during threats. This study recorded the first instance of successful breeding in Greater Flamingos in an ex-situ conservation centre in Sri Lanka. The breeding success of this small flock is contradicting the established beliefs of non-breeding of smaller flocks. Breeding period at Hambantota extended from June to August was distinct from the natural breeding period observed in the Indian subcontinent.

Keywords: Captive breeding, Captive environment, Crop milk, False Incubation, Incubation dynamics

(ID 252)

Effect of Anthropogenic Disturbances on Critically Endangered, Black-Necked Stork in Kumana National Park

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Abstract

Black-necked stork (*Ephippiorhynchus asiaticus*) (BNS), is a Critically Endangered bird species in Sri Lanka inhabiting the south-eastern coastal areas. Being the tallest bird found on the island, it stands as one of the most remarkable waterbird species. A thorough study was undertaken from August 2022 to April 2023 in Kumana National Park with the intention of identifying the degree of anthropogenic disturbances faced by this species. Vehicle noise and speed were measured along transects in all road-accessible habitats. Additionally, the range finder (Bushnell 1700) was used to measure the distance between vehicles and the birds. The study documented all behavioural responses of BNS, whether the birds habituated to the vehicle noise and the speed or chose to escape. Only three individual birds were observed within the confines of the park. The Black-necked storks habitually encountered average noise levels of (59.65 ± 0.704) dB and vehicle speed of (27.70 ± 4.59) kmh⁻¹. They could escape, experiencing noise levels of (72.30 ± 1.14) dB and vehicle speeds of (41.60 ± 2.09) kmh⁻¹. The average habituate and escape distances of BNS were (147.4 ± 12.1) m and (55.45 ± 1.99) m, respectively. The BNS displayed alertness in response to the noise and the speed of jeeps up to a distance of 250 m. This heightened alertness might be attributed to their tall stature, which affords them a broader field of vision in open areas. Black-necked storks were not observed habituating to jeeps. These findings illustrate the impacts of human disturbances on the behaviour of this critically endangered bird whose population is at its lowest within the park. Consequently, it is crucial to focus on management implications for their survival. This includes continuous monitoring and research, visitor education and awareness, implementing buffer zones, and enforcing limitations for visitors inside the parks.

Keywords: Black-necked stork, Anthropogenic disturbances, Conservation

(ID 010)

Assessing the Management Effectiveness of Hikkaduwa Marine National Park, Sri Lanka

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Abstract

Marine Protected Areas (MPA) are globally recognized conservation tools used in safeguarding the world's marine environments, ensuring their ecological sustainability. Achievement of predefined conservation goals of an MPA requires a strong correlation with its effective management measures. Hence, the assessment of MPA effectiveness has received greater attention as a frequently addressed element in MPA-related studies. However, a lack of studies on the management effectiveness of Sri Lankan MPAs can be considered as a major drawback that leads to severe management collapses in the process of MPA governance. This study aims to assess the management effectiveness of the first MPA in Sri Lanka, Hikkaduwa Marine National Park (HNP). The scorecard method was used to determine the management effectiveness of HNP as a measure of the success of its current management practices. Randomly selected 120 stakeholders (representing the groups of Tourists, fishermen, tourist guides, and business owners related to tourism) were interviewed using a semi-structured questionnaire. The key findings of the survey revealed that among all the different stakeholder groups, a significant proportion of tourists (77%) were unaware of the ongoing conservation measures in HNP. Furthermore, a considerable downgrade in the scorecard (18%) was observed in the year 2020 when compared to a previous study conducted in year 2005. According to our results, this study concludes that the loopholes in the existing management practices might have resulted in a low degree of awareness among tourists. Findings further suggest that it is a requisite to revisit the existing management framework in HNP into a more collaborative and inclusive approach based on a well-defined management plan.

Keywords: Marine Protected Areas, Management effectiveness, Hikkaduwa Marine National Park, Scorecard assessment, Awareness

(ID 120)

Aspects of the Demography and Social Behaviour of Asian Elephants (*Elephas Maximus*) in the Minneriya and Kaudulla National Parks**Warnapura, A.G.S.M.^{1*}, Jayarathna, K.H.D.L.², LaDue, C.A.³, Vandercone, R.P.G.^{4,5}**¹*Oklahoma City Zoo and Kaludiyapokuna Primate Conservation joint research centre, Sri Lanka*²*Post Graduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka*³*Oklahoma City Zoo and Botanical Garden, Oklahoma, USA*⁴*Department of Zoology, University of Peradeniya, Peradeniya, Sri Lanka*⁵*Kaludiyapokuna Primate Conservation and Research Centre, Peradeniya, Sri Lanka***malshawarnapura000@gmail.com***Abstract**

Sri Lanka has the highest Asian elephant density and one of the highest human population densities among habitat countries. Consequently, human-elephant conflict is widespread in the country and is a major impediment to the survival of the species in Sri Lanka. Moreover, adult male elephants are also more prone to come into conflict with humans and consequently experience a higher degree of human induced mortality than other age-sex categories, which can result in changes to aspects of the demography. The behavioural characteristics of male elephants that increase their propensity to come into conflict with humans is poorly understood. Estimating demographic parameters such as adult sex ratios and herd structure for wild populations of Asian elephants is problematic. However, the analysis of elephant herds that congregate in open areas such as around the tank beds of Kaudulla and Minneriya National Parks may provide a window into demographic characteristics of the elephant population in the dry zone of Sri Lanka. We report the results of an ongoing study on the population structure and male elephant behaviour at Minneriya and Kaudulla National Parks. The data presented here was gathered over a period 6 months from May to October 2023. 5,120 of elephant sightings were observed in total, of which 9.7% were adult males (496), 38.4% adult females (1,964), 47.9% juveniles (2,452) and 4.1% calves (208). The average number of elephants observed per visit was 53 (0-181). A social group on average was 11 (1-83). The adult male:female ratio was 1:4 and the number of calves per adult female was 0.1. When considering the behaviour of adult males, their reaction with other females (84.9%) and males (61.4%) was largely prosocial. Musth males displayed dominance (67.8%) and aggressive (72.5%) behaviours towards other males they interacted with. Almost all males were found to associate with at least one other male during our study. Our study shows that the adult male:female sex ratio differs from the ratio from the last national elephant census, and the adult males show a complex repertoire of social interactions.

Keywords: Asian elephants, Behaviour, Demography, Dry zone, National Park

(ID 149)**Floral Diversity in the Manalkaadu Sand Dune, Jaffna, Sri Lanka****Amarasekara, E.A.K.K.^{1,2*}, Perera, H.A.C.C.¹, Yatawara, M.D.M.D.W.M.M.K.¹,
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Coastal sand dunes are one of the most important ecosystems in the coastal areas. These dune ecosystems are sensitive and breakable ecosystems which are habitable to different varieties of specific floral species. The present study was conducted to assess the floral status of the Manalkaadu sand dunes, which is spread from Katkivalam to Aliyawalai (approximately 46 km in length) in Jaffna Peninsula from September 2022 to September 2023. The study area was divided into nine sites, namely Katkivalam (A), Manalkaadu (B), Kudathanai (C), Ampan (D), Nagarkovil (E), Mamunai (F), Chempianpattu (G), Thalayadi (H) and Aliyawalai (I) and 50×5 m belt transects were used to obtain data (5 belt transects for each site, covering 50 m from the shoreline to landward side). Floral identification was done using available keys and guides of Sri Lanka. A total of 110 species of dune flora belonging to 94 genera and 49 families were identified. The highest number of species belonged to the family Fabaceae. Studied dune flora consisted of variety of vegetation types including, herbs, shrubs, trees, creepers and climbers, the herbs were the most abundant floral type which was about 70% and climbers were the least present vegetation type which was about 3%. The Shannon Wiener diversity index, species richness and evenness were also calculated. The Shannon-Wiener diversity indices (H) from site A to I were 1.72, 1.51, 2.07, 2.43, 1.86, 1.31, 1.33, 1.23 and 1.75 respectively, while species richness was ranged from 3 to 28. The evenness was ranged from 0.59 to 0.80. Highest Shannon Wiener diversity and the highest species richness were found at site D. According to the National Red list of Sri Lanka 2020, from the identified 110 species, three species are critically endangered, four species are endangered, three species are vulnerable, seven species are nearly threatened, and two species fall under the data deficient categories. Since the dune ecosystems create a variety of mixed environments, which are important for maintaining and creating food webs, for the dune dwelling species, protection of these delicate ecosystems from habitat destruction is recommended in order to protect their inherent biodiversity and ecological functions.

Keywords: Coastal ecosystem, Dune flora, Floral diversity, Sand dunes, Sri Lanka

(ID 269)

Relationship Between Tributyltin Contamination Level and Total Lipid Content in Body Tissues of Marine Invertebrates**Bandara, K.R.V.^{1,2}, Manage, P.M.^{1,2*}**¹*Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***pathmalal@sjp.ac.lk***Abstract**

Tributyltin (TBT) is a xenobiotic, and it has highly hydrophobic, lipophilic, and ionic characteristics resulting toxicity to living organisms. These chemicals easily cross cell membranes and accumulate in adipose tissue due to lipophilicity. TBT has a high affinity for biomagnification along food chains, in addition to bioaccumulation of these chemicals. This study aimed to find the relationship between the TBT contamination level and total lipid content in body tissues of collected molluscs samples (*Crassostrea madrasensis*, *Saccostrea cucullate*, *Perna viridis*, *P. perna*, *Thais clavigera*) to confirm their bioaccumulation potential. TBT levels in mollusc tissues were quantified using Gas Chromatography Mass Spectrometry method after Solid Phase Micro Extraction. Freeze-dried tissue samples of molluscs (n=10 from each species) were used for crude lipid extraction using a mixture of chloroform and methanol in gravimetric method. Different size classes of *P. viridis*; 0-15 g, 16-30 g, 31-45 g were used to study the relationship between TBT levels and different size classes. The results revealed that the highest concentration of TBT with the highest lipid content in body tissue of *P. viridis* (234 ± 3 ng/kg and $5.84 \pm 1.4\%$) followed by *T. clavigera* (134 ± 2.3 ng/kg and $2.01 \pm 0.6\%$). The average lipid content in gastropods was positively correlated ($P < 0.005$) with the average TBT concentrations in all tested individuals. A positive correlation between TBT concentrations and total lipid content in body tissues of *C. madrasensis* ($P = 0.004$), *S. cucullate* ($P = 0.02$), *P. viridis* ($P = 0.003$), *P. perna* ($P = 0.001$) and *T. clavigera* ($P = 0.001$) was found. Similarly, the highest concentration of TBT in the highest body weight of the mussels were observed. TBT contamination in different size classes of the *P. viridis* varied from 4 ± 1.2 ngkg⁻¹ to 42 ± 2.2 ngkg⁻¹ (wet weight). The highest level was recorded as 42 ± 2.2 ngkg⁻¹ for 30-35 g size class in Dikkowita harbour, which is situated adjacent to the Colombo port. The TBT concentrations in *P. viridis* were recorded by ascending order of 12 ngkg⁻¹, 22 ngkg⁻¹ and 42 ngkg⁻¹ following the average body weight ranges of; 0-15 g < 16-30 g < 31-45 g, respectively. According to the results, there was a positive correlation of TBT with the body weight and fatty tissues accumulate a high level of TBT in molluscs.

Keywords: Tributyltin, Bioaccumulation, Lipid tissues, Body size, Molluscs

(ID 088)

A Preliminary Assessment on the Current Status and General Ecology of the Point Endemic, *Ceylonthelphusa durrelli* (Crustacea: Decapoda: Gecarcinucidae) in Sri Lanka

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Abstract

Ceylonthelphusa durrelli Bahir & Ng, 2005 is a microendemic freshwater crab considered as Critically Endangered (CR), recorded only from its type locality in Corbett's Gap (07°22'N 080°50'E, altitude 1,000 m above sea level (asl), in the Knuckles mountains Range, Sri Lanka. As it has been nearly 20 years since this species was originally described, there was a knowledge gap about the current status of this population. Therefore, a preliminary assessment was carried out from 24-27 September 2023 at the type locality at an elevation range of 1,000-1,360 m asl. Physiochemical parameter ranges recorded along with the sample frequencies (n) as follows: water temperature; 20.5±1.2° C (n=10) at night it drops down approximately by 2° C, pH; 7.5-7.8 (n=5), Dissolved Oxygen (DO); 6.0±0.5 mg/L (n=5), Biological Oxygen Demand (BOD); 1.5-2.0 mg/L (n=2), salinity; 0‰ (n=5), depths of the water column in the habitats; <20 cm (n=8), width of the stream; 5.05±1.45 m (n=6), and the turbidity; clear water (using Secchi disk). Vegetation mainly consist of ferns and cardamom plantations where the habitats were fully shaded by a canopy cover. Microhabitats; littoral zones with wet soil and leaf litter and substrate is sandy-cobble. Predators prey on *C. durrelli* (by analyzing scat samples); *Lutra lutra* and *Prionailurus viverrinus*. As co-existing fauna; *Schistura notostigma*, Odonata species and water striders were recorded. The mean width and the total length of the only stream (1st order streamlet of the Heel Oya) within the extent of occurrence [EOO]~1 km² was calculated as 5.01 m and 700 m respectively. Therefore, according to the calculations, the area of occupancy [AOO] is approximately 3,507 m². Based on observations from the quadrat sampling method (quadrat: 1×1 m) and considering 0-4 individuals per 1 m² (n=8) with a population density of 1.63 m⁻², the current population is theoretically estimated to be less than 5,716. However, the abundance of found dead adult shells and frequent sightings of juveniles (comprising the majority of recorded individuals) suggests a seasonal pattern in the reproductive maturity of adults. Since *C. durrelli* is a narrowly endemic species, declaring a species management area would be a successful initiative as a conservation approach to further study the species' phenology, reproduction, and ecology. This is especially important because the Corbett's Gap trail is subjected to anthropogenic activities by tourists and resident villagers.

Keywords: Freshwater crab, Microendemic, Physico-chemical, Knuckles mountain range, Population estimation

(ID 299)

Exploring Human-Hog Deer (*Axis procinus*) Interaction in Agricultural Landscapes of Southwest Sri Lanka: Impetus for Conservation Planning

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Abstract

The Sri Lankan Hog Deer population (*Axis procinus*) is critically endangered and confined to a delimited region between the Bentota and Gin River basins at present. With their preferred natural habitats of riverine marshes shrinking rapidly due to anthropogenic pressure, this Hog Deer population predominantly occupies commercial croplands, mainly cinnamon and paddy fields. As a consequence, Hog Deer are increasingly coming into contact with humans, causing greater risks for this small population, which highlights the importance of immediate conservation actions. Therefore, a better understanding of the nature of human-Hog Deer interactions and current risks is vital for planning future conservation strategies. In the current study, a community survey was conducted in 24 villages within the Hog Deer distribution area using a scientifically prepared semi-structured questionnaire, to evaluate the community's perception of the species. Altogether 71 individuals were interviewed, and 80% of the respondents claimed that hog deer are causing minor crop damage. However, it is deemed inconsequential by 75% of the respondents, who do not categorize hog deer as an agricultural pest. Approximately 89% of the respondents recognize the most eminent threat to hog deer in these areas is hunting and poaching for bush meat. Snaring (43%, N=56), electrocution (38%), and shooting (13%) are the frequently used killing methods. Although instances of poaching exist, a predominant proportion of the local community maintains positive interactions with Hog Deer. Noteworthy, among such interactions are the rehabilitation and rearing of injured hog deer in captive or domestic settings. Interestingly, these rescued animals are easily tamed to live with people and adapted to any provided food including human comestibles. Further, it is evident that the majority of the local community is not aware of the species' critically endangered status, geographically restricted distribution, and rarity. Therefore, it is imperative to underscore the importance awareness programs about the species to implement effective conservation actions for Hog Deer in the southwest lowlands of Sri Lanka.

Keywords: Hog Deer, Community perception, Sri Lanka, Human-wildlife conflict, Agriculture with Wildlife

(ID 071)**Development of Surface Sterilization Protocol for Nodal Explants Collected from Field Plants of Pomegranate****Janani, N.J.^{1*}, Seran, T.H.², Samanmalee, L.G.I.³**¹*Department of Biosystems Technology, Eastern University, Oluvil, Sri Lanka*²*Department of Crop Science, Faculty of Agriculture, Eastern University, Oluvil, Sri Lanka*³*Plant Tissue Culture Division, Plant Virus Indexing Centre, Homagama, Sri Lanka***navodyajansz@gmail.com***Abstract**

Pomegranate is an economically important fruit crop of the tropical and subtropical regions of the world. Hard wood cuttings are the traditional method for pomegranate propagation. However, there are a number of drawbacks to the conventional propagation approach, including poor success rates, delayed propagation and the inability to guarantee healthy, disease-free plants. The use of micropropagation technology as an alternative to traditional vegetative propagation method is growing in popularity nowadays. Hence, this study was aimed to develop a protocol for surface sterilization method to produce planting materials of the Kalipitiya hybrid variety. Initially nodal explants were washed with running tap water for 45 min then they were washed with liquid vim (teepol) solution for 15 min and followed by dipping in 0.06% fungicide for 45 min. Finally, streptomycin solution (100 mg/L) treatment was also used to explants for 20 min. After these steps, nodal segments were subjected to the following twelve treatments which included three different concentrations (5%, 10%, and 15%) of sodium hypochlorite (NaOCl) without or with 0.05% (w/v) concentration of silver nitrate (AgNO₃) in the different exposure times (10 and 15 mins). In this experiment, the high fungal and less bacterial contaminations were observed after 10-14 days of culture. Among the treatments, contamination percentage was less in treatment containing 15% NaOCl with 0.05% AgNO₃ for 15 mins which has resulted 26.7% fungal contamination but bacterial contamination was not noted at two weeks of culture. It was noted that NaOCl with AgNO₃ showed less fungal and bacterial contaminations than without silver nitrate (AgNO₃). The lowest percentage (6.7%) of browning was recorded in the treatment containing 5% NaOCl with 0.05% AgNO₃ for 15 mins after two weeks. The survival rate of 73.3% was recorded after two weeks with 15% NaOCl and 0.05% AgNO₃ treatment for 15 mins which was the best surface sterilant concentrations for reducing the contamination and increasing the survival of the cultured explants of pomegranate. Sprouting of the survived nodal explants was started after five weeks of culture and high bud formation from nodal explants (53.3%) was achieved in the treatment 15% NaOCl and 0.05% AgNO₃ for 15 mins. Hence, it can be concluded that 15% NaOCl with 0.05% AgNO₃ for 5 mins procedure was the best treatment for surface sterilization of nodal explants Kalpitiya hybrid variety of pomegranate (*Punica granatum* L.). The results indicate the possibility of mass production of pomegranate using locally available planting material with tissue culture technology.

Keywords: Micropropagation, Pomegranate, Silver nitrate, Sodium hypochlorite

(ID 106)

Start Codon Targeted Markers as a Suitable DNA Marker to Assess Population Genetic Diversity of *Suaeda maritima*

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Abstract

Members of the genus *Suaeda* is one of the most frequently found halophytic plant in salt marsh vegetation's around the world. More than 100 different species in the genus have been reported and distributed in arid and semi-arid coastal lines around the world. In Sri Lanka three species of the genus have been reported as *S. maritima*, *S. monoica* and *S. vermiculata*. *S. maritima* is the most common species distributed in North, Northwestern parts in the island. Even though a considerable level of phenotypic plasticity is reported among the members of *S. maritima*, it is not clear whether the populations in Sri Lanka are sub divided and the level of genetic diversity remains unknown. With the high economical potential of the plant, it is utmost importance to detect the genetic diversity present in Sri Lanka. The first step in such an attempt is to identify a set of suitable polymorphic markers. Here we assessed the suitability of Start codon targeted (SCoT) DNA markers as a tool for analysing population genetic diversity of *S. maritima* for the first time in Sri Lanka. Genomic DNA was extracted from young leaves of *S. maritima* plants collected from three study sites: Manner, Seguwantiwu and Palavi, using modified CTAB method. Three representative samples from *S. maritima* plants were subjected to PCR amplification using eight SCoT primers (SCoT4, SCoT5, SCoT6, SCoT7, SCoT12, SCoT17, SCoT32 and SCoT34). Optimum temperature was identified for SCoT primers and all the markers amplified successfully. Among the 8 markers, 6 pairs showed polymorphism among three individuals. Notably, SCoT12 and SCoT32 exhibited the highest polymorphic percentages as 70% and 57.14% respectively. Our findings indicate the suitability of these SCoT markers for elucidating the genetic diversity of *S. maritima* populations, laying the foundation for comprehensive genetic studies in future.

Keywords: DNA extraction, Halophytes, Polymorphic percentage, *Suaeda maritima*, SCoT markers

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(ID 323)

Practical Application of Environmental Engineering Technology for the Management of Covid-19 Waste

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Abstract

The COVID-19 pandemic and its consequent biomedical waste is an unprecedented challenge worldwide. The large amount of extra medical waste from the response to the COVID-19 pandemic has put a tremendous strain on healthcare waste management systems worldwide, threatening human and environmental health. As per the approval of the Ministry of Health, Covid waste generated in the major healthcare waste-generating provinces (50% of the population) Western, Southern, and Central provinces in Sri Lanka was managed by the Sisili Hanaro Encare (Pvt) Ltd. which is the national priority for the clinical waste management. Accordingly, 1,148,000 kg of COVID waste generated from March 2020 to July 2022 was scientifically managed by Encare through advanced incineration technology. Three COVID waves were identified in the county and the Encare plotted those waves through the declaration of the waste quantity disposed of in the Encare incineration facility. According to the Encare waste disposal data analysis, COVID-19 waste has contributed to an increase in daily waste intake by 563 kg in 2020, 2,340 Kg in 2021 and 680 kg in 2022 (up to June). Minimization of cross-contamination of the virus while waste handling and scientific treatment of extra waste volume generated in the pandemic was the most challenging issue faced by Encare. The application of Encare, 's environmental engineering technology for the Covid-19 biohazardous waste handling process has significantly contributed to mitigating cross-contamination related to human contact and caring health of the people, and eco-friendly disposal of the waste has led to the protection of the environment adherence to the national environmental regulations. Following the safety hierarchy, engineering controls were kept as the most effective measures out of all, and they were implemented by the in-house engineering team owned by Encare. Specific leakproof closed-type Aluminium wheel bins were fabricated, and these bins were provided to waste generators/hospitals for COVID-19 waste disposal by following a bin-to-bin replacement system. After the quantity declaration, COVID waste bins were transported by using vehicles modified by Encare enabling automatic loading and unloading of waste bins. After the transporting of waste to the Encare incineration facility, the bins were automatically forwarded to the incinerator using a bucket feeder and incinerated through a high thermal incineration process with a total flue gas cleaning system. Through this engineering control and technology, the waste generated in all three waves was scientifically managed by preventing cross-contamination and was able to provide uninterrupted clinical waste management service for the country. As an emergency response plan, an emergency incinerator (4 Mt/day) was established in less than 3 weeks by the Encare environmental engineering team to cater to extra waste including vaccine dive waste and test kits generated in the pandemic situation. Comparatively, 2.1 million rupees monthly average operational cost was additionally borne by Encare for the management of Covid waste. In conclusion, the use of environmental technology through a trained in-house engineering team has successfully helped to mitigate adverse health and environmental impacts due to the pandemic. Otherwise, if the waste was handled unscientifically or mixed with municipal waste without implementing a proper emergency response plan, the situation of the country would be more dangerous by affecting social health, the economy and the environment.

Keywords: Biohazardous, Flue gas, Cross-contamination, Incineration, Safety hierarchy

(ID 009)

Optimizing Wastewater Treatment: Harnessing Non-Potable Treated Wastewater Reuse to Foster Sustainable Development Goals

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Abstract

Kurunegala is an urban city located in the intermediate zone, facing the challenge of eutrophication, lousy odour, and blackish-coloured water in the city's stormwater drains despite the presence of a sewage treatment plant (STP). Wastewater collected from the city is effectively treated to acceptable quality complying with discharge standards and released back to the same inland water drains. This study investigated the recontamination of treated water in urban drains and explores the potential of utilizing treated water for direct non-potable uses (NPU) to achieve multiple Sustainable Development Goals (SDGs) for community benefits. Through a comprehensive assessment, it was observed that the water quality issues in urban drains are a result of excessive nutrients in the water, likely caused by recontamination of the treated wastewater by external sources. Water samples from five sampling sites downstream to the STP were taken and temporal and spatial variations of physicochemical parameters and *E. coli* were assessed. Based on the findings, after the establishment of the STP, current water quality in the canals depicted only marginal improvement ($p < 0.05$, ANOVA) except for TDS, pH, conductivity, and *E. coli*. To address this issue, the best solution that can be employed is to direct treated wastewater for NPUs such as agricultural irrigation, industrial processes, and urban landscaping, by which the potential for recontamination of the treated wastewater in the canals could be minimized. The study demonstrates that redirecting treated water for NPU aligns with multiple SDGs and benefits the community in various ways. By reducing freshwater demand for non-drinking purposes, it contributes to SDG 6. Implementing water reuse practices promotes sustainable water management and conservation (SDG 6) while mitigating the impact of climate change on water resources (SDG 13). SDG 11 is positively impacted by enhancing the urban environment by promoting water reuse for sustainable land use. Moreover, utilizing the sludge to generate biogas supports SDG 7. Reutilizing the treated water of Kurunegala STP instead of returning it to polluted canals maximizes the value of wastewater treatment efforts, contributing to SDGs for sustainable development. To align with SDGs and safeguard existing freshwater sources, urgent action is recommended to reevaluate the discharge strategy for treated wastewater, seeking alternative means that would enhance its value and contribute to the broader goals of environmental sustainability effectively addressing water contamination concerns and conserving vital resources of Kurunegala City.

Keywords: Reuse, Sustainable development, Treatment plant, Wastewater, Water quality

(ID 012)

**Development of Protein Rich Ready to Serve Drink by Incorporating Whey in Wood Apple
(*Limonia acidissima*)**

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Abstract

Whey is a by-product of the dairy industry, obtained during the manufacture of cheese, paneer, or similar products by separation from curd after the coagulation of milk. Whey contains almost all the nutrients of milk except casein and fat, thus making it highly nutritious. Whey is commonly disposed of as waste in many countries. However, it is hazardous to dispose of whey directly into the environment because several toxic substances are formed during the decomposition of whey, which can have several harmful consequences for the environment. The production of a ready-to-serve drink by combining whey and fruit juice for human consumption has been shown to have good commercial potential and also reduce the issues related to waste disposal. Therefore, a study was designed to incorporate different proportions of whey into wood apple (*Limonia acidissima*) pulp with the aim of developing a protein-rich, ready-to-serve drink. In the first trial, ready-to-serve drinks were prepared by incorporating different ratios of (0%, 10%, 20%, 30% and 40%) whey into wood apple pulp. Then, the second trial was conducted by incorporating various ratios of (30%, 40% and 50%) whey into wood apple pulp. Based on the results of sensory analysis using 5-point hedonic scale, 40% of whey incorporated with 60% wood apple pulp ready-to-serve drink was selected for further studies along with a control (100% wood apple pulp). Then, physicochemical, and nutritional properties of raw materials and selected ready-to-serve drink and control were evaluated. According to this analysis, whey is a good source of protein ($13.31 \pm 0.02\%$), ash ($8.74 \pm 0.03\%$) and phosphorous content (995.16 ± 4.14 mg/100 g). Then, shelf-life studies were also carried out, and it reported ready-to-serve drinks can be stored for 60 days without a significant increase in microbial content with the addition of SMS at 50 ppm. The cost of production of the whey-incorporated drink (89 rupees/1000 g) is comparatively lower than the control (129 rupees/1000 g). Therefore, it can be concluded that whey can be incorporated in wood apple pulp up to the ratio of 40:60 to prepare ready-to-serve beverages that have reasonable amounts of minerals, vitamins, and high-quality protein, which will be acceptable to consumers, and may solve the issue of waste disposal of whey.

Keywords: Ready-to-serve drink, Waste management, Whey, Wood apple

(ID 124)

Cleaner Production Opportunity Assessment for a Concentrate Fruit Syrup Manufacturing Plant in Sri Lanka

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Abstract

After industrialization, industries consume more and more natural resources and contribute to the environmental pollution. Therefore, major global initiatives started to find ways of environmental management and protection, and Cleaner Production (CP) is one of the results of those initiatives that focused on pollution prevention. Specially, food and beverage industry consume a lot of natural resources. Although the beverage industry consists of a less complex manufacturing process compared to the food industry, it consumes raw materials, energy and chemicals in greater quantities that results in large amount of waste and emissions causing lot of risks to health and the environment. Therefore, this study selected beverage manufacturing plant which is a leading concentrate fruit syrup manufacturer in Sri Lanka to identify the potential of CP opportunities of the selected industry and to recommend suitable CP alternatives to the industry. Also, this study conducted a SWOT analysis in order to determine strengths, weaknesses, opportunities and threats associated with CP implementation of the selected company. The standard CP assessment methodology which was presented by United Nations Environment Programme and United Nations Industrial Development Organization was followed in the study. During the assessment, primary and secondary data was collected and interviews with the cross section of the employees were conducted. CP assessment was conducted in the plant to estimate the water consumption, product carbon footprint and the total raw material wastage from the manufacturing process and activities in the plant. The material balance showed that there were only 2.475% of unaccounted losses for a batch of product manufacturing. Also, the water balance showed the intensive water consumption activities and losses, while the carbon footprint analysis disclosed the total greenhouse gas emissions generated at the plant was 300.206 tonnes CO₂e in 2022. Since the raw material consumption efficiency was 97.525%, the study focused on five major CP opportunities including air rinsing of bottles, installing automatic clean-in-place system, installing a highly efficient air curtain, resource improvements for diesel boiler and personal training and awareness raising to reduce water usage and product carbon footprint in the plant. Furthermore, another potential CP options were recommended on the basis of cost of implementation. The SWOT analysis revealed strengths: fully optimized raw material usage, availability of resources; weaknesses: lack of knowledge regarding CP, limited flexibility of the production process; opportunities: demand for eco-friendly products; threats: uncertainty of the market etc. Additionally, this study showed that CP options are not only efficient from the environmental point of view, but also provide economic benefits to the industries through saving resources, raising productivity as well as minimizing or avoiding treatment and/or disposal costs.

Key words: Carbon footprint, Cleaner production, Concentrate fruit syrup manufacturing, Water

(ID 233)

Removal Efficiency of Pb (II) Metal Ions from Wastewater using Base-Modified Jack Saw Dust**Jayasinghe, D.M.¹, Jayasundara, U.K.^{1,2*}**¹*Department of Chemistry, Institute of Chemistry Ceylon, Sri Lanka*²*Department of Chemistry, University of Maine at Presque Isle, Presque Isle, ME USA***udaya.jayasundara@maine.edu***Abstract**

Presence of excess heavy metals such as Pb (II) ions is one of the major causes of water pollution. Lead contaminated effluents can form complexes with ligands in aqueous media and tend to bio-accumulate in the food chains causing acute and chronic diseases. Therefore, efficient and cost-effective methods to remove such heavy metals from water are important. Since activated carbon (AC) based adsorption techniques have their own drawbacks, the use of biomass has been tested as potential candidates due to abundancy, eco-friendliness, and low cost. This research is focused on the removal of Pb (II) ions from polluted aqueous media using jack saw dust and comparison of its efficiency with commercially available AC. After sieving, washing with distilled water and drying under ambient conditions, the saw dust was treated with different concentrations of NaOH (0.25-5.0 M) to yield BMJSD. The highest adsorption capacity and percent removal was obtained with the 0.25 M (NaOH) on BMJSD. Adsorption of Pb (II) onto BMJSD was optimized by adjusting Pb (II) ion concentration, adsorbent dosage, contact time and temperature. From the results, it was revealed that optimum Pb (II) ion adsorption is 700 ppm with a contact time of 30 minutes at room temperature for 20 g L⁻¹ of adsorbent. The optimum Pb (II) ion adsorption is 700 ppm with a contact time of 60 minutes at room temperature for 28 g L⁻¹ of AC. The collected data were tested with the linear Freundlich, Langmuir and Temkin isotherm models. The rate of adsorption was studied using pseudo-first order (PFO) and pseudo-second-order (PSO) kinetic models. The adsorption processes by both BMJSD and AC follow the PSO kinetics as well as Freundlich, Langmuir and Temkin adsorption isotherms with R² values of 1.00, 1.00, 0.99 and 0.99, respectively. The rate constants suggest that adsorption process by BMJSD is more efficient than that by AC. The Gibbs free energy of adsorption by BMJSD and AC were determined to be -8.25 and -6.98 kJ mol⁻¹ respectively, revealing both processes to be spontaneous. In conclusion, the adsorbent produced in this study offers high potential for the removal of Pb (II) from aqueous solutions with a percent removal of over 95% and the adsorption process is more feasible, efficient, and economical compared to AC.

Keywords: Adsorption, Biomass, Heavy metals, Jack saw dust, Lead (Pb)

(ID 017)

Assessment of Environmental Impacts of Municipal Solid Waste Disposal Options using Life Cycle Assessment Methodology: A Case Study in Matara Municipality**Kalhari, H.K.M.G¹, Weeraratne, J.², Wijetunga, S.^{1*}**¹*Department of Agricultural Engineering and Environmental Technology, University of Ruhuna, Matara, Sri Lanka*²*Colombo Commercial Fertilizers Ltd, Ministry of Agriculture, Sri Lanka***swije@agri.ruh.ac.lk***Abstract**

Municipal solid waste is growing problem in Sri Lanka. Improper waste management practices cause harmful impacts to the environment. High population density of Matara municipality generates reasonable amounts of wastes creating disposal problems. Life cycle assessment was conducted to determine the environmental impacts associated with existing waste management practices and compare it with other scenarios in Kotawila waste management centre, Sri Lanka. Three waste management scenarios were considered for the assessment process. Baseline scenario (S₁) indicates the existing waste management practices which are open dumping 30 tons, recycling 3 tons and composting 1.5 ton. In the second scenario (S₂) the amount of waste that goes to the open dumping is 15 tons, recycling 4.5 tons and composting 15 tons. In the third scenario (S₃), open dumping further reduced to 4.5 tons, recycling was 7 tons, and 23 tons were used for anaerobic digestion. Field studies were conducted to gather data of each element of the municipal solid waste management system. The waste collection rate (ton/day), waste transportation, waste composition, fuel consumption, human resources engagements in waste collection, etc. were identified and quantified. Several calculation methods according to IPCC guidelines, open LCA software ELCD Greendelta databases, ReCipe 2016 Midpoint (H) Impact Assessment method were used for the impact assessment. The impacts of present waste management process are quite high compared to other scenarios studied. The Global Warming (772.652 kg CO₂eq), Ozone Formation (0.00565kg NO_x eq), Terrestrial Acidification (0.19903 kg SO₂eq), Fine Particulate matter formation (0.09494 kg PM 2.5eq), Freshwater Eutrophication (0.14266 kg P eq), Terrestrial Eco Toxicity (0.7125 kgL,4-DCB), Human non-carcinogenic Toxicity (0.0350 kgL,4-DCB) are comparatively higher than that of other scenarios. The scenario 3 was found to be the option with the highest mitigation potential of most impacts. It is the suitable scenario to manage these harmful impacts. Global Warming (247.24876 kg CO₂ eq), Ozone formation (0.00190 kg NO_x eq), Terrestrial Acidification (0.09964 kg SO₂ eq), Fine particulate matter formation (0.03088 kg PM 2.5 eq), Freshwater Eutrophication (0.050 kg P eq), Terrestrial Ecotoxicity (0.22280 kgL,4-DCB), Human non-carcinogenic Toxicity (0.01121 kg 1,4-DCB) can be reduced to 68%, 66%, 50%, 67%, 65%, 69%, 68% respectively. It can be concluded that existing waste management practices cause harmful impacts to bio system. The use of anaerobic digestion reduces the amount of waste that goes to open dumping, and it has a significant mitigation potential of harmful environmental impacts.

Keywords: Environmental impacts, Life Cycle Assessment, MSW disposal

(ID 024)

**Phytoremediation of Soil Contaminated with Used Lubricant Oil by Marigold Plant
(*Tagetes erecta* L.)**

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Abstract

Lubricating oils, used extensively in various industries and it contains a complex mixture of base oil and additives, posing environmental hazards when improperly disposed as used lubricant oil (ULO). The objective of this study was to explore the potential of Marigold plants (*Tagetes erecta* L.) for phytoremediation as a sustainable and eco-friendly solution to address ULO contamination. The study involved a pot experiment of marigold seeds planted in six different concentrations of ULO-contaminated soil (0%, 1%, 2%, 3%, 5%, and 8% on w/w basis). For the determination of the percentage degradation of ULO in the contaminated soil, the gravimetric method was performed. This involved suspending soil samples from the rhizosphere of the Marigold plants in dichloromethane and subsequently measuring the change in weight after the solvent had evaporated. Soil Samples were drawn after every 30-day intervals over three months continuous period of time with good caring and careful watering to the plant. In a three-month experiment, the percentage degradation of ULO-contaminated soil was assessed in MINITAB 19 software. Results revealed a contamination level-dependent decrease. Notably, higher percentages of oil degradation were observed in 1% and 2% ULO-contaminated soil concentrations. Additionally, the chlorophyll content of Marigold plants in different ULO-contaminated soil concentrations was also evaluated. Chlorophyll a and chlorophyll b contents exhibited similar variations, while total chlorophyll content decreased with increasing ULO contamination levels. The highest total chlorophyll content was found in control plants, while the lowest was observed in plants grown in 8% ULO-contaminated soil. In conclusion, Marigold plants showed moderate potential as phytoremediators for ULO-contaminated soil, with higher oil degradation in lower ULO concentrations. In terms of chlorophyll content, the presence of ULO in the soil resulted in a contamination level-dependent decrease in total chlorophyll content in the leaves.

Keywords: Phytoremediation, Used lubricant oil, Marigold plants (*Tagetes erecta* L.), Soil contamination. Chlorophyll content

(ID 061)

Assessment of Beach Macroplastic Abundance and Distribution Along Western Province Coastline in Sri Lanka

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Abstract

Marine plastic pollution is global concern, which is arising with the exponential increment of plastic manufacturing. Massive amount of land-based and-ocean based plastic wastes enter to the marine environment, acquiring unmeasurable destruction to both marine ecosystems and human health. Sri Lanka is a small island nation with vastly disturbed coasts. The Western Province coastal belt is particularly vulnerable to macroplastic pollution because of its dense population, high level of urbanization, and industrialization. There are many estuaries situated within this belt with increasing above risk of accumulating many inland plastic debris along coastline. This study aims to understand the beach macroplastic sources and distribution patterns along the Western province coastline; and to study the abundance of those macroplastic pollutants. This will make more convenience during decision making and policy making processes in both regional and national levels. The survey was conducted during a 3-month field campaign (from March 13, 2023 to June 5, 2023) in selected 15 beach areas along Western Province coastline in Sri Lanka. Three cross-belt transects, which were lied 100m distances, use for the assessment each with 1m width. The results show that, highest plastic density was recorded in Wellawatta beach (3.09 items/m²) and second most in Crow-Island beach (2.57 items/m²) of Colombo district. The most abundant plastic category was Poly Propylene (PP) with 48.1% composition and then PS-E (foams) with 19.4%, among all. The least was represented by Polyethylene terephthalate (PET) with 2.3% composition. According to the Clean Coast Index (CCI) Moragalla and Kalido beaches are in moderately dirty category and Seththappaduwa beach is under the dirty category. Other all sites are categorized under the extremely dirty category. Relatively highest amount of household plastic wastes was recorded in Modara beach and relatively highest amount of fisheries/aquaculture wastes was recorded in Preethipura beach. In overall fisheries/aquaculture-based plastics represent considerable portion of 24.8% in amount among all and contribute to significant increment of macroplastic pollution. Based on the findings the importance of raising local awareness and changing people attitudes are emphasized. As single-used plastics are playing crucial role in environmental pollution it is necessary to reduce those items from daily human activities and even banning them within Sri Lanka. Other than that, regulating of plastic usage in fisheries sector and related waste disposal activities is also recommended.

Keywords: Beach macroplastic, Abundance, Marine environment, Plastic distribution

(ID 075)

Detection of *E.coli* O-157 in Polluted Cannels of Colombo District , Sri Lanka

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Abstract

Water pollution is one of a major ecological circumstance in Sri Lanka, particularly in metropolitan areas that are subjected for rapid urbanization and poor waste management practices. Colombo is the capital city of the country which contains a number of polluted canals due to the extensive population density causing for spreading of diverse diseases among the community. The direct discharge of solid waste, toilet effluents to canals causing for contamination of canal water from pathogenic microorganisms. Therefore, the polluted canals of the Colombo city can be act as carrier to distribute number of waterborne diseases among the community. Further, out of different water borne pathogenic microorganisms *Escherichia coli* O157 considers as a specific strain of *E. coli* due to its potential to causes serious illness in humans by producing Shiga toxin that causes Hemolytic Uremic Syndrome in human. Therefore, this study aimed to look for the presence of the *E. coli* O157 strain of *E. coli* in polluted canals in Colombo, Sri Lanka. In the study, 20 water samples were collected from different polluted canals, including Hamilton, Wellawatta, Karadiyana, Dehiwala in the Colombo area. Then the samples were transported to the laboratory under cooling conditions, and they were enumerated using the membrane filter method. The filtered samples were then cultured on Membrane Lactose Glucuronide Agar (MLAG) and Eosine Methylene Blue (EMB) agar plates to isolate *E. coli*. Five *E. coli* isolates were taken from each sample for DNA extraction. Further, the presence of *E. coli* was determined by DNA Extraction, the Freeze-thaw method, followed by PCR amplification of the *Eae* genes using specific primers. *Eae* gene is one of the virulent gene which can be used to detect *E. coli* O157. From 20 tested samples, three samples were positive for the *E. coli* O157 in Karadiyana, Wellawatta and Dehiwala canals respectively. The findings suggest that canal water could be a source of *E. coli* O157 contamination, emphasizing the importance of ongoing monitoring and the deployment of appropriate measures to prevent contamination and limit public health hazards.

Keywords: *Escherichia coli* O157, Water quality, Canal water, Virulent *Eae* gene

(ID 077)

Seagrass Beds May Act as a Trap of Microplastics: A Case Study at Puttalam Lagoon, Sri Lanka**Bhathiya, M.A.M.^{1*}, Udagedara, S.², Dissanayake, P.A.K.N.^{1,3}, De Silva, P.M.C.S.⁴, Sivyer, D.⁵, Reeve, C.⁵, Bakir, A.⁵**¹*Department of Oceanography and Marine Geology, University of Ruhuna, Matara, Sri Lanka*²*Blue Resources Trust, Colombo, Sri Lanka*³*Marine Biology Laboratory, Ecology and Biodiversity Research Group, Vrije Universiteit Brussel (VUB), Belgium*⁴*Department of Zoology, University of Ruhuna, Matara, Sri Lanka*⁵*Centre for Environment, Fisheries and Aquaculture Science, United Kingdom***menuka.bhathiya@gmail.com***Abstract**

Microplastics (MP) have become a ubiquitous presence in various ecosystems, including seagrass, posing significant environmental concerns. However, a comprehensive understanding of their full implications remains inadequate. The extent of MP accumulation in seagrass meadows in Sri Lanka is not well-documented, prompting our efforts to investigate MP contamination in Puttalam Lagoon. Sampling was conducted across ten specific sites throughout the entire lagoon during the North-East monsoon period of 2021, aiming to fill the knowledge gap on this matter. In total, vegetated (n=30) and non-vegetated sediment samples (n=30, 30 cm cores), and seagrass samples (n=30, 0.25 m² quadrat) were randomly collected to determine MP. The length of the seagrass blades, the percentage of the canopy cover, and the water depth were also measured. Additionally, three transects (each 50 m) were deployed perpendicular to the shore to assess the correlation between MP accumulation potential against the seagrass species and the water depth. Under a dissecting microscope, details such as colour, morphotype, and MP counts were recorded, while the polymer type was identified using Fourier Transform InfraRed (FT-IR) Spectroscopy. All surveyed sites showed contamination with MP. Among the seagrass samples, 86.7% contained MP, ranging from 7.7 to 13.7 MP blade blade⁻¹. The mean MP abundance was higher in seagrass sediment (62.8±30.7 MP kg⁻¹) compared to non-vegetated sediment (29.87±12.10 MP kg⁻¹). Out of the five identified seagrass species, the highest MP abundance was found in *Enhalus acoroides* (13.7±3.5 MP blade⁻¹). The exclusive morphotypes identified in both seagrass and sediment samples were fibres and fragments. Notably, fragments were the prevailing morphotype in both seagrass blades (6.7±1.4 MP blade⁻¹) and vegetated sediments (32.3±10.1 MP kg⁻¹), while fibres dominated in unvegetated sediments (15.8±4.5 MP kg⁻¹). A total of six different colours of MP were noted, with blue emerging as the most abundant colour in both seagrass and sediment. The findings of this study reveal the significant capacity of seagrass meadows to trap MP with their root systems. Considering the potential transfer of MP from seagrasses and sediment through various levels of the food chain, there is a critical need to advocate for sustainable consumption practices and implement effective waste management strategies. These measures are essential to safeguard the coastal environment from persistent pollution and mitigate the MP contamination in seagrass habitats.

Keywords: Microplastics, Puttalam lagoon, Morphotype, Polymer, Fourier Transform InfraRed (FT-IR) Spectroscopy

(ID 081)

Characterization of Compost and Screening of Antibiotic Residues, Antibiotic Resistant Bacteria in Commercially Available Compost in Sri Lanka**Parameswaran, R.¹, Liyanage, G.Y.,^{2,4}, Wijerathna, P.A.K.C.^{2,3}, Manage, P.M.^{4*}**¹*Business management school, Colombo, Sri Lanka*²*Centre for Water Quality and Algae Research, Department of Zoology,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka*³*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*⁴*Department of Aquatic Bioresources, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***pathmalal@sjp.ac.lk***Abstract**

Antibiotics are chemical substances that kill or inhibit the growth of bacteria by interfering with metabolic processes. The resistance among various bacterial species to different antibiotics has emerged as a cause of public health threat all over the world at a terrifying rate. Antibiotic residues and antibiotic-resistant bacteria can enter the environment in many ways, and compost is one such way. Composting of municipal solid waste is widely used as a greener approach and a low-cost method of global waste management. However, antibiotic residuals in the MSW compost cause a critical impact on human health by developing antibiotic resistance in environmental bacteria. Therefore, the focus of the present study was to evaluate the antibiotic resistance and antibiotic residuals in selected compost types to determine the quality of the compost. Five different composts that are commercially available in Sri Lanka were investigated for the presence of antibiotic residues and resistant bacteria. Solid-Phase Extraction (SPE) was employed to concentrate antibiotics and quantification was done by High Performance Liquid Chromatography (HPLC). Recoveries for each antibiotic was remained between 83%±0.021 to 95%±0.034. The Total Viable Counts (TVC) were measured using the standard pour plate method using Lauryl-Bertani (LB) medium. To enumerate antibiotic resistant bacteria, filter sterilized (0.2 µm) antibiotics; Amoxicillin and Ciprofloxacin at final concentration of 60 µg/mL were spiked to each molting agar media (40⁰ C) before preparing plates and continued standard pour plate method. In the present study, none of the amoxicillin and ciprofloxacin groups targeted were detected in any compost sample. Amoxicillin resistance ranged from 1% to 90%, and ciprofloxacin resistance ranged from 6% to 44%. Overall, amoxicillin-resistant bacteria were higher than ciprofloxacin. The results of the study revealed that release of antibiotics into the environment will lead to an emerge in antibiotic resistant bacteria and it compromises the effectiveness of antibacterial therapy, since the infectious organisms become resistant against more antibiotics.

Keywords: Amoxicillin, Ciprofloxacin, Resistance, Solid-phase extraction, High-performance Liquid Chromatography

(ID 102)**Removal of Nitrate and Phosphate in Wastewater by Composite Rice Husk Ash and Dolomite****Jayaranga, I.S.L., Sewwandi, B.G.N.****Department of Zoology and Environmental Management, University of Kelaniya, Kelaniya, Sri Lanka***sewwandidh@kln.ac.lk***Abstract**

Excess nitrate and phosphate present in water contribute to water quality degradation, altering the structure and functions of aquatic ecosystems, and also induces socio-economic impacts by facilitating eutrophication. Although many techniques are available for the removal of nitrate and phosphate from wastewater, adsorption using solid materials as adsorbents is simpler, more effective, and cheaper process than other techniques due to the possibility of using any conventional or non-conventional material as the adsorbent. Therefore, this study was conducted to investigate the potential of composite rice husk ash and dolomite to remove phosphates and nitrates in wastewater by adsorption. Batch studies were conducted for composite rice husk ash and dolomite to determine the effect of pH, initial concentration, and contact time on the anion adsorption. For that, the sieved RHA and dolomite were mixed in 1:5 ratio and used as the adsorbent maintaining adsorbent concentration at 60 gL⁻¹. The adsorption capacity of composite rice husk ash and dolomite for the removal of phosphates and nitrates was evaluated in the range of pH 3 to 9, changing initial anion concentrations from 20-200 mgL⁻¹ for 24 h contact time. According to the results, overall adsorption of both phosphates and nitrates onto composite rice husk ash and dolomite was increased with the increase in pH. The adsorption of both phosphates and nitrates reached highest level at pH~8. Furthermore, isotherm studies showed that the adsorption of both phosphate and nitrate onto composite rice husk ash and dolomite was well fitted to the Langmuir isotherm model indicating a monolayer adsorption. The dimensionless constant was ranged in between 0 and 1 for both phosphate and nitrate adsorption indicating a favourable adsorption with a strong affinity between the solute and the adsorbent. The maximum adsorption capacities of phosphate and nitrate were 5.59 mg g⁻¹ and 1.84 mg g⁻¹, respectively. According to the kinetic studies, adsorption of both phosphate and nitrate was well described by pseudo second-order model suggesting chemical sorption. Importantly, the equilibrium for phosphate and nitrate adsorption was achieved within just 60 minutes and 45 minutes, respectively under the experimental conditions. In summary, this study concludes that rice husk ash and dolomite composite is an effective adsorbent for the removal of phosphate and nitrate in wastewater, offering an eco-friendly and cost-effective alternative for addressing water pollution challenges, thereby contributing to the restoration of water quality, and associated socio-economic well-being.

Keywords: Adsorption, Isotherm models, Kinetic models, pH, Phosphate, Nitrate

(ID 112)

Contamination of Buried Plastic Marine Litter on Sandy Beaches in the West Coast of Sri Lanka

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Abstract

Sandy beaches act as an interface between land and sea and can serve as an indicator of the level of contamination in the marine environment. The beach can be both a source and a sink for marine litter contamination. Long-term accumulation of buried plastic marine litter (BPML) can produce microplastics by mechanical destruction and/or UV-degradation. This study aims to investigate the contamination and distribution of BPML in the Crow Island (CR) and Wattala (WT) beach areas during the Northeast monsoon. CR had a significantly higher anthropogenic load compared to WT beach. BPML (>5 mm) was determined in 12 quadrats (0.5×0.5 m) per beach area. From each quadrat, sand samples (2 sand samples per quadrat) were obtained in shallow and deep layers of the beach (surface to 3 cm, and 3 cm to 6 cm respectively). The fraction of the mass of coarser sand was determined to identify the relationship between the coarseness of the sand sample and BPML contamination. Coarseness of the sample was determined by removing fine sand using a 1 mm sieve. Accumulation patterns of BPML were analysed between the storm line and sand dune. On average, 21 items/kg Dry Weight (DW) and 7 items/kg DW were collected from sand samples from shallow and deep layers of the CR beach, respectively. In contrast, the WT beach area had almost no plastic pieces on average in a kilogram of dried sand samples collected from both depths. Out of the 24 sand samples collected from the WT beach, only 7 of them contained plastic pieces. Characterization of the polymers of the BPML was carried out using ATR-FTIR. Shallow and deep layers of sample from CR beach contained Polyethylene (10 items/kg DW and 3 items/kg DW respectively) and polyethylene terephthalate (5 items/kg DW and 2 items/kg DW respectively) type BPML in high amounts. BPML accumulation on the CR beach was significantly affected by the depth of the beach and distance from the storm line ($p < 0.05$, One-way ANOVA). High contamination by BPML is found to be associated with coarser sands. The average fraction of coarser sand for samples collected from the shallow and deep layers of the CR beach near the storm line is 17.4% and 26.1%, respectively, which indicates high contamination of plastics in the deep layer compared to the shallow layer. In contrast, the shallow layer contained a high percentage of coarse sand (5.3%) compared to the deep layer (3.7%) near the sand dune or vegetation. Findings indicate encouraging mitigatory measures to clean up marine litter focusing on both shallow and deep layers is recommended.

Keywords: West Coast, Buried plastic marine litter, ATR-FTIR, Coarser sands

(ID 113)

Fish Scale Derived Bio Sorbents for the Removal of Organics from Greywater**Suntharalingam, Y.*, Devaisy, S.***Department of Bioscience, University of Vavuniya, Vavuniya, Sri Lanka***yogasubanuja@gmail.com***Abstract**

Utilization of greywater can reduce water scarcity if, it is used as an alternative source of water for non-potable use. Fish scales, a low-cost waste product from the seafood industry, have gained attention as a potential bio sorbent for greywater treatment. Fish scales are natural biopolymers rich in minerals, aligned type I collagen fibrils with two layers which forms a plywood structure for fish scales. This makes the fish scales a good adsorbent to remove contaminants from wastewater. Previous studies used fish scales to treat different types of wastewaters, however the literature on the use of fish scale to treat greywater is lacking. This study emphasizes to use fish scale derived bio sorbent, to treat the grey water produced from a student hostel. The fish scales were collected from a local market, then it was thoroughly washed and dried under shade. The scales were cut into small pieces to enhance the surface area. Batch adsorption experiments were conducted through adsorption isotherm and kinetics to determine optimum dosage and the optimum contact time of the bio sorbent respectively. Isotherm and kinetics were conducted respectively for varying doses of bio sorbent (1 g/L to 12 g/L) and varying contact time (30 min to 24 hours). Results revealed the 4 g/L dosage of fish scale exhibited maximum reduction in COD (64%), turbidity (98%) and EC (43%) at contact time of 300 mins from raw wastewater (COD 449 mg/L; turbidity 172 NTU; EC 4.20 ms/cm). This corresponds to the adsorption capacity (q_e) of 161.0 mg/g for COD. Optimum dosage (4 g/L) and optimum contact time (300 mins) were determined based on adsorption capacity of the adsorbents to the respective dosage and time. The proposed kinetic models for COD were predicted well with R^2 value 0.988 for Pseudo-second-order kinetic model which assumes that this adsorption is chemisorption, which involves covalent bonding through sharing or exchanging electrons between the adsorbent and the adsorbate. Elovich isotherm model well explains the experimental data on adsorption equilibrium with R^2 value 0.806, which based on a chemisorption kinematic principle in heterogeneous surfaces. The wasted fish scales could be potentially incorporated into constructed wetlands, sand filters or other alternative natural treatment systems, enhancing their ability to effectively remove contaminants from greywater. The utilization of fish scales as a bio sorbent not only addresses waste management concerns but also aligns with the principles of circular economy by repurposing waste into valuable resources and fostering sustainability through innovative, eco-friendly solutions.

Keywords: Greywater, Adsorption, Fish scales, Reuse, Chemical Oxygen Demand

(ID 118)

Development of a Cellulose-Based Aerogel using Aquatic Invasive Plants to Treat Oil-Contaminated Wastewater**Darshani, U.G.N.P., Manage P.M., Idroos F.S.****Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***sumaiyaidroos@sci.sjp.ac.lk***Abstract**

Water pollution due to industrial oily wastewater, accidental oil spills and oil leakages have become a serious disaster that threatens the aquatic environment and ecological systems. Oily wastewater contains hazardous chemicals such as phenols, petroleum hydrocarbons, and polycyclic aromatic hydrocarbons. Dispose of this oily wastewater within acceptable environmental standards has been challenging. Therefore, oil/water separation using an efficient and eco-friendly method is a timely requirement. The present study focused on synthesizing an environmentally friendly and hydrophobic aerogel with low density, high porosity, high oil adsorption capacity, high oil adsorption rates and greater reusability using *Eichhornia crassipes* (Water hyacinth-WH); an aquatic invasive plant as the raw material and Polyvinyl Alcohol (PVA) as the crosslinking agent through simple and low-cost method. Initially, WH powder-based aerogel and WH fibre-based aerogel were prepared via alkaline/H₂O₂ pretreatment, freeze-drying and silanization with Methyltrimethoxysilane (MTMS). Among these two aerogels, WH fibre-based aerogel showed the highest oil adsorption capacity. Moreover, the WH fibre-based aerogel showed the lowest density ($0.46 \pm 0.01 \text{ g cm}^{-3}$), highest porosity ($77.18 \pm 0.35\%$), and highest oil adsorption rate ($3.48 \pm 0.11 \text{ g s}^{-1}$). Hence, their physico-chemical properties including chemical structure and surface morphology were characterized in detail by Fourier Transforms Infrared Spectroscopy (FTIR) and Scanning Electron Microscope (SEM). The results revealed that aerogels exhibited a multilevel/multi-layered, interconnected three-dimensional pore structure connected by flexible sheets having a large number of macro and micro pores throughout the aerogels and different functional groups such as alcohol O-H, alkali C-H, carboxylic group C=O, C-O group, aromatic C-H, etc. were distributed at the surface of the aerogel. Moreover, the adsorption capacity and the adsorption rates were determined, and the results revealed that the WH fibre-based aerogel presented excellent adsorption performance for a wide range of oil products (Crude oil $17.38 \pm 0.57 \text{ g g}^{-1}$, Diesel oil $13.07 \pm 0.48 \text{ g g}^{-1}$, Gasoline $12.64 \pm 0.30 \text{ g g}^{-1}$). The corresponding cyclic tests showed the adsorption capacities of both aerogels remained at 80.98% after 10 consecutive cycles, indicating a high reusability. Henceforth, the production of aerogel using *Eichhornia crassipes* is an eco-friendly green approach to control the growth of these aquatic invasive plants. Therefore, the present study has proposed a sustainable green approach for the effective usage of aquatic invasive plants.

Keywords: Oily wastewater, Eco-friendly, Aerogel, Aquatic invasive plants, Sustainable

(ID 143)**Environmental Health Assessments of Beaches using Beach Quality Indexes****Yogarajah, V.*, Gobiraj, S., Kuganathan, S.***Department of Fisheries, University of Jaffna, Jaffna, Sri Lanka***vithushshika@gmail.com***Abstract**

Marine litter represents a significant issue along the northern coast of Sri Lanka, where it substantially impacts marine biodiversity and the local ecosystem. Therefore, assessing and managing beach quality is crucial for the protection of marine biodiversity and the sustainability of the local ecosystem. The present study provides the first assessment of marine debris and beach quality using five Beach Quality Indexes (BQI), such as the Plastic Abundance Index (PAI), Clean Coast Index (CCI), General Index (GI), Pellet Pollution Index (PPI), and Hazardous Items Index (HII), along the northern shore of Sri Lanka. The marine litter survey was conducted at Kankesanthurai (KKS), Myliddy, and Akkarai beaches from February to July 2023, following the protocols set by NOAA and OSPAR. A 50 cm × 50 cm wooden quadrat was placed with a 20 m interval along the 100 m transect at each beach. The samples were collected at a depth of 1 cm and any debris larger than 2.5 cm in size on its longest dimension was included in the analysis. The study at the three beaches recorded 538 marine debris items and classified them into five distinct material groups: plastic, metal, glass, paper, and wood. The highest number of marine debris was recorded at KKS (187 items), followed by Myliddy (176 items) and Akkarai Beach (175 items). The average litter density was 1.19 ± 0.05 items/m². Plastics constituted the highest percentage, amounting to 85.69% (289 items), while metal (1.12%, 6 items) was the least common. The beach quality index scores obtained in this study indicate that the studied beaches are 'extremely dirty' based on the average GI (23.73) and CCI values (104.89), and as 'very low' by the PPI value of 0.02. The PAI value (69.89), highlights that all beaches had a 'high abundance' and the HII value (0.55) indicates 'little to no litter'. The studied beaches are at low risk based on plastic pellets and hazardous litter items, but with a high risk as indicated by the GI, CCI, and PAI values. These findings underscore the need for a comprehensive marine litter management framework on the northern coast of Jaffna and provide valuable baseline data for future research and conservation efforts.

Keywords: Beach Quality Index, Marine litter, Northern coast, Plastics

(ID 166)

Graphene Oxide Coated Sand Composites as Molecular Sieves to Mitigate Water Contaminants

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Abstract

This research focuses on the synthesis of a novel adsorbent, a sand/graphene oxide composite with five layers of graphene oxide coating, referred to as S-GO5. The primary aim of this study is to assess the potential suitability of S-GO5 as a molecular sieving material via the adsorption of Methylene blue (MB) dye and 2-methyl-4-chlorophenoxyacetic acid (MCPA) pesticide molecules. The composite is created through a stepwise deposition of graphene oxide onto river sand using a thermal annealing process. Characterization studies conducted with scanning electron microscopy (SEM) and Fourier-transform infrared spectroscopy (FT-IR) reveal a non-uniform graphene oxide coating on the sand's surface and the incorporation of oxygenated functional groups within the composite structure. The study compares the adsorption capacity of S-GO5 with other sorbent materials like activated carbon, graphene oxide, and sand, for the removal of MB dye and MCPA. For the analysis of MB dye and MCPA adsorption, UV visible spectroscopy (665 nm) and high-performance liquid chromatography (HPLC) methods were employed respectively. The optimization studies for MB adsorption on S-GO5 revealed that the ideal conditions are a concentration of 5 mg/L, a dosage of 0.09 g, a contact time of 20 minutes, at pH 9. Focusing on the adsorption of MCPA onto the S-GO5, the optimum concentration, dosage, and contact time were 75 mg/L, 0.05 g, and 105 minutes respectively, at neutral pH values. The investigation of adsorption equilibrium isotherms indicated that the Freundlich model best describes the adsorption process, with high correlation coefficients for both MB and MCPA. Additionally, adsorption kinetics analysis suggests a pseudo-second-order model best fits the data, indicating a chemical sorption mechanism governing the adsorption process. It is evident that MB (98.6%) has a significantly higher adsorption capacity on S-GO5 compared to MCPA (53.3%). The adsorption capacity values of MB, and MCPA were 52.861 mg/g and 4.7316 mg/g respectively. Despite MB having a cationic charge and MCPA being either neutral or negatively charged in solution, the S-GO5 composite demonstrates a remarkable adsorption capacity for both compounds. This suggests that the synthesized composite could be a promising solution for molecular sieving material, owing to the removing positively charged molecules (MB) as well as negatively charged (MCPA) pesticide contaminants from water.

Keywords: Adsorption, Graphene, Sand, Dye, Pesticide

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(ID 220)

The Effect of Environmental Concentrations of Metformin on Growth, Development, Sex Differentiation, and Nitrogen Metabolism of Developing Zebrafish (*Danio rerio*)**Maduwanthi, M.P.D., Rajapaksa, R.P.G.K.****Department of Zoology and Environmental Management, University of Kelaniya,
Kelaniya, Sri Lanka***gayani@kln.ac.lk***Abstract**

Metformin is the most widely prescribed anti-hyperglycemic medication and has been categorized as an emerging contaminant in aquatic ecosystems owing to its ubiquitous environmental occurrence. Metformin in the concentrations range of 10-50 µg/L has been reported from natural water bodies worldwide. The exact effects of pharmaceuticals contaminant, metformin on aquatic ecosystem health remain poorly known. Studies have acclaimed metformin-mediated reproductive health effects in aquatic fauna, suggesting non-classical pathways of endocrine disruption. However, the growth-related and physiological effects of metformin on aquatic organisms remain poorly known. This study was carried out to investigate the effects of long-term exposure to environmentally relevant concentrations of metformin on growth, development, and physiology of juvenile zebrafish (*Danio rerio*). Zebrafish of 25 dpf (days post-fertilization) were acclimatized for 5 days, exposed to environmental doses of metformin (10 µg/L, 50 µg/L), and controlled for 60 days in triplicate treatments. Increments in body length and weight, specific growth rate, body mass index, condition factor, sex ratio, and nitrogen excretion were investigated. The condition factor was used to determine the general well-being of fish. According to the results, length gain of fish was not significantly different between treatments and control ($p > 0.05$). However, weight gain, specific growth rate, and body mass index were significantly low in zebrafish under 50 µg/L of metformin treatment, when compared with fish in control and 10 µg/L of metformin treatments ($p < 0.05$). Significantly low condition factors were observed under both metformin concentrations, indicating the poor well-being of fish under metformin exposure ($p < 0.05$). Ammonia excretion rate of zebrafish was significantly low in 50 µg/L of metformin treatment than 10 µg/L of metformin and control, indicating disturbed nitrogen metabolism ($p < 0.05$). Significantly high female-biased sex ratios were observed under both metformin concentrations in 90 days old zebrafish. However, control treatment had male: female sex ratio of 1:1 ($p < 0.05$). Based on the findings it can be concluded that, long-term exposure to environmentally relevant concentrations of metformin could lead to detrimental effects on the growth, sex differentiation and physiology of developing zebrafish. These findings highlight the adverse impacts of pharmaceutical pollution on aquatic ecosystems.

Keywords: Metformin, Growth, Sex ratio, Zebrafish, Endocrine disruption

(ID 256)

Determination of Heavy Metals in *Metapenaeus dobsoni* and *Penaeus indicus* Shrimp Species Captured from Negombo and Puttalam Lagoons, Sri Lanka**Dulanjani, K.G.*, Perera B.A.***Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***dulanjani132@gmail.com***Abstract**

The presence of heavy metals in aquatic ecosystems has become a growing concern worldwide due to their potential impact on human health and environmental well-being. Shrimp consumption has also been increasing over the years in Sri Lanka, underscoring the need to analyze shrimp to ensure that contaminant heavy metal levels meet international food safety standards. This study was carried out to determine the levels of Cu, Zn, Pb, Cr, and Cd in muscle tissue of commercially important *Metapenaeus dobsoni* (Kadal Issa) and the levels of Cu, Zn, and Cr in *Penaeus indicus* (Kiri Issa) shrimp species from Negombo and Puttalam lagoons in Sri Lanka. The study aimed to compare heavy metal levels in shrimp species between two lagoons and evaluate potential risks to human health associated with shrimp consumption. Shrimp samples were collected monthly from October 2022 to March 2023. Dry ash preparation was carried out as the digestion technique for the samples and quantified for Cu and Zn using Flame-Atomic Absorption Spectroscopy (FAAS), while Cr using Graphite Furnace Atomic Absorption Spectroscopy (GFAAS). Inductively Coupled Plasma Mass Spectroscopy (ICP-MS) was used to determine Pb and Cd. The mean heavy metal levels in $\mu\text{g/g}$ wet weight in the *Metapenaeus dobsoni* captured from Negombo lagoon were found in order of $\text{Cu}(4.1 \pm 1.7) > \text{Zn}(4.0 \pm 3.3) > \text{Pb}(0.126 \pm 0.066) > \text{Cd}(0.088 \pm 0.013) > \text{Cr}(0.061 \pm 0.031)$, while captured from Puttalam lagoon were found in order of $\text{Zn}(6.6 \pm 4.3) > \text{Cu}(6.6 \pm 1.404) > \text{Pb}(0.172 \pm 0.193) > \text{Cd}(0.145 \pm 0.066) > \text{Cr}(0.076 \pm 0.005)$. The mean metal levels in $\mu\text{g/g}$ wet weight found in *Penaeus indicus* were as follows, $\text{Cu}(4.4 \pm 1.8) > \text{Zn}(2.7 \pm 1.3) > \text{Cr}(0.048 \pm 0.019)$ in Negombo lagoon and $\text{Cu}(5.9 \pm 0.8) > \text{Zn}(4.4 \pm 2.3) > \text{Cr}(0.073 \pm 0.030)$ in Puttalam lagoon. The findings show that in general, the heavy metals levels detected in shrimp samples were higher in Puttalam Lagoon than in Negombo Lagoon. In addition, the results demonstrated that shrimp from both lagoons and species were safe for human consumption during the study period since none of the heavy metal levels in the shrimp samples exceeded the maximum permissible level (MPL) allowed for shrimp consumption according to FAO/WHO. Furthermore, the Estimated Daily Intake (EDI) and Target Hazard Quotient (THQ) values indicated that there was no non-carcinogenic risk of the determined metals via the consumption of *Metapenaeus dobsoni* and *Penaeus indicus* shrimp species captured from Negombo and Puttalam lagoons.

Keywords: Heavy metals, Shrimp consumption, Negombo lagoon, Puttalam lagoon, Potential risks

(ID 266)

Waste Disposal Determinants and Disparities: Evidence from Islandwide Survey in Sri Lanka

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Abstract

Waste management is a vital aspect of economic development, human development, and environmental sustainability. Identifying the socioeconomic background behind the household behaviour toward waste disposal highlights could provide important insights towards better waste management. Therefore, this study investigates trends and the demographic and socioeconomic determinants of waste disposal methods at the household level in Sri Lanka. Data were obtained from the Sri Lanka Household Income and Expenditure Survey conducted in 2019 covering 19,838 households. Multinomial logit model is used to identify factors influencing the choice of household waste disposal mechanism. Results indicate that burning waste is the dominant household waste disposal method in Sri Lanka, accounting for 45.5% of households, while dumping within premises at 27.7% and garbage truck collection at 21.8%. Waste collection services are used by 79% of urban households. More than half of rural and estate households burn their waste, and more than a third dump of it on-premises. While 45 percent of households in the Western and Eastern provinces use the waste collection service, other provinces mostly depend on waste burning and on-premises waste dumping. Model estimates reveal that waste collection services are more likely to be used in urban areas with relatively short distances to local authorities with single housing units, and wealthier households led by more educated individuals and the presence of older household members. Composting is more likely to be used as a waste disposal method among single housing units, and wealthier households led by more educated persons and older household members. Waste burning is preferred by households located further from municipal authorities and representing various socioeconomic subgroups. Single household units and line rooms representing various socioeconomic groupings, excluding urban households, prefer on-premises waste dumping. The findings highlight the polarization of disposal methods according to the sector and suggest the importance of introducing effective and safe waste disposal methods to households, particularly in the rural and estate sectors, in order to reduce hazardous waste disposal practices.

Keywords: Waste management, Household survey, Sri Lanka, Multinomial logistic

(ID 282)**Current Techniques in Density Separation, Identification Methods, and Characterization of Microplastics in Sedimentary Environments: A Comprehensive Review of Currents Studies****Dasanayake, S.R.S.S.^{1*}, Chathurani, S.H.U.²**¹*Department of Fisheries and Marine Sciences, Ocean University, Tangalle, Sri Lanka*²*National Aquatic Resources Research and Development Agency, Colombo, Sri Lanka***suyamasanjunee@gmail.com***Abstract**

Plastic particles, often less than 5 mm in size, known as microplastics (MP), cause catastrophic pollution which is a significant environmental concern globally. In recent decades, scientific investigations have substantiated the ubiquitous presence of microplastics across diverse environmental compartments, encompassing oceans, rivers, soil, and atmospheric aerosols. Notably, emphasis within the realm of microplastic research has predominantly centred on sedimentary matrices. Therefore, this literature aimed to summarize abundance of microplastics, factors affecting for abundance of microplastics, accurate and cost-effective procedures of identifying microplastics in different sediments, including sample collection, sample pre-treatment, density separation, chemical digestion and identification methods, issues that occurred during the studies, and prospective developments. For evidentiary support, an exhaustive review of thirty papers published between 2019 and 2023 was conducted via Google Scholar and Science Direct. Predominantly, the studies scrutinized the microplastic content in sediments sourced from diverse environments, including rivers, lakes, beaches, coral reefs, sea grass beds, wetlands, estuaries, lagoons, and mangrove forests. Varieties of microplastic shapes, such as fibres, films, fragments, microbeads, pellets, and foams, were consistently detected. Most recent studies (73%) used saturated Sodium chloride solution (density 1.2 gcm⁻³) while few studies used Zinc chloride, Calcium chloride, Sodium bromide, Potassium iodide, and Potassium formate solutions to separate microplastics from sediment matrices by density separation. In conclusion, this comprehensive review underscores the pivotal role of microscopic techniques, particularly stereomicroscopy, alongside advanced analytical instruments such as Fourier-transform infrared spectroscopy and Micro-Raman spectroscopy in enhancing the identification and characterization of microplastics within sedimentary environments. The exploration of these methodologies reveals promising avenues for overcoming existing limitations, paving the way for more precise and efficient analyses of microplastics in sediments. Within this review, the integration of new analytical instruments and effective microscopic techniques holds significant potential for advancing our understanding of microplastic pollution in aquatic ecosystems and informing strategies for mitigation and remediation.

Keywords: Density separation, Identification techniques, Microplastics, Sediments, Limitations

(ID 288)

Chopped Pine (*Pinus caribae*) Needles as a Component of Growth Substrate of *Gerbera hybrida* Soilless Culture

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Abstract

This study aimed to assess the feasibility of using freely available pine (*Pinus caribae*) needles in up country of Sri Lanka as a growth substrate for gerbera (*Gerbera hybrida*) cut flower production. Traditional gerbera cultivation commonly uses soilless media in pot or bed culture, typically using coco-peat as the primary growth substrate. However, the limited availability of coconut plantations in Gerbera-growing regions has led to increased cultivation costs due to long-distance transportation. To address this issue various combinations of chopped pine needles, coco-peat, and partially burned paddy husk were evaluated as growth substrates in different ratios: 1:1:½ (T1), 0:1:½ (T2), 1:0:½ (T3), 1:1:0 (T4), 0:1:0 (T5), and 1:0:0 (T6) for their suitability with gerbera cut flower varieties, Ruby Red (red), Dalma (white), Sunglow (yellow), and Pink Elegance (pink). The experiment was designed as a Completely Randomized Design (CRD) with a two-factor factorial and two replicates. Analysed results did not indicate a significant interaction between variety and growth media for any measured parameter. The tested media influenced leaf length and number, while both variety and media treatments independently impacting flower diameter, flower stalk length, and survival ($p=0.5$). All the varieties exhibited significantly higher leaf numbers and leaf lengths in T1 and T4 (average leaf numbers in T1 were 8.85 ± 0.5 , and in T4, 9.2 ± 0.32 , while leaf lengths in T1 were 26.0 ± 1.3 cm and in T4, 24.92 ± 0.6 cm). Higher survival rates were observed in Pink Elegance when grown in T2, T5, and T4, with rates of $90 \pm 3.33\%$, $88.66 \pm 4\%$, and $92.33 \pm 3.66\%$, respectively. Ruby Red and Dalma displayed higher average stalk lengths (47.1 ± 2.1 and 46.8 ± 0.4 respectively) in all treatments compared to other varieties. However, significantly higher average stalk lengths and flower diameters were observed in T1 (48.3 ± 0.51 cm and 10.1 ± 0.33 cm respectively) and in T4 (46.9 ± 2.1 cm and 9.8 ± 1 cm respectively). These findings suggest that the partial substitution of coconut coir peat with chopped pine needles offers a viable alternative to reduce the cost of soilless growth substrates for gerbera cultivation.

Keywords: Coconut coir peat, Growth substrate, Pot culture, Partially burnt paddy husk

(ID 175)

Emerging PFAS Contamination: Understanding the Ecological and Human Health Impacts on Water Quality

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Abstract

The emergence of per- and polyfluoroalkyl (PFAS) contamination has raised critical concerns regarding its profound impact on the environment and human health. PFAS, widely known as "forever chemicals" due to their exceptional persistence, have infiltrated aquatic ecosystems globally, posing a dual threat to water quality and public well-being. Hence, we conducted a thorough systematic review of primary research to provide insights into the geographical distribution, detection patterns, and the serious environmental and health concerns associated with PFAS contamination. The process of article screening was executed by adopting search keywords such as "PFAS contamination", "sustainable water resources", "aquatic ecosystems", "health risks", and "innovative remediation approaches" using the Web of Science database. We exclusively considered 25 peer-reviewed articles published in English from 2018 to 2023 for our analysis. We employed content analysis and thematic analysis to analyse data. The study's findings reveal that PFAS contamination has become pervasive in aquatic environments, stemming from industrial discharges and atmospheric deposition. Recent research highlights the presence of PFAS in Finnish rivers and fish, with profound ecological consequences as these chemicals persist in ecosystems, entering the food chain and potentially disrupting aquatic life. On the human health front, consuming PFAS-contaminated fish, particularly those with high PFAS levels like PFOS, poses inherent risks, potentially exceeding safe intake levels. The evolving landscape of PFAS compounds, shifting from long-chained to short-chained variants, adds complexity to the issue. Therefore, addressing these multifaceted challenges requires robust monitoring, stringent regulations, and source-focused remediation efforts at wastewater treatment plants and contaminated land areas. In conclusion, the emerging PFAS contamination crisis demands comprehensive strategies for safeguarding ecosystems and public health. Continued research, strict regulations, and innovative remediation methods are essential to mitigate these ecological and health risks effectively.

Keywords: Aquatic ecosystems, Innovative remediation approaches, Ecological and human health risks, PFAS contamination, PFOS contamination

(ID 128)

Investigation of Compost Generation Potential for Municipal Waste: A Case Study in the Kurunegala Municipal Council Area, Sri Lanka

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Abstract

Waste management is an ever-increasing global concern, with particular emphasis in municipal areas. The effective management of waste, especially organic waste, has become a pressing issue. Developing an effective waste management strategy for a specific region requires the estimate on the amount of waste generated per unit period of time and the composition of the waste. Especially, in the context of wastes with high organic proportion composting has emerged as a promising solution to manage such wastes. Therefore, this study was conducted in the Kurunegala municipal area of Sri Lanka, focusing on the compost generation potential using municipal waste. The primary data collection method for this study was a semi-structured questionnaire survey conducted over a three-week period. 120 sample households were selected using a stratified random sampling from 12 municipal wards of Kurunegala municipal area. The assessment of waste generation and the composition of the waste stream in the Kurunegala Municipal Council area was conducted by analyzing data from four months' worth of truckloads, including their weights. Estimations and descriptive analyses were performed to find the municipal waste generation rates. Descriptive analyses were used to explore the relationships between the quantities of organic waste and several socio-economic factors, including population and monthly average income values. This study found that, in the Kurunegala municipal area, the average daily waste generated per person was approximately 0.6055 kilograms, with organic waste accounting for about 0.4055 kilograms, making up the majority at 67%. The average per capita daily organic waste generation was 0.2851 kg for the high-income group, 0.2186 kg for the middle-income group, and 0.2092 kg for the low-income group. Furthermore, the average household daily organic waste generation was 1.1012 kg for the high-income group, 1.0145 kg for the middle-income group, and 0.8197 kg for the low-income group. Specifically, when the average family income has got increased, the organic waste generation rate also increased. Contrastingly, it has been observed that higher-income households tended to produce more polythene and paper waste than middle and lower-income families. Based on the SWOT analysis, composting was identified as the most appropriate option for managing organic waste in the Kurunegala municipal area.

Keywords: Compost, Municipal waste management, Organic waste, Socio-economic factors, Waste generation and composition

(ID 241)

Study Surface Emission Quantification of Trace Gasses (CH₄, NH₃, H₂S, And VOC) in a Specific Blend of Compost and Soil**Samarasingha, T.N.*, Jayawardana, D.T.***Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka***thanurisamarasinghe1998@gmail.com***Abstract**

This study was to determine how methane (CH₄), ammonia (NH₃), hydrogen sulphide (H₂S), and volatile organic compounds (VOCs) from particular compost and soil mixtures changed over time and under varied environmental conditions. The research objective was to analyse the surface emission of trace gasses from particular compost and soil mixtures to study the gas formation process and variations over time. The experimental design has involved collecting soil (red-yellow podzolic soil from A horizon) and compost samples (municipal solid waste compost), conducting initial analyses, and preparing different compost-soil mixtures. Selected mixtures, such as compost 40:soil 60(C4S6), compost 50:soil 50(C5S5), and compost 60:soil 40(C6S4), were prepared in large polythene pots, alongside control experiments using only soil and only compost, to assess and compare their effects. Closed chamber flux with gas sensors was used to investigate trace gasses. Gas flux measurements were based on determining the gas concentration inside the chamber placed on the surface (chamber volume=0.0018 m³, chamber surface area=0.0123 m²). Material temperature was measured, and atmospheric conditions (temperature, wind speed, humidity, atmospheric pressure) were diligently noted during each gas data collection. Infrared spectroscopy study of the material has revealed the presence of particular functional groups relevant to gas formation in the system (O-H, N-O, C-O, and N-H). Compost samples have the highest conductivity (1.5 μS/cm). The research revealed a correlation between compost maturity and methane emissions, with a decrease in methane levels as compost with time (mean 10.7 ppm). Strong positive correlations of CH₄ emission concerning time were found between specific compost and soil mixtures, such as C4S6, C5S5, and C6S4 (R=0.94, 0.99, and 0.99, respectively). In contrast, NH₃ emissions showed a lower positive association with raw soil and C4S6 (R=0.16 and 0.25, respectively), while H₂S emissions exhibited weak to moderate correlations with different variables. Compost and all compost-soil mixtures exhibit relatively high VOC emissions (R from 0.50 to 0.60). The PCA analysis investigated the effect of different atmospheric conditions and gas emissions (temperature, wind speed, humidity, pressure, and soil temperature). Soil temperature exhibits a moderate positive correlation with CH₄, while NH₃, H₂S, VOCs, and atmospheric temperature demonstrate a weak negative association with methane levels, providing valuable insights into the intricate dynamics of these interactions.

Keywords: Pot experiment, Time series, Correlation, Environment

(ID 261)

Removal of Ciprofloxacin from Aqueous Media Using Dendro Biochar**Attanayake, A.M.P.M.¹, Rajapaksha, A.U.^{2,3*}, Liyanage, S.S.L.W¹, Hettithanthri, O.², Vithanage, M.²**¹*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Ecosphere Resilience Research Center, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*³*Instrument Center, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**anurajapaksha@sjp.ac.lk**Abstract**

Ciprofloxacin (CPX) is an emerging contaminant concern; hence this study is aimed to investigate the potential of bioenergy plant derived biochars (Dendro) (Produced from plants available in Embilipitiya (EBC), Mahiyanganaya (MBC), and Thirappane (TBC)) in the mitigation of CPX from the aqueous medium. The physiochemical properties of the biochar were characterized by the proximate analysis and Fourier Transform Infra-Red Spectroscopy (FTIR). Batch adsorption studies were conducted to study the effect of pH (2-9), contact time (0-2,880 minutes), and initial concentration (5-100 mgL⁻¹). The maximum adsorption of CPX onto three biochar samples was facilitated around pH values of 6.5 and 7. Experimental kinetic data were best fitted with pseudo second order ($R^2=0.846$) for MBC while Elovich model described the kinetics for EBC ($R^2=0.923$) and TBC ($R^2=0.854$) in aqueous medium. Isotherm data for aqueous medium were well described by the Langmuir model for EBC ($R^2=0.936$), Freundlich model for MBC ($R^2=0.985$), and Temkin model for TBC ($R^2=0.985$). Obtained data confirmed that EBC followed chemisorption and physisorption interactions meanwhile MBC and TBC showed physisorption interactions. EBC reported the highest maximum adsorption capacity value as high temperature produced biochar exhibits greater potential in the removal of organic contaminants. Distribution coefficient values calculated for three biochar samples showed a positive correlation with adsorption in aqueous medium. Furthermore, colloids were fabricated to study the adsorption with varying pH in comparison with the pristine form. According to the studies, colloidal form of TBC and MBC showed significant adsorption compared to EBC with its pristine form as the ball milling may have increased the surface area which aids in the adsorption. FTIR data suggested the presence of hydroxyl groups, aromatic nature on the surface of the biochar. Isotherm studies conducted using synthetic hydrolysed urine matrix using MBC and MBC colloids suggested a chemisorption mechanism dominated in the adsorption of CPX onto biochar in competitive ions. Thus, these outcomes imply that bioenergy plant derived biochar can be utilized as a potential low-cost, sustainable adsorbent in mitigating emerging contaminants such as CPX from the environment.

Keywords: Carbon materials, Emerging contaminants, Antibiotics, Adsorption

(ID 273)**Beach Cleanliness using the Clean Coast Index at a Recreational Beach: A Case Study of Charty Beach, Northern Sri Lanka****Shobiya, G.*, Thennakoon, T.M.D.L., Sivashanthini, K.***Department of Fisheries, University of Jaffna, Jaffna, Sri Lanka***shobiya@univ.jfn.ac.lk***Abstract**

Marine litter is a major environmental concern and has a huge impact on the cleanliness of beaches in Sri Lanka. The Clean Coast Index (CCI) is a tool that monitors marine debris as a beach cleanliness indicator and is used to evaluate the actual cleanliness of the coast. The aim of this first investigation is to assess the quantity of marine debris, determine the cleanliness of the beach using CCI and identify the sources of marine debris using the basic assumption method and the matrix scoring technique. A total of ten surveys were conducted between December 2020 and April 2021. Two transects of sampling were carried out, each with a dimension of 100 m in length and 5 m in width, covering an area of 500 m². The marine litter greater than 2.5 cm in the longest dimension was collected, quantified and classified into eight distinct types. The average marine debris density on the beach was 0.106 items m⁻² and 0.574 gm⁻². Plastic (92%) was found to be the most abundant type of marine debris. The highest CCI recorded (13) was in December 2020, while the lowest (CCI=5) was recorded in March 2021. As the first study of actual beach cleanliness at Charty Beach in northern Sri Lanka, the findings show that the average beach cleanliness was moderate, with a CCI of 9. When the matrix scoring technique and the basic assumption method were used to determine the source of marine debris, both methods showed that recreational activities, smoke-related activities, and fishing activities are the main contributors to beach pollution. Quantifying beach cleanliness is an effective method to attract beachgoers and keep them coming back to bathing beaches. Therefore, continuous monitoring of beach cleanliness is important for environmental conservation and the sustainable development of coastal areas.

Keywords: Basic assumption method, Beach cleanliness, Clean Coast Index, Marine debris, Matrix scoring technique

(ID 117)**Removal of Organics and Phosphate from Rice Mill Wastewater using Crab Shell Biochar****Thavaratnam, H.*, Devaisy, S.***Department of Bioscience, University of Vavuniya, Vavuniya, Sri Lanka***hobikahobika9@gmail.com***Abstract**

Exponential population growth drives increased demand for rice, causing a surge in rice mill industries. Unfortunately, the effluent from these mills, although lacking toxic compounds, contains elevated levels of Chemical Oxygen Demand (COD), nitrate, and phosphate, posing an environmental threat. This paper explores the use of crab shell-derived biochar to purify rice mill wastewater by removing organics and phosphates. The objective of the study is to meet environmental standards through wastewater treatment using crab shell derived biochar. In this study, crab shell biochar was prepared via controlled slow pyrolysis, involving cleaned and dried crab shells pyrolyzed at temperatures between 350-400° C for 3 hours. Adsorption isotherm tests used varying crab shell biochar doses (2.5-20 g/L) in 100 mL glass flasks filled with rice mill wastewater. The control experiment was done without biochar. Agitation lasted six hours at 150 rpm; samples were filtered through Whatman grade 1 sheets. Kinetic experiments examined the adsorption rate with 15 g/L of crab shell biochar in 100 mL of wastewater for varying contact times 30 mins to 1,440 mins. Then the samples were filtered through Whatman grade I papers, and primarily analysed for COD, and phosphate. Crab shell biochar achieved optimum removal efficiencies, i.e., 76.8% of COD at 15 g/L, and 64.4% of phosphates at 15 g/L dosage were observed. Kinetic study revealed the optimal contact time for the optimum removal organics and phosphates was 400 min at 15 g/L at the 150 rpm shaking speed. The adsorption capacity of crab shell in treating rice mill wastewater for COD and phosphate were 1040 mg/g and 4.9 mg/g respectively. The Langmuir and Freundlich models revealed the correlation coefficients (R^2) were 0.9475 for COD and 0.91059 for phosphate. The Pseudo 2nd order model best fits both COD and phosphate adsorption, with correlation coefficients (R^2) of 0.99978 and 0.99976, respectively, suggesting the removal mechanism as chemisorption with electron sharing or exchange. This study underscores biochar's potential in treating rice mill wastewater and reducing pollutants, aligning with zero-waste principles for sustainable water pollution control.

Keywords: Bio sorbents, Biochar, Paddy straw, Crab shell biochar, Rice mill wastewater

(ID 285)

Comparing the Fate of Biodegradable Products in Seawater Under Laboratory and Natural Conditions

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Abstract

Biodegradable products drive much attention because of their apparent significant impact on the environment. Their degradability under natural conditions is identified as a solution for waste plastic accumulation. Mismanaged non-degradable wastes from islands are carried to the ocean, and cause irreversible damage to organisms, the environment, and human health. The present study was to compare the degradability of three commercial polymer products with "biodegradable", "oxo-degradable", and/or "compostable" labels on them i.e., Garbage Bag (GB), Lunch Sheet (LS), and Salad Plate (SP) in seawater under laboratory and natural conditions. The laboratory setup contained a glass tank filled with seawater, equipped with a wave pump, and kept near a window for simulating natural environment conditions. The natural setup was submerged in the Dikkovita international fishery harbour. Samples were cut into 1-2 g pieces, cleaned, and air-dried until constant dry weights were reached. Prepared samples were separately packed inside nylon mesh pockets and placed in the water column. Samples in the natural setup were placed inside a net-cage to avoid disturbances from known and unknown sources in a functioning harbour. A filter paper (FP) was used as the control. Samples were placed in triplicates, and monthly sampling was conducted. Degradability was assessed as a percentage of Mean loss of weight (MWL%). Results of initial RAMAN analysis confirmed the presence of polyethylene in GB, polybutylene adipate terephthalate and polylactic acid in LS, and cellulose in SP and FP. According to weight loss results, all three products exhibited significantly higher ($p < 0.05$) MWL% in the natural setup when compared to the laboratory setup. The control was completely degraded in 45 days while the SP and LS took 90 days. However, none of them reached complete degradation even after 12 months of sampling under laboratory conditions. The GB showed significantly higher ($p < 0.05$) degradation potential under natural conditions, but MWL% were less than 2% (0.47-1.50%) by 3 months of sampling. The reason for the higher degradation potential under natural conditions might be due to mechanical degradation caused by continuous, strong wind and wave actions.

Keywords: Oxo-degradable, Polyethylene, Mean weight loss, Natural seawater setup, RAMAN spectroscopy

(ID 047)

Vegetable Wastes as Alternative Culture Media for the Growth of Selected Fungi

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Abstract

Culture medium is the environment which provides essential nutrients to support the growth of microorganisms in the laboratory. Potato Dextrose Agar (PDA) medium is widely used for the growth of fungi. The exorbitant cost of conventional culture media such as PDA, has limited the use of these media in schools and laboratories with less facilities. Potato Dextrose Broth (PDB) is used to grow fungi in liquid medium. This study was aimed to find out the potential of vegetable waste such as cabbage, onion, carrot, beans, beetroot and drumstick as alternative nutrient source for the growth of fungi. Nowadays, waste disposal has become a major problem. High amount of these waste materials is often improperly disposed which causes severe environmental pollution. The dumping sites of vegetable wastes promote the growth of vectors and pathogenic bacteria. Thus, the use of vegetable waste for preparing an alternative culture media for the cultivation of fungi would be a new avenue. Six different fungi were used to this study such as *Aspergillus* sp., *Fusarium* sp., *Mucor* sp., *Penicillium* sp., *Rhizopus* sp. and *Trichoderma* sp. The haemocytometer count of spores and dry weight of mycelia of different fungi after five days of inoculation were obtained. Most of the fungi showed higher growth in alternative media than Potato Dextrose Broth (PDB). According to the results, *Mucor* sp. and *Rhizopus* sp. showed higher growth in onion, *Aspergillus* sp. and *Penicillium* sp. showed higher growth in carrot. *Fusarium* sp. showed higher growth in drumstick and *Trichoderma* sp. showed higher growth in cabbage.

Keywords: Alternative media, Vegetable waste, Potato dextrose broth

(ID 050)**Effect of Ethanol Extracts of Plant Materials High in Polyphenol and Flavonoid on Nitrogen Loss and Nematode Count of Broiler Litter During Storage****Ahamed, M.J.I.¹, Atapattu, N.S.B.M.^{1*}, Mannakkara A.²**¹*Department of Animal Science, University of Ruhuna, Matara, Sri Lanka*²*Department of Agricultural Biology, University of Ruhuna, Matara Sri Lanka***nsbm@ansci.ruh.ac.lk***Abstract**

Loss of nitrogen, mainly as ammonia from poultry litter is reported to have a range of financial, environmental and social impacts. Higher ammonia levels in poultry houses reduce the performance, welfare and carcass parameters of broilers while causing occupational health hazards to the employees. Loss of N from litter continues during composting, storage and after the field application and thus reduces its organic fertilizer value. Some plant Polyphenols and flavonoids reported to reduce the action of urease enzyme that involves in the conversion pathway of litter nitrogen into ammonia. Objective of this study was to determine the effects of ethanol extracts of five plant materials high in polyphenols and flavonoids on the nitrogen loss and nematode count of broiler litter during storage. Ethanol extracts of Betel (*Piper betle*) leaves, Ehela (*Cassia fistula*) bark, Neem (*Azadirachta indica*) leaves, Pomegranate (*Punica granatum*) leaves and spent-tea (*Camellia sinensis*) were prepared. Air-dried-ground samples of each material (200 g) were shaken with 1000 mL of ethanol for six hours and subsequently the methanol was evaporated. The crude extract of each material was then mixed with 1000 mL of distilled water. Plastic pots (n=42) were filled broiler spent litter at the rate of 1000 g/pot. Giving a completely randomize design experiment with seven replicates, pots were randomly allocated into six treatments. On day 1, seven pots were sprayed with 50 mL of tap water (control) while remaining 35 pots were sprayed with one of the five ethanol extracts at the same rate. Right after treatment application, samples were collected for the determination of pH, EC, dry matter, nitrogen (Kjeldahl method) and nematode count (Baermann funnel method). Another 50 mL of water or extracts was sprayed on day 15 of storage. Pots were stored at room temperature for 25 days. Another sample was taken from each pot on day 25 for the analysis of same parameters. Repeated measure ANOVA procedure was used to analyse the pH, EC, N% and nematode counts. Extract x time interaction was not significant for litter pH, EC, N% and nematode count. Betel leaves, Ehela bark, neem leaves and pomegranate leaves significantly increased the pH compared to water (control). Storage of litter significantly increased the pH from 7.7 ± 0.01 to 8.0 ± 0.02 . During the 25 days of storage, the litter N percentage reduced significantly from 2.52 ± 0.20 to 2.00 ± 0.01 . Though not statistically significant ($p=0.13$), the lowest percentage reduction of N was reported for the litter sprayed with tea-waste extract ($30.30 \pm 4.13\%$) while the control reported the highest percentage N loss ($36.16 \pm 5.45\%$). Interestingly, compared to control (82/10 g) neem extract reported significantly lower (42/10 g) nematode count. The study concluded that ethanol extracts of the tested materials at the does titrated do not reduce the loss of nitrogen from broiler litter during storage. However, further studies are suggested to evaluate the effectiveness tea waste. The study concluded that neem has a potential to reduce the nematode count.

Keywords: Litter, Nitrogen, Nematodes, Plant extracts

(ID 133)

Comparative Analysis of Metal Accumulation in Selected Plants as an Indicator of Environmental Pollution

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Abstract

Harmful pollutants of vehicular emissions contribute to the environmental contamination of heavy metals, leading to adverse effects on plant and animal species. The presence of roadside plants has the potential to absorb significant quantities of heavy metals, presenting a possible solution for mitigating heavy metal pollution. Therefore, the current study was undertaken to comparatively determine the ability of certain plant species commonly growing along roadsides to absorb and accumulate heavy metals. It was aimed to assess the concentrations of the specified metals Pb, Cu, Zn, Mn, and Fe in leaf samples of the species, *Mangifera indica*, *Polyalthia longifolia*, *Delonix regia*, *Cassia fistula*, and *Mesua ferrea*, on the roadside and inside the premises, of the University of Sri Jayewardenepura, Sri Lanka. The analysis was done using AAS and the results were analyzed and compared through one-way ANOVA, using Minitab-21. According to the results, *M. indica* accumulated a significant amount of Pb, Cu, Zn, and Mn. *P. longifolia* accumulated a high level of Mn. A significant Zn accumulation was observed in *C. fistula* and the highest accumulation of Fe was observed in *M. ferrea*. *D. regia* accumulated a comparatively high amount of Cu and Zn. The heavy metal accumulation pattern in all roadside plants was Mn>Fe>Zn>Cu>Pb. From the results, it was observed that the plants alongside roads show bioaccumulation of a substantial quantity of heavy metals than those growing inside the premise, with a lower exposure to vehicular emissions. Since the environmental conditions were similar in both sites, it can be suggested that observed changes in the metal contents may be due to the effect of vehicular emissions. Based on the level of accumulation, each plant species could be considered a hyperaccumulator for the specific heavy metals. From the species analysed, *M. indica* accumulated the highest content of heavy metals, thus it could be considered a suitable accumulator, to be grown on traffic-dense roadsides, and other species could be used in mitigating metal-related pollution in other contaminated areas.

Keywords: Vehicular, pollution, Traffic, Roadside, Biomonitoring

(ID 136)

Developing a Natural Toothbrush to Reduce the Non-Biodegradable Wastes in the Environment

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Abstract

The World Health Organization estimates that 3.5 billion people worldwide suffer from one or more oral disorders. As a solution, brushing teeth is being done by people to lessen the occurrence of oral illnesses. The American Dental Association suggests that everyone should replace their toothbrushes once every three or four months and 3.5 billion toothbrushes are sold worldwide each year. Discarded toothbrushes can take up to years to decompose as they have been made from polypropylene, polyethylene and nylon. Dental twigs which were prepared from various medicinal plants have been used to brush teeth in ancient times. It was replaced by the non-biodegradable plastic toothbrushes in the modern era that has become an impact to the environment. The objectives of this study were to develop a natural toothbrush in order to decrease the amount of non-biodegradable wastes in the environment and to improve the environmental sustainability. The literature has been gathered from the various Pharmacology texts, journals and authentic websites to find out pharmacodynamics properties of plants which are used to prepare dental twigs in Ayurveda. Results were analysed and a natural toothbrush was prepared. Considering the bristles, husk of *Areca catechu* has been chosen as it provides anti-microbial action against oral pathogens like *streptococcus mitis*, *streptococcus salivarius* and husk is a disposed product commercially without reusing. Arecanut is mentioned in Ayurveda as *mukhavishyadyakara dravya* (cleansing the oral cavity). The fibres extracted from the arecanut husk are used for soft, natural bristles of the toothbrush. For the handle of the toothbrush, the wood of *Cinnamomum zeylanicum* is used as it is discarded after taking the barks. Therefore, this unused cinnamon wood, which has medicinal value and widely used for oral diseases, was used as the handle. The final product was convenient to grip and user-friendly. As this toothbrush is made from natural plant materials, it is biodegradable and promotes reusing the most discarded natural by-products. Thus, it is possible to reduce the impact to the environment due to plastic toothbrushes and help to preserve the environmental sustainability.

Keywords: Toothbrush, Biodegradable, Natural, Sustainability

(ID 242)

Analysis of Heavy Metal in Macrophytes from Negombo Lagoon, Sri Lanka

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Abstract

Heavy metal contamination poses a serious threat to coastal ecosystems. The comprehension of these metals' effects and how they bioaccumulate via food webs is still insufficient. This research aimed to examine the concentrations of heavy metals (Cu, Zn, Cr, Fe, Cd, and Mn) in four coastal macrophytes (*Halodule pinifolia*, *Chaetomorpha* sp., *Ulva intestinalis*, and *Gracilaria* sp.) collected from the Negombo lagoon, Sri Lanka. A random sampling approach was utilized by using a quadrat (50×50 cm) to collect macrophyte samples from each species across the study area. The samples were collected from January 2023 to June 2023, and twenty samples (n=20) from each species were analyzed. The heavy metals were extracted from macrophyte samples by acid digestion (conc. HNO₃ and H₂O₂) and analyzed by the atomic absorption spectrometer (AAS). The heavy metal concentrations were varied among macrophytes, but their abundance was in the order of Fe>Cu>Zn>Mn. Cd and Cr were not at detectable levels. *Gracilaria* sp. exhibited higher concentrations of Cu, Zn, Fe, and Mn compared to other species (3.05±0.11 mg/L, 5.92±0.51 mg/L, 215.85±6.75 mg/L, and 0.86±0.95 mg/L, respectively). *Chaetomorpha* sp. consisted of Fe; 89.98±47.73 mg/L; Cu; 2.86±0.05 mg/L; Zn; 0.61±0.45 mg/L; and Mn; 0.20±0.21 mg/L. The abundance of metals in *Ulva intestinalis* is 2.80±0.21 mg/L, Zn is 0.18±0.26 mg/L, Fe is 11.01±4.64 mg/L, and Mn is 0.16±0.17 mg/L. The concentrations of metals in *Halodule pinifolia* are Cu (2.78±0.33 mg/L), Zn (0.44±0.08 mg/L), Fe (29.241±12.40 mg/L), and Mn (0.69±0.56 mg/L). This study reveals that bioaccumulation of heavy metals within marine food webs can occur, and further studies are required to evaluate the bioaccumulation of these metals in marine food webs resulting from macrophyte consumption.

Keywords: AAS, Heavy metals, Macrophytes, Negombo lagoon

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(ID 319)

Valuing the Disamenity of Karadiyana Open Dumpsite in Sri Lanka: Application of Hedonic Pricing Method

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Abstract

The way municipal solid waste (MSW) is managed differs from country to country and is largely dependent on the financial situation of the country. For a large part of Asia, open disposal is the most common way of disposing of municipal solid waste. The open disposal of waste can pose environmental and health risks to people, and these problems are aggravated with rapid urbanisation. When making decisions on MSW management, the externalities posed by open dumping are often overlooked. However, there are few studies that attempt to identify or calculate the cost of externalities caused by open dumps. The study therefore aims to adopt a hedonic model to assess the disamenity value of the Karadiyana open-dump site, which is said to be the most polluted dumpsite in Sri Lanka. A pre-tested questionnaire was administered to the local community living near the dump site, using stratified random sampling. The households were chosen from distances of 100 m, 200 m, 300 m, 500 m, and 700 m in three directions. The survey was conducted in June 2022, and a total of 153 households were surveyed. The findings demonstrate that the worth of the property increases by 2% for every 100 meters away from the edge of the dumpsite. Additionally, the odour and visibility of the dumpsite had a negative effect on the property values. The mean willingness to pay for restoring the site is LKR 6,000.00 per household. In conclusion, the results suggest a significant welfare consequence on local wealth and the surrounding communities.

Keywords: Open dumpsite, Hedonic Pricing Model, Disamenity

(ID 235)

Non-Price Determinants of Cooking Fuel Choice among Households in Sri Lanka

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Abstract

Clean energy is critical to bridging between economic development, human development, and environmental sustainability. The fact that one-third of the world's population still cooks with solid fuels emphasizes the need to transition to clean fuels. Thus, this study looks into the socioeconomic and demographic factors that influence cooking energy choices at the household level in Sri Lanka. Data were acquired from the Sri Lanka Household Income and Expenditure Survey 2019 conducted by the Department of Census and Statistics, which included 19,875 households. Multinomial logit model is used in this study to find the relevant factors influencing the choice of household cooking fuel. According to descriptive statistics, 59.5% of households in Sri Lanka use solid fuel for cooking as the dominant choice, whereas 39.2% use clean fuel. Empirical findings show that urban, wealthier households, younger and more educated household heads, the presence of educated spouses, fewer household members, and annexed housing units significantly increase the likelihood of using clean fuels for cooking. The results are consistent with the energy ladder theory, as household income increases, households shift from solid fuels to transitional fuels and then to clean fuels. Private sector employees and self-employees and households in the rural sector are less likely to use clean fuels. Apart from estate households, transitional fuels such as kerosene are preferred by households with fewer members and representing different socioeconomic sub-groups. Also, ethnicity is a significant factor in determining household cooking fuel choices. The findings underscore the importance of formulating a proper national energy policy. Also, since the transition to clean energy is not instantaneous, attention should be paid to providing adequate incentives to households to switch from solid energy to clean energy, especially in rural and estate sectors.

Keywords: Clean fuel, Solid fuel, Cooking fuel, Energy transition, Sri Lanka

(ID 264)

Assessment of Groundwater Quality-Related Damage Costs: A Study in Jaffna District

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Abstract

Groundwater found in the Karstic aquifers are the most crucial and only reliable source of freshwater for Jaffna Peninsula. Anthropogenic activities including overextraction, closely built toilet pits, and excessive use of fertilizers have led to groundwater degradation in the peninsula, both in terms of quality and quantity. Hence, a significant economic burden is exerted on the community due to agrochemical and microbial contamination. Though the existing literature highlights the presence of groundwater degradation and its impacts, few studies have addressed the cost incurred by the society due to this issue. Hence, this study mainly focuses on assessing the damage costs associated with degrading groundwater quality in Jaffna, which is achieved through two specific objectives namely, estimating the damage costs associated with health issues caused by groundwater contamination in Jaffna peninsula and identifying the preventive measures and estimate the associated costs in households. Cost of Illness (COI) approach was used to estimate health damages and cost of preventive measures was estimated using Averting Behaviour Approach. A questionnaire survey was conducted in 80 households from Nallur District Secretariat Division. Information on demographics, health issues associated with poor drinking water quality, and mitigation measures to avoid polluted water consumption were gathered from the sampled households. The annual total estimated damage cost incurred due to health issues and preventive measures was approximately USD 11 million for the entire peninsula. Only 30% of the sampled households had experienced Diarrhoea. The total annual COI extrapolated to the population of the peninsula was USD 2.4 million. Boiling water and purchasing filtered water bottles were the two prominent preventive measures. Out of the sampled households, 87.5% have responded that they practice one of the preventive measures to avoid consuming polluted water. The annual total cost of preventive measures was USD 8.8 million. This study highlights the social cost incurred due to poor groundwater quality and emphasizes the importance of estimated values in justifying the investments in water supply projects.

Keywords: Groundwater, Cost of illness, Damage cost, Averting behaviour approach, Household survey

(ID 148)

Ocean Pollution and the Fishing Community

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Abstract

The ecosystem known as the ocean is a large body of saline water covering approximately 71% of the Earth's surface. The relationship between man and the ocean is deeply intertwined as the ocean provides resources for the survival of mankind. Among them, the fishing community and the ocean have a unique relationship. The reason for that is because livelihoods and trade routes have been created for the fishing community through this. With the development of human society, marine pollution has become a global problem today. Fishing also contributes to marine pollution. Therefore, it is crucial to consider the detrimental consequences of the ocean as they affect the fishing community. This research has been conducted using qualitative data analysis approach. The study area chosen for this study is the fishing harbour area of Dondra area. Both primary data and secondary data sources were used for data collection. In-depth interviews, participant observation and focus group discussions were used as primary data collection methods and thirteen individuals were selected as data contributors through simple random method. Reports, research papers, books and internet were used as secondary data. In this research, the types and sources of pollutants can be identified as the waste that the fishing community discharges into the ocean. The garbage that the fishing community dumps into the ocean can be used to identify the types and sources of pollution in this instance. Changes in water quality, sea erosion, and destruction of coral reefs have also affected the ocean system. Excessive growth of algae, bacteria and fungi has damaged the beauty of the coast. Also, the main findings that could be studied in this research are that the risk of health problems for humans and animals has increased through ocean pollution. Furthermore, due to the limited awareness and education in the fishing community, it can be recognized that the adverse effects on the ocean through them are high. Finally, it appears that the fishing community makes a significant contribution to ocean pollution through this study conducted in the vicinity of Dondra Port. Accordingly, fishermen have to face many problematic situations due to the amount of damage caused to the ocean compared to the rest of the community. The conclusion of this study is that if proper measures are not taken to reduce this, ocean pollution through the fishing community may increase further.

Keywords: Environmental, Fishing community, Health, Ocean pollution, Waste

(ID 083)

Local Fishermen's Willingness to Accept Compensation for Commercial Sea Cucumber Farms in Jaffna Lagoon, Sri Lanka

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Abstract

This study aims to investigate local fisherman's willingness to accept compensation for commercial sea cucumber farms in Jaffna Lagoon, Sri Lanka, and analyse the factors influencing the selected attributes for this study. A choice experiment was applied in this study. A well-structured questionnaire was employed, and a random sample of 164 participants was chosen from the local fishing community within the Jaffna Lagoon. This study focuses on five attributes- rearing area of sea cucumbers, breeding sites of fishes and crustaceans, tourist facilities, mangroves, and cost. A random parameter logit model was used to estimate respondents' preferences. The results revealed that local fishermen are willing to accept compensation for commercial sea cucumber farms and are willing to pay for improvements in the breeding sites for fish and crustaceans, tourist facilities, and mangroves. Fisherman's annual mean willingness to accept compensation for the establishment of commercial sea cucumber farms in Jaffna lagoon is estimated to be LKR 1,842.25 and fisherman's annual mean willingness-to-pay for enhancing breeding sites, tourist facilities, and mangroves is estimated to be LKR 1,622.48, LKR 1,272.48, and LKR 700.48 per year, respectively. Furthermore, our research has highlighted that fisherman's choices regarding breeding sites for fish and crustaceans are significantly influenced by their educational background and monthly income. In addition, the level of education among fishermen plays a significant role in determining their inclination toward tourist facilities and mangroves. The results of this study provide valuable insights for policymakers, aiding in the development of sustainable policies for commercial sea cucumber farms in the region. By understanding the preferences of local fishermen, policymakers can work towards striking a balance between economic development and environmental conservation.

Keywords: Choice experiment, Sea cucumber farms, Random Parameter Logit Model, Willingness-to-accept, Willingness-to-pay

(ID 217)

Optimizing the Value Chains for Underutilized Fruits: A Comprehensive Approach to Promote Sustainable Production and Consumption

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Abstract

Tropical underutilized fruits, predominantly found in forested and rural areas, are abundant and accessible seasonal availability. Most remain limited to local markets, despite the rich biodiversity and countless edible fruit species, currently opening up new avenues to the processing and food service industry. The objectives of this study were to explore potential underutilized fruit varieties and its traditional value addition options, to identify the barriers in establishing the value chains and to propose new value-added products for the value chain upgradation. Market ethnography was conducted in the main fruit markets; Nuwara Eliya, Kandy, Ampara, Rathnapura, Colombo and Galle with the participation of experienced researchers. Field visits and case analysis were instrumented through photographs and in-depth interviews were conducted with key market actors. Market inventory recorded 41 underutilized fruit crops, seasonally available across various locations. Most of the varieties were available in fresh form, poor post-harvest management badly affected on quality and limited the shelf life. Underutilized seasonal fruits were transformed into dehydrated, pickled, fermented, canned, and sugared products and natural colorants were used to enhance their value and extend the shelf life. Value added products were mostly unavailable in the market but value addition using traditional preservation methods were identified at the household level. Traditional and indigenous knowledge on preservation of underutilized fruits were recorded limitedly and the technologies may disappear with the loss of knowledge bearers. Samples of various fruit species were collected to develop market-oriented value addition and recipes were developed to cater the needs of specialty market segments who search for natural ingredients and different tastes.

Keywords: Underutilized fruits, Value addition, Value creation

(ID 303)

Climate Change Research in Sri Lanka: Assessing Current Status, Identifying Gaps, and Recommending Emerging Priorities

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Abstract

Climate change poses a formidable threat to Sri Lanka, necessitating extensive research to comprehend, mitigate, and adapt to its multifaceted impacts. This abstract reviews the current state of climate change research in the country, underscores existing gaps, and proposes key priorities for future investigations. Notably, current research primarily concentrates on agriculture, water resources, and coastal ecosystems, highlighting the impacts of rising temperatures, altered precipitation patterns, and more frequent extreme weather events. Vulnerability assessments, adaptation strategies, policy frameworks, and public awareness initiatives have also been explored. Disparities in research adequacy emerge across mitigation areas, with renewable energy potential and forest and land use showing satisfactory outputs, while energy efficiency, transportation, agriculture, and waste management demand strengthening efforts. Recommendations for enhanced climate change mitigation underscore the need for detailed studies on the country's renewable energy potential to inform low-carbon energy sector policies. Strengthening research on energy consumption patterns and opportunities for efficiency improvements is crucial. Similarly, a call for intensified research on the carbon footprint of the transportation sector and sustainable transportation options is made. Local emissions factors and sequestration factors for diverse forests and land uses are identified as essential. In agriculture and livestock, emphasis is placed on researching emission profiles and sustainable practices. The waste management sector requires strengthened research on practices, methane reduction, and sustainable techniques. Carbon pricing and market mechanisms demand enhanced research on implementation and implications. Further recommendations extend to fostering innovative, climate-friendly technologies, evaluating the effectiveness of existing mitigation policies, understanding public attitudes, promoting green finance, establishing a comprehensive carbon footprint database, and exploring co-benefits of mitigation actions within broader sustainable development goals. In the realm of climate change adaptation, the need for additional studies in underrepresented areas like health, ecosystems, biodiversity, export agriculture, industry, energy, transport, tourism, human settlements, infrastructure, coastal, and marine areas is highlighted. Future research should aim for diversity in regional coverage, conduct thorough evaluations of policy implementation, and emphasize the social dimensions of climate change policy and governance. A holistic approach that incorporates multiple perspectives and engages local stakeholders is proposed to enhance the effectiveness of climate change policy and governance strategies.

Keywords: Climate change, Research, Adaptation, Mitigation, Recommendations

(ID 172)

Disaster Risk Reduction and Awareness: A Case Study on Landslide Risk Reduction in Kegalle District, Sri Lanka

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Abstract

Globally, 66 million people live in high-risk landslide areas and around 300 million people are exposed to landslides. Sri Lanka belongs to a landslide-prone geographic setting area in the Asian continent. Governments spend millions annually on disaster risk reduction, however, community awareness and involvement on this is questioned by many researchers. Thus, recognizing the landslide-prone communities and investigating their knowledge of this hazard are important in mitigating its impacts. Therefore, this study aims to investigate the community perception of landslide risk reduction strategies in the study area. A community survey using a structured questionnaire was conducted with a total sample size of 100 families. The study areas included the heavily affected five landslide-prone Divisional Secretariat Divisions (DSD) (Dehiowita, Rambukkana, Yatiyanthota, Kegalle and Warakapola) of Kegalle in 2021. The community responses to disaster awareness were analysed using basic statistics. The results revealed that the majority (88%) of participants had identified the landslides as a hazard in their areas and some participants had taken mitigation measures to reduce the impacts. Such measures were stacking sandbags against cuts, growing trees or bushes in slopes and preparing drainage ways to drain off rainwater in vulnerable sloppy areas. The month of May is the highest voted among the participants (27%) for landslide occurrence in these areas and Disaster Management Coordination Unit reports were also compatible with these results. According to the responses, disaster alert communication had several methods the most used was mass media (50%) followed by social media (41%) and government website users. Government website users accounted for up to 2% only. Interestingly, alternative ways of disaster communication were evident. Around 7% of the participants had been informed about landslides by Grama Niladhari (GN) via text messages or separate alarm systems. Disaster reporting and Knowledge on crisis management indicated that 79% of participants had knowledge of the emergency management system and 59% of participants had knowledge about emergency evacuation routes in the area. Disaster reporting was mainly done through the GN of the area (83%). It can be concluded that the Mass media and Social media play a crucial role in landslide disaster risk reduction by facilitating communication, information dissemination, and community engagement. However, as there are challenges such as misinformation, involvement in government authorities in facilitating the accurate information is vital.

Keywords: Landslides, Community awareness, Disaster risk reduction

(ID 199)

Identification of Most Suitable Tree Species for Temperature Reduction in Colombo, Sri Lanka

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Abstract

Urban areas are currently experiencing a scarcity of green spaces due to growing urbanisation, which has a significant impact on increasing air temperatures and reducing the quality of life. In the Colombo Municipal Council (CMC) area, 34 Grama Niladrari (GN) divisions out of 55 do not have the required amount of green space per person which is 9.5 m² recommended by the World Health Organization. Lands are limited in the CMC area, and it is hard to find land for a park or urban forest. Therefore, the existing trees' performance to reduce the air temperature has to be identified. This study was planned to identify the most suitable tree species for temperature reduction and was performed at the five selected GN divisions of the CMC area. The focus of the study was to evaluate the contribution of the species type in reducing the air temperature. A total of ten tree species with five replicates were used for the assessment. Air temperature was measured under the tree canopy and away from the tree canopy at three intervals (08.00 am, 12.00 pm, and 4.00 pm) over six months. ANOVA was performed to determine if there is a significant difference between the temperature reduction values and tree species type. It was identified *Terminalia catappa* (Indian Almond), *Mangifera indica* (Mango), *Terminalia arjuna* (Arjun Tree), *Albizia saman* (Rain Tree), and *Humboldtia laurifolia* (Little Amherstia) as the most suitable tree species for temperature reduction in Colombo, Sri Lanka. These tree species offer valuable insights for urban planners and policymakers seeking effective strategies to combat increasing temperatures in densely populated cities with limited green spaces. Further, it is recommended to conduct more studies to identify the contribution of tree morphology in mitigating the microclimatic variation in urban cities.

Keywords: Increasing air temperature, Urbanization, Urban tree species

(ID 211)

Mapping the Spatial Distribution of Drought Vulnerability in the North Central Province of Sri Lanka**Gunawardhana, L.M.A.P.^{1,3*}, Dharmasiri, L.M.², Ranagalage, M.M.³**¹*Faculty of Graduate Studies, University of Kelaniya, Kelaniya, Sri Lanka*²*Department of Geography, University of Kelaniya, Kelaniya, Sri Lanka*³*Department of Environmental Management, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka***pgunaw.geog2101@kln.ac.lk***Abstract**

Drought is a natural phenomenon imaged as the recurrent feature of the climate. The frequency of drought occurrence and its impacts have been increased, particularly in developing countries. Sri Lanka has experienced drought since ancient times with many losses, particularly for the farming sector. Though much research is available, there are still gaps in visualising drought vulnerability. The main objective of this research was to create a drought vulnerability map with particular reference to farming communities in the North Central Province (NCP) of Sri Lanka. Secondary data was used for this study collected from different sources such as 29 Divisional Secretariats Divisions (DSD) of the NCP and the USGS website. The Multi-Criteria Decision Making (MCDM) method and Analytic Hierarchy Process (AHP) were utilised to develop the hierarchical structure. Eight factors representing drought vulnerability and its subcomponents, i.e., exposure, sensitivity and adaptive capacity, were selected after an excessive literature review. Twenty experts' views were used to weigh the selected eight factors. Eight thematic map layers were created using Geographic Information System (GIS) Arc map 10.8 software. The weighted overlay technique was used to create the final drought vulnerability map for the NCP. The results found that 12%, 26%, 24%, 26% and 13% of the total land area of NCP belong to categories of very low, low, moderate, high and very high, respectively, in terms of drought vulnerability. Kahatagasdigilya Horowpothana DSD belongs to the very high drought vulnerability category. Palagala, Galenbindunuwewa, Rambewa, Medawachchiya, Kebithigollewa, Padaviya and Medirigiriya DSD are correlated with the high drought vulnerability category. Southern parts of the NCP belong to very low, low and moderate drought vulnerability classes. Selected eight factors have contributed to drought vulnerability in different proportions where rain-fed agricultural land areas, the number of dependents, and land use and land cover have become first (20%), second (18%) and third (14%) places, respectively, according to priority weight. These results will help decision-makers.

Keywords: Adaptive capacity, Drought, Exposure, Sensitivity, Vulnerability

(ID 026)**Estimation of Above-Ground Biomass using Vegetation Indices in a Selected Mangrove Vegetation in Thambalagam Bay, Trincomalee****Jeyapalu, J.*, Weerasinghe, V.P.A.***Department of Zoology and Environmental Management, University of Kelaniya, Kelaniya, Sri Lanka***jevalusaimathini@gmail.com***Abstract**

Mangroves are extremely productive ecosystems along the coast that help to mitigate climate change by absorbing carbon dioxide from the atmosphere. Understanding the carbon storage capacity is critical for assessing these ecosystems' resilience and vulnerability to climate change. The aim of this study is to estimate carbon dioxide (CO₂) absorption by mangroves and to find the equation to derive AGB using the best vegetation index for mangrove forest in the selected site of Thambalagam Bay using GIS and remote sensing techniques. The purposive sampling method was used to select a site from the mangrove forest around Thambalagam Bay in Trincomalee District. A field survey was carried out in the selected and the site was divided into five strata based on the species' dominance and named according to the dominant species. The five stratas are *Avicenia marina*, *Rhizophora*, Multispecies, *Lumnitzera racemosa*, *Avicenia officinalis*. The fishnet tool divided each stratum into plots (10m×10m). Twenty sampling plots were taken based on Simple random sampling. AGB was calculated using allometric equations of each mangrove species in each plot. Finally, the total AGB of each stratum was calculated as (ton/ha). The above-ground carbon stock and CO₂ absorption for each stratum were calculated as (ton/ha) using empirical equations; (AGC = AGB × 0.47), (Total CO₂ absorbed = AGC (ton/ha) × 44/12). Vegetation indices (NDVI, SAVI, GNDVI, RVI) maps of the selected site for the year 2022 were prepared using ArcMap 10.8. Polynomial regression analysis between vegetation indices and AGB was carried out to find the best vegetation index to predict AGB using Minitab 17 statistical software. The best vegetation index was selected based on the high R² value. Results of the polynomial regression analysis show NDVI had a strong correlation ($AGB = 7232 - 20420NDVI + 14482NDVI^2$; $r^2=92.10\%$) with above-ground biomass (AGB) in the Thambalagamam Bay mangrove forest. Increasing order of total absorbed CO₂ relevant to stratum are *Lumnitzera racemosa* (186.195 ton/ha), Multi species (439.858 ton/ha), *Rhizophora mucronata* (453.825 ton/ha), *Avicena officinalis* (675.937 ton/ha), *Avicena marina* (2635.572 ton/ha). In total, 4391.387 ton/ha of CO₂ was absorbed by the selected site of the mangrove forest around Thambalagam bay. The study highlights the importance of efforts to preserve the long-term survival of mangrove ecosystems in the face of global climate change.

Keywords: Mangrove, Above-ground biomass (AGB), Above-ground carbon stock (AGC), CO₂ absorption, Climate change

(ID 027)

Carbon Footprint of the Divisional Secretariat Office, Galewela, Sri Lanka

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Abstract

Global warming (GW) poses a significant concern in the world today. Most of this warming is found to be caused by human-generated greenhouse gas (GHG) emissions. To address this issue, it is essential to calculate Carbon Footprint (CFP), as a valuable first step towards quantifying emissions and implementing measures to reduce them. The CFP provides insight into how individuals, organizations, countries, and the world are responding to the challenge of GW. Many different types of organizations, including universities, fire brigades, rescue services, food manufacturers, hotels, and hospitals, are now estimating their CFP. Among these, divisional secretariat offices play a significant role in serving the general public and are actively involved in addressing the impact of GW on local level. Therefore, the main objective of this study is to quantify the CFP of the organization with special reference to the divisional secretariat office, Galewela, and subsequently develop an emission reduction plan while estimating the impact of COVID-19 pandemic on organizational CFP. First, organisational, and operational boundaries were estimated based on GHG protocol. Activity data were collected across three distinct scopes: scope 1 encompassed office-owned vehicle transportation, disposal of food and paper waste, and the use of liquid petroleum gas; scope 2 involved purchased electricity; and scope 3 covered employee commuting and water usage. Information was gathered from 2018 to 2022 time period using bills, data sheets, personal communication, and questionnaires. The CFP of each emission source and activity was calculated in t CO₂e/year by multiplying activity data with emission factors developed according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Results showed that the Galewela Divisional Secretariat has a total CFP of 49.6 t CO₂e/year including 11.4, 7.2, and 31.0 t CO₂e/year under scopes 1, 2, and 3 respectively. Employee commuting contributes to the highest CFP, accounting for 60% of the total. Transportation of office-owned vehicles (21%) and electricity consumption (15%) show the second and third highest, while all other sources represented less than 5% of total CFP in this office. The emission reduction plan revealed that 44.5% of CFP can be reduced by switching all employees to public transportation (29.5%) and installing solar panels (15%) in this office. Furthermore, during the COVID-19 pandemic, the CFP of electricity consumption decreased, while the CFP of transportation by office vehicles increased compared to the previous period, indicating a significant influence of the pandemic on the total CFP of this organization.

Keywords: Carbon footprint, Global Warming, Greenhouse gases

(ID 014)

Assessment of Urban Heat Island Effect Through Land Use Analysis and Surface Temperature Based on Satellite Imagery: A Case Study in Gampaha District

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Abstract

Rapid population growth and extensive development associated with urbanization exert notable influence on the environment and climate. Gampaha District, the second most populous district and administrative region, exemplifies such urban expansion. This study aims to scrutinize these dynamics, offering insights for future planning. The focus lies on assessing the urban heat island effect in Sri Lanka's Gampaha District through land use analysis using land surface temperature (LST). The approach involves generating land use and land cover maps for 2000 and 2021, alongside computing normalized difference vegetation index (NDVI), normalized difference built-up index (NDBI), and LST through satellite imagery. The relationships among these variables were analyzed. The findings unveiled an inverse relationship between NDVI and LST, while a direct association emerged between NDBI and LST. Regions with elevated LST, including Negombo, Katunayake Airport, Sapugaskanda Power Station, Biyagama, Yudaganavi Power Plant, Kadana, Kelaniya, and Wattala, were identified as heat spots. The extent of LST hotspots expanded by 4.84% in 2021 compared to 2000, primarily concentrated in the western sector of Gampaha District. In 2000, cold spots were primarily situated in the northern part of the district, yet by 2021, they had shifted to the southeastern region such as Alawala, Meethiriyala and Urapola. Built-up areas exhibited an average LST rise of 6.85% from 2000, with commercial and residential sectors experiencing a 1.69% increase. The narrative underscores that the population growth from 2000 to 2021 resulted in increased urbanization, reduced vegetation, and agricultural land loss being one of the contributing factors to these impacts. These findings highlight the necessity for strategic urban planning to counteract the heat island effect and its implications. Initiatives like advocating green spaces, enacting sustainable urban design, and fostering a resilient environment become imperative for Gampaha District.

Keywords: Gampaha district, LST, LULC change, NDBI, NDVI, Urban heat island

(ID 191)

**Climate Change Vulnerability and Adaptive Capacity of Small-Scale Farmers in Imbulpe
District Secretariat Division, Belihuloya**

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Abstract

Climate change has caused a significant threat to various economic sectors worldwide, with the notable impact on agriculture. Sri Lanka is one of the countries negatively affected by climate change due to its high exposure to extreme events and low adaptive capacity. Particularly vulnerable is the agriculture sector which is pivotal for the livelihood of smallholder farmers engaged in paddy and vegetable cultivation. The objectives of this study were to examine how climate change was perceived by farmers and how their farming practices were adapted in response to perceived changes in climate. Data was gathered from 100 small-scale paddy and vegetable farmers residing in seven Grama Niladari (GN) divisions within the Imbulpe Divisional Secretariat (DS) division of Rathnapura District. A structured questionnaire and in-depth interviews were key data collection tools. The findings of the study revealed a widespread awareness of climate change among the farming community in the study area and adjustments were made by farm households to adapt their agricultural practices in response to climatic change. Within the sampled group, 60% of farmers possess land holdings of one acre or less for their agricultural practices. Of the sample, 62% reported encountering variations in rainfall patterns during both the Yala and Maha seasons. These climate changes typically resulted in decreased yields, increased occurrences of pests and diseases, and water shortages. Adaptation methods, such as Changing crop types, changing planting dates, and changing fertilizers, were commonly employed in response to climatic change. However, 42% of farmers had no strategies to cope with climate change. Additionally, the study identified several constraints that hindered the process of adaptation to climate change. These limitations included insufficient access to information, financial constraints, and a lack of knowledge regarding effective climate change adaptation methods in the study area. Based on these results, it is evident that there is a pressing need for increased investment in farmer education and the establishment of more robust institutional support systems for climate change adaptation.

Keywords: Climate change, Adaptation strategies, Small scale farmers, Perceived awareness

(ID 054)

Identification of Annual and Seasonal Trends of Extreme Temperature and Precipitation in the Intermediate Zone, Sri Lanka from 1981 to 2019

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Abstract

This study focuses on the Intermediate Zone (IMZ) in Sri Lanka, a region with diverse ecological and socio-economic characteristics. The main objective is to analyse annual and seasonal trends in extreme events of temperature and precipitation to better comprehend the potential impacts of climate change in this area. From 1981 to 2019, the daily maximum and minimum temperature and precipitation data were collected from the Department of Meteorology, Sri Lanka, as temperature data in four locations and precipitation data in six locations based on the maximum data availability. The analysis utilized sixteen extreme temperature indices and twelve extreme precipitation indices as defined by ETCCDI via RClimDex software. The Mann-Kendall trend test and regression analysis were employed for trend identification. The trend analysis of annual and seasonal as Yala and Maha revealed significant changes in daytime and night-time temperatures. Analysis of selected indices indicates that the daytime temperature has decreased significantly in Monaragala both seasonally and annually. Similarly, the number of days with cooler days has increased significantly in the Maha season. Badulla, the location that is adjacent to Monaragala, showed a similar pattern annually. However, by shifting the IM zone to the North-western part of the country, the temperature behaves differently. Kurunegala and Batalagoda experienced a significant decrease in the number of days with cooler daytime temperatures. Night-time temperatures behave differently than daytime temperatures in the IM zone. Badulla and Monaragala demonstrated a significant rise in night-time temperature patterns, while also experiencing decrease in the number of cooler days annually. The temperature difference between day and night decreased in Badulla and Monaragala while increasing in Batalagoda, both annually and seasonally, indicating both negative and positive impacts on agriculture. The annual mean daytime temperature (TMAXMEAN) showed a significant decreasing trend throughout the IM zone, while the mean night-time temperature (TMINMEAN) showed both increasing (Monaragala, Kurunegala) and decreasing (Batalagoda) trends annually as well as seasonally. Over the past 30 years, there have been no significant changes in precipitation, both annually and seasonally, in all the selected locations, and it is expected to continue this trend in the future. Over the study period, the Intermediate Zone in Sri Lanka experienced significant changes in extreme temperature indices. The daytime has become both warm and cool according to the location, and the night-time has become warm throughout the IM zone.

Keywords: Extreme, Intermediate zone, Precipitation, Sri Lanka, Temperature

(ID 205)

Assessment of the Vulnerability of Paddy Cultivation to Impacts of Climate Change in Kurunegala District in Northwestern Province, Sri Lanka

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Abstract

Rice serves as the staple food for most of the Sri Lankans, playing a crucial role in ensuring the country's food security. Climate change has brought about some negative impacts on paddy cultivation in Sri Lanka. This study aims to assess the vulnerability of paddy cultivation to the negative effects of climate change in Kurunegala District, Northwestern Province, Sri Lanka. A combination of secondary and primary data was employed in this study. Secondary data encompassed the analysis of average annual and monthly rainfall and temperature variations in Kurunegala District from 2010 to 2020, as well as the occurrence of droughts and floods in the same period. Additionally, the study examined the variations in average annual paddy yield in Kurunegala District from 2010 to 2020. For primary data collection, Climate Change Vulnerability Indices (CCVI) were employed, which included indicators, exposure, sensitivity, and adaptive capacity. Under the exposure indicator, climate exposure, biophysical exposure, and biological exposure were considered. Sensitivity was assessed through social, financial, and farm sensitivity sub-indicators, while adaptive capacity was evaluated using socio-economic, agricultural, and institutional capacity sub-indicators. The field sampling focused on divisions with significant paddy lands that depend on minor irrigation and rainfed cultivation, such as Mahawa and Narammala. Mawathagama, which had fewer paddy lands and a population engaged in non-paddy-related activities, was used as a control. Two Grama Niladhari (GN) divisions from each selected Divisional Secretariat (DS) division were randomly chosen for detailed sampling. In each GN division, 50 families were randomly selected to participate in semi-structured questionnaire surveys supplemented with focus groups discussions and key informant surveys. The collected data were used to create a vulnerability map for Kurunegala District through GIS analysis. The study results revealed that while the annual maximum and average temperatures from 2010 to 2020 did not exhibit significant variations, the annual minimum temperature demonstrated an upward trend. In terms of vulnerability, Narammala DSD exhibited the highest vulnerability followed by Maho DSD with the lowest vulnerability observed in Mawathagama DSD.

Keywords: Climate Change, Paddy Cultivation, Adaptation Measures, Vulnerability Assessment, Kurunegala

(ID 181)**A Geospatial Analysis of Demarcating Landslide Susceptibility and Risk Assessment for Landslide Disaster Management: A Case Study of Rathnapura District****Kokawalage, I.T.H.^{1*}, Jayasinghe, K.D.P.P.***Department of Geography, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**[*isinithisara@gmail.com](mailto:isinithisara@gmail.com)***Abstract**

Natural hazards are environmental phenomena that can significantly impact society and the surrounding ecosystem. In Sri Lanka, landslides are recognized as a major natural hazard, with nearly 20,000 km² spanning ten districts susceptible to landslides. Rathnapura District has historically experienced a high incidence of landslides. This study utilizes Geographic Information System (GIS) and multicriteria evaluation to identify landslide susceptibility and high-risk zones, providing geospatial insights aimed at mitigating adverse consequences on lives, property, and the environment. The study identifies slope, elevation, topographic wetness, vegetation cover, and annual average rainfall as the primary physical and environmental factors influencing landslide susceptibility. Employing Analytical Hierarchy Process (AHP) for ranking these factors, areas susceptible for landslides within the Rathnapura District were identified through geospatial analysis. Analysis revealed that Kalawana, Imbulpe, Rathnapura and Balangoda DSDs (District Secretariat Divisions) are the major four high susceptible zones for landslides than other ten DSDs of Rathnapura District. Assessing the vulnerability of landslides is crucial for mitigating impacts and minimizing damages to lives, property, and environment. Therefore, considering factors like built-up areas, road networks, and population data, this study identified socio-economic vulnerable zones within a 1,000 m buffer zone of highest four landslide-susceptible areas. Specifically, GNDs (Grama Niladhari Divisions) where susceptibility 50% or more out of area of the GNDs were selected for the vulnerability analysis. Out of the overall 308 GNDs, this research identified 96 GNDs as high landslide-vulnerable zones in four high susceptible DSDs. All 96 highly vulnerable GNDs have some level of landslide risk, as they meet at least one of the socio-economic vulnerability analysis criteria. As a non-structural mitigation approach for landslides, the results of this geospatial analysis can guide the implementation of structural mitigations in both susceptible and high-risk zones. This serves as the initial step in the disaster management cycle, ultimately enhancing disaster preparedness and prevention efforts.

Keywords: Landslide, Susceptibility, Geo-spatial approach, Analytical hierarchy process, Vulnerability

(ID 193)

GIS-Based Approach to Identify High Risk Zones for Floods and Evacuation Centres

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Abstract

Urban areas are vulnerable to both natural and man-made disasters, which can put the lives of the population at risk. In order to protect them, an effective evacuation plan must be in place. This research study proposes a GIS-based system that utilizes a multi-criteria analysis method to identify safe areas for evacuees and determine the best evacuation routes from the disaster site to the designated safe areas. The aim is to minimize the time required for the evacuation process to be completed. Jaffna is one of the areas that suffer from seasonal flood disaster annually. The suitability of evacuation centres can be determined based on several criteria such as Elevation, LULC pattern, distance from road, distance from water bodies, slope and rainfall. The aim of the study was to identify suitable evacuation centres after calculating required resources for all evacuees, create short and safe routes for navigation in a disaster situation. ArcGIS Pro main software was used for final route analysis along with network analysis tools and ArcMap package was used for all layer creation and multi-criteria analysis. Multi-criteria evaluation method was chosen to analyse the suitable areas and Analytical hierarchical process was used to assign the weights for each primary criterion. Those are providing suitable evacuation centres with 80% validity and found the route risk zones to evacuation centres. The weights for primary criteria were assigned by using pairwise comparison matrices. All these layers were overlapped according to their weights and final suitable weighted overlay map was prepared and it was reclassified as 1, 2, 3, 4 and 5 where 1 is less rating and 5 is high rating. More suitable locations were found as the best evacuation centres. Closest evacuation shelter area from all flood hazard regions were identified by using closet facilities under the network Analysis. Hazard residents was taken as incidents and evacuation buildings Points are chosen for facilities. Nearest evacuation shelter facility for a hazard area was identified by analysing the attribute table of routes in closet facilities. The result of the study suggests a number of disaster management processes for the administration and general public.

Keywords: Flood, Risk, GIS, Analytical hierarchical process, Disaster management

(ID 223)

Sustainability Measures Under Implementation of SDG 13 by Selected Regional Plantation Companies in Sri Lanka

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Abstract

Climate change has been one of the greatest threats the world has ever faced. The primary factor driving climate change is the increased emission of greenhouse gases, with carbon dioxide (CO₂) being the most prominent among them. This study aimed to assess the sustainability measures taken by three leading regional plantation companies in Sri Lanka in achieving the Sustainable Development Goal 13, focusing on mitigation of CO₂ emissions from energy consumption. CO₂ emissions from electricity consumption and fossil fuel use (diesel, petrol, and liquid petroleum) were calculated, and the eco-efficiency of each company was determined. The trends in waste generation were also studied. The study period spanned from April 2017 to October 2022, and data were collected with the assistance of sustainability officials of the respective companies. The results showed that all three companies were able to reduce CO₂ emissions from energy consumption per kg of the final product of tea and increase eco-efficiency over time. However, the findings also revealed that CO₂ emissions from fossil fuel usage had an increasing trend in all three companies, while CO₂ emissions from electricity had a decreasing trend. Waste generated per 1kg of the final product of tea had an increasing trend in two companies, but company C was able to reduce the trend. Solid waste can directly contribute to greenhouse gas emissions by generating methane through the anaerobic decay of waste in landfills. The findings of the current study help in understanding the sustainability trends in tea industry and highlight the importance of reducing fuel and electricity consumption to achieve SDG 13, as CO₂ emissions are a major cause of climate change. The selected companies have also implemented biodiversity conservation and reforestation programs to support the fight against climate change, and all three companies have the rainforest alliance certificate. Deforestation needs to end in the country in order to mitigate the climate crisis. Despite the positive steps taken, there is still room for improvement in achieving the SDGs by these companies by 2030. Therefore, the findings suggest that continuous evaluation and improvement of sustainability measures are necessary for regional plantation companies to contribute effectively to achieving the SDGs.

Keywords: SDG 13, Energy consumption, CO₂ emissions, Waste generation, Climate change

(ID 197)

Seasonal Spatiotemporal Changes in the NDVI and its Driving Forces in Wuliangsu Lake Basin, Northern China from 1990 to 2020

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Abstract

In the context of global climate change, many studies have focused on the inter-annual vegetation variation trends and their response to precipitation and temperature, but ignored the effects of seasonal variability. This study explored the relationship between normalized difference vegetation index (NDVI) and seasonal climate elements in the Wuliangsu Lake Basin area from 1990 to 2020 and quantified the impacts of human activities on vegetation dynamics. We used Landsat series data to analyse the spatial and temporal variation of the NDVI using the trend analysis method, the Theil–Sen median, the Mann–Kendall test, and the Hurst index. Then, we used meteorological data and land use data to quantify the effects of human activities using residual analysis, and correlation methods to determine the driving forces of NDVI variations. The results showed that the NDVI changes presented obvious regional characteristics, with a decreasing trend from southeast to northwest in Wuliangsu Lake Basin. Due to global warming, the start of the growing season (SOS) is 4.3 days (2001 to 2010) and 6.8 days (2011 to 2020) earlier compared with 1990 to 2000. The end of the season (EOS) is advanced by 3.6 days (2001 to 2010) and delayed by 8.9 days (2011 to 2020). Seasonal (spring, summer, autumn, and winter) NDVIs with precipitation and temperature show spatial heterogeneity. Further, changes in grasslands and woodlands were vulnerable to climate change and human activities. Since the beginning of the 21st century, human activity was the driving force for vegetation improvement in the Dengkou, west-central, north and southwest regions, where ecological instability is weak. This finding can provide a theoretical basis for the implementation of the same type of ecological restoration projects and the construction of ecological civilization, and contribute to the regional green and sustainable development.

Keywords: Climate change, Driving forces, Human activities, Seasonal spatiotemporal changes, Wuliangsu Lake Basin

(ID 105)

Assessment of Soil Carbon Stocks in Selected Freshwater Urban Wetlands in Colombo District, Sri Lanka

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Abstract

Wetlands have a high potential to sequester atmospheric carbon and can play an important role in climate change mitigation. Vegetation parameters and climatic conditions have a direct influence on the capacity of carbon stock in wetlands and the carbon sequestering process is linked to the productivity and decomposition rate. The current study assessed the carbon stock capacity of two wetlands in the Colombo district. These were the Green Isle urban wetland (part of the Bellanwila-Attidiya sanctuary), which is a wetland undergoing restoration and the Beddagana urban wetland, a successfully restored wetland of the Colombo Ramsar wetland complex. The current study had two main objectives: firstly, to assess and compare the soil carbon stock capacity in two urban wetland areas (one successfully restored, the other undergoing restoration). Secondly, to compare the carbon stock capacity of freshwater urban wetlands in the Colombo district with that of other tropical ecosystems. The study was conducted from December 2022 to February 2023. Soil samples were collected at depths of 0-20 cm and 20-40 cm from the soil surface and obtained from four plots in Green Isle and five in Beddagana. The loss of ignition method was used to calculate soil organic carbon (SOC) concentration. Soil organic matter (SOM), soil bulk density, and soil depth were determined for calculating carbon stock. The estimated average carbon stock up to a depth of 40 cm in the Green Isle urban wetland was 245 ± 5 C/ha. Regarding Beddagana urban wetland, three ecosystem types were identified: shrubland, marshland, and woodland. The average carbon stock up to 40 cm depth in the three ecosystems was 315 ± 5 t C/ha, 493 ± 6 t C/ha, and 513 ± 3 t C/ha respectively. The overall average carbon stock up to 40 cm depth in the Beddagana urban wetland was estimated at 441 ± 4 t C/ha. The study revealed that the soil organic carbon stock capacity of the restored urban wetland surpasses that of the wetland currently undergoing restoration. Comparison with studies on other tropical terrestrial ecosystems showed that the urban wetlands under study held relatively higher carbon reservoirs. The vegetation cover and human disturbance on the soil influenced the diversity seen within the two sites and between them. The study highlights that within the Colombo district, restored freshwater urban wetlands in particular are important for climate change mitigation as they have a higher soil organic carbon stock capacity.

Keywords: Urban wetlands, Climate change, Mitigation, Carbon stock, Carbon sequestration

(ID 146)

Determining the Uncertainty of Changing Onsets of Major Crop Growing Seasons in Sri Lanka: A Spatial-Temporal Modelling Approach**Bandara, A.L.J.¹, Herath, H.M.L.K.^{1*}, Kadupitiya, H.K.²**

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Abstract

Agriculture globally faces a serious threat from climate change, with Sri Lanka being especially vulnerable. The nation's rich agricultural culture is in risk because of its heavy reliance on rice cultivation. To overcome these challenges and increase agricultural output, it is critical to understand how climate change affects growing seasons and thus changes in crop management. The main objective of this study was to assess long-term changes of the onset of major crop-growing seasons in Sri Lanka in time and space. The specific objective is to identify vulnerable areas with respect to changes in crop-growing seasons in Sri Lanka. The study utilized a dataset over 47-years that included daily rainfall data gathered from 22 agro-meteorological stations. The dataset was divided into two distinct data sets: the base period (1976-2000) and the second period (2001-2022). To determine the best-fitting probability distributions, onset weeks were fitted with four different probability distributions: Gaussian, gamma, Weibull, and exponential. Then, using statistical indicators such as the Akaike information criterion (AIC), Bayesian information criterion (BIC), and goodness of fit, a best-fit probability distribution was identified. The parameter estimation for early onset and late onset followed afterwards. The spatial variance in the onset of growing seasons was further interpolated and visualized using the acquired probability values. This comprehensive technique gave an in-depth understanding of the effects of climate change on agriculture in Sri Lanka. Significant inter-period variations in the probability of early and late onsets throughout the Maha and Yala seasons were found in the study across several Sri Lankan locations. The probability of early and late onsets varied noticeably; in the base period, certain areas were more likely to experience early onsets, whereas the Dry Zone was more likely to experience late onsets. Furthermore, in the second period, the Dry Zone showed increased likelihoods of early onsets during the Yala season. The study highlighted differences in late onsets' occurrences both temporally and spatially during both Yala and Maha seasons. Therefore, the study highlights the impact of climate change on agriculture in Sri Lanka, specifically in terms of changes in the onset of growing seasons, and the need for farmers to adapt their cultivation practices and select suitable crop varieties to optimize crop growth and yield accordingly.

Keywords: Maha, Onset, Probability distribution, Spatial variation, Yala

(ID 218)

Assessment of the Vulnerability of Paddy Cultivation to Impacts of Climate Change in Anuradhapura District in North Central Province, Sri Lanka

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Abstract

Anuradhapura District in Sri Lanka heavily relies on paddy cultivation and plays a significant role in the country's paddy production. Given the grave threat posed by climate change to paddy cultivation in this region, it is crucial to assess its vulnerability. This study aims to fill the gap in sub-national vulnerability assessments by determining the degree of vulnerability and mapping it in the district. A combination of secondary and primary data was employed in this study. Secondary data encompassed the analysis of average annual and monthly rainfall and temperature variations in Anuradhapura District from 2010 to 2020, as well as the occurrence of droughts and floods in the same period. Additionally, the study examined the variations in average annual paddy yield in Anuradhapura District from 2010 to 2020. For primary data collection, Climate Change Vulnerability Indices (CCVI) were employed, which included indicators, exposure, sensitivity, and adaptive capacity. Under the exposure indicator, climate exposure, biophysical exposure, and biological exposure were considered. Sensitivity was assessed through social, financial, and farm sensitivity sub-indicators, while adaptive capacity was evaluated using socio-economic, agricultural, and institutional capacity sub-indicators. The field sampling focused on divisions with significant paddy lands that depend on minor irrigation and rainfed cultivation, such as Thirappane and Kahatagasdigiliya. Nuwaragam Palatha Central which had fewer paddy lands and a population engaged in non-paddy-related activities, was used as a control. Two Grama Niladhari (GN) divisions from each selected Divisional Secretariat (DS) division were randomly chosen for detailed sampling. In each GN division, 50 families were randomly selected to participate in semi-structured questionnaire surveys supplemented with focus group discussions and key informant surveys. The collected data were used to create a vulnerability map for Anuradhapura District through GIS analysis. The study results revealed that the annual rainfall showed a decrease from 2010 to 2020. Other parameters did not show significant variation. In terms of vulnerability, Kahatagasdigiliya DSD exhibited the highest vulnerability followed by Thirappane DSD. The lowest vulnerability was observed in Nuwara Gampalatha Centre DSD.

Keywords: Climate change, Paddy cultivation, Adaptation measures, Vulnerability assessment, Anuradhapura

(ID 268)

Preliminary Indications on an Atmospheric Particulate Matter and Rainwater Chemistry in Colombo, Sri Lanka: A Study During Southwestern Monsoon

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Abstract

The atmospheric cleansing nature of rainfall, specifically in the removal of particulate matter, is a determinant of rainwater quality. This study investigated the relationship between atmospheric particulate matter (PM₁₀) concentration and rainwater quality in Colombo during the southwest monsoon period in 2023. The rainwater samples were collected using a manually prepared high-density polyethylene collector and analysed for pH, electrical conductivity (EC), water-soluble cations (Na⁺, K⁺, Ca²⁺, Mg²⁺, and NH₄⁺), and anions (Cl⁻, NO₃⁻, and SO₄²⁻). The concentration of atmospheric PM₁₀ was obtained from the ambient air quality monitoring station (AQMS) at Battaramulla. The measured data were analysed using multivariate statistical techniques, including principal component analysis and Pearson correlation analysis, to identify relationships between the concentration of atmospheric PM₁₀ and rainwater quality. The atmospheric PM₁₀ showed an insignificant positive correlation with southwest monsoon rainfall ($r=0.14$, $p>0.05$). The concentration of atmospheric PM₁₀ increased the total concentration of water-soluble ions ($r=0.30$) and decreased the pH ($r=-0.42$) and electrical conductivity ($r=0.07$) of rainwater samples. The concentration of Na⁺, K⁺ and Ca²⁺ displayed moderate positive correlation, while Mg²⁺, NH₄⁺, Cl⁻, NO₃⁻ and SO₄²⁻ showed a weak positive correlation of rainwater samples in the atmospheric PM₁₀. This study contributes valuable insights into the variations of PM₁₀ in the atmosphere and its potential implications on rainwater quality in southwest monsoon, underscoring the importance of comprehensive analyses for a more nuanced understanding of the intricate relationships between atmospheric components and rainwater chemistry.

Keywords: Atmospheric chemistry, Correlation analysis, Particulate matter, Rainwater quality, Southwest monsoon

(ID 070)

Total Lipid Content and Fatty Acid Composition of Two Morphologically Distinct *Chlorella* sp. for Biodiesel Production

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Abstract

This study investigated the potential of two morphologically distinct *Chlorella* spp. to assess the total lipid content and fatty acid composition targeting biodiesel production. Due to their rapid growth, less space requirement, and zero-conflict with current food demand, green microalgae-led biodiesel production has gained a key attention as an alternative, sustainable and eco-friendly substitute for fossil fuels diminishing the increased demand for fossil fuels, fuel prices and excessive release of greenhouse gases to the atmosphere. The *Chlorella* spp. were isolated from Beire Lake, Colombo (Wet Zone) and Kiriibban Lake, Monaragala (Dry Zone) of Sri Lanka. They were named as BCS1 and RCS2, respectively. Semi-mass culturing of *Chlorella* spp. in BG-11 medium (pH=7.5-8.5) was carried out in a greenhouse providing aeration and a 12:12 light: dark photoperiod. After 4 weeks, *Chlorella* sp. were harvested using aluminium sulphate, employing flocculation method. Harvested biomass was oven-dried and made into a fine powder for analysis. The total lipid content (TLC) of *Chlorella* spp. was determined using *n*-hexane as the extraction solvent in a soxhlet extractor maintaining three replicates for each. Extracted lipids were dried in a rotary evaporator and TLC was calculated gravimetrically. The total lipid content of BCS1 and RCS2 was recorded as 15.67% and 18.33%, respectively. After quantification, lipids were resuspended and concentrated in 1 mL of *n*-hexane to convert into fatty acid methyl esters (FAMES)/ biodiesel via a transesterification reaction. The trans-esterified lipids (FAMES) were analysed via Gas Chromatography. The most dominant FAMES of BCS1 were palmitic acid (C16:0), oleic acid [C18:1 cis (n9)], stearic acid (C18:0), lignoceric acid (C24:0), lauric acid (C12:0) and myristic acid (C14:0). The most dominant FAMES of RCS2 were cis-10-pentadecenoic acid (C15:1), elaidic acid [C18:1 trans (n9)], linolelaidic acid [C18:2 trans (n6)], cis-11-eicosenoic acid [C20:1 (n9)], lignoceric acid (C24:0) and oleic acid [C18:1 cis (n9)]. A well-balanced saturated and unsaturated FAME composition is essential for the optimal biodiesel quality, herein it was found in BCS1 with 41.62% of palmitic acid and 33.38% of oleic acid. Higher percentage of oleic acid exhibits a combination of oxidative stability and low temperature properties determining the suitability of BCS1 as a biodiesel feedstock compared to RCS2. In conclusion, even though RCS2 has a higher total lipid content, BCS1 exhibits more favourable characteristics in its FAME composition as a promising feedstock for biodiesel production.

Keywords: Green microalgae, *Chlorella* sp., Total lipid content, Lipid composition, Biodiesel

(ID 253)

Lipid Yields and Fatty Acid Composition of Indigenous Microalgae, Isolated from the Beira, and Diyawanna Urban Lakes, for Sustainable Biofuel Production in Sri Lanka

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Abstract

Biofuels are carbon-neutral combustibles produced from renewable biomass. Third generation biofuels, derived from microalgal biomass, are distinctly superior to their preceding generations, due to higher productivity and resource use efficiency of microalgae compared to conventional energy crops. It is a viable source of sustainable energy for our country due to the availability of water, ambient temperatures and year-round sunlight needed for microalgae cultivation, and most importantly, the abundance of diverse microalgae species. However, these native microalgae are relatively unexplored for their productivities and thereby, greatly underutilized. This research was aimed to investigate the lipid yields and fatty acid compositions of local freshwater microalgae, and to identify their potential for biodiesel production. This was carried out by (1) microalgae isolation and morphological identification (2) microalgae cultivation (3) biomass harvesting, lipid extraction, gravimetric measurement of extracted lipids and (4) acid-catalysed transesterification, followed by GCMS analysis of the biodiesel product. *Chlorella* sp., *Chlorococcum* sp. and *Chlamydomonas* sp. were isolated from Beira/ Diyawanna Lakes using streak plate technique in solid standard BBM media. They were next cultivated under axenic conditions in liquid standard BBM media under 16: 8 (light: dark), at 25°C for 20 days in duplicates. The biomass was then harvested using alum, dried to reach a constant weight and the Bligh and Dyer lipid extraction was done in triplicate. The extracted lipids were trans-esterified with methanol, using sulfuric acid catalyst at 90° C for 60 minutes. The separated product was analysed by GCMS. *Chlorella* sp., *Chlorococcum* sp. and *Chlamydomonas* sp. cultivated under standard conditions gave average lipid yields of 11.34±1.01%, 15.00±1.40% and 2.10±0.50% respectively. Average lipid yield of *Chlamydomonas* sp. was significantly lower than the other two species at 95% confidence level (Two-sample T test on SPSS Version 21). GCMS analysis of the biodiesel product from *Chlorella* sp. indicated significant levels of saturated fatty acids including palmitic and stearic acids, monounsaturated fatty acids like cis-11-eicosenoic acid and polyunsaturated fatty acids including linoleic and linolenic acids. The fatty acid ratios were used to calculate the saturation value, cetane number, density, iodine value and pour point of the produced biodiesel. These quality parameters were in accordance with the ASTM D6751- 20a standards. Therefore, with a substantial yield and fatty acid composition of intracellular lipids, this local species of *Chlorella* can be a prospective candidate for sustainable bioenergy production in Sri Lanka.

Keywords: *Chlorella*, *Chlorococcum*, *Chlamydomonas*, Microalgal lipids, Biodiesel

(ID 272)

Optimizing Vertical-Axis Wind Turbine Performance and Determining Optimal Velocity and Deflector Configuration Based on Wind Speed

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Abstract

In the realm of wind energy harnessing, Vertical-axis Wind Turbines (VAWTs) have emerged as promising alternatives. However, they face persistent challenges due to their low efficiency and poor self-starting properties. This study addresses these limitations and aims to unlock the full potential of VAWTs by conducting a comprehensive investigation. The focus of this research lies in determining the optimal operating velocities to enhance the performance of Savonius-type VAWTs, leveraging advanced deflectors. The study delves into an in-depth analysis of the optimal deflector distances and angles for the turbine, taking into account different geographical areas with varying wind velocities. To achieve this, a Savonius-type VAWT equipped with advanced wind deflectors was meticulously designed and tested. Utilizing SOLIDWORKS software, sophisticated turbine models were crafted, which were then subjected to rigorous analysis using ANSYS Fluent, Computational Fluid Dynamics (CFD) software. The research methodology involved conducting simulations across a range of wind velocities, spanning from 1 ms^{-1} to 8 ms^{-1} , and changing the deflector distance from 100 cm to 150 cm from the centre of the turbine, and the deflector angle from 12 to 45 degrees. During the simulations, critical indicators of turbine performance, including moment coefficient, moment, force coefficient, and force acting on the blade, were closely examined. The study uncovered significant variations in the power output of the Savonius-type vertical-axis wind turbine (VAWT) fitted with an advanced deflector system, especially at lower wind speeds. Notably, the study revealed that at different wind velocities, the optimum deflector configuration changed, with the highest energy-generating capacity observed at 1 m/s for the wind turbine equipped with advanced deflectors. Outperforming the turbine lacking a deflector system, this inventive method demonstrates the capacity to notably boost energy generation. This novel method underscores the capacity for substantial improvements in energy production. Additionally, the research offers valuable insights into customized deflector distance and angle combinations, optimizing turbine performance for specific wind velocity ranges. By strategically positioning the deflectors, higher energy output can be achieved, making the VAWT system more adaptable and efficient across diverse wind conditions.

Keywords: Vertical-axis wind turbine, Wind deflectors, Computational Fluid Dynamics, SOLIDWORKS, ANSYS Fluent

(ID 007)

Applications of Geothermal Energy for Desalination: A Review Technological Advancement and Water Security

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Abstract

Geothermal energy, harnessed through the Earth's thermal resources, emerges as an enduring and sustainable remedy to tackle the urgent concern of water scarcity through desalination. By harnessing the innate thermal reservoirs within the planet, geothermal energy provides a distinctive avenue for generating heat and electricity, particularly when synergistically aligned with desalination procedures. To understand the insights of the implications of geothermal energy for desalination, we conducted a comprehensive literature review analysis. Main objectives of the review are to (i.) disseminate insights into geothermal-driven desalination, (ii.) explore potentialities and obstacles of geothermal-driven desalination, and (iii.) evaluate forthcoming environmental, socio-economic predicaments associated with this approach. We selected 50 peer reviewed scholarly communications published using Google Scholar from 2000 to 2022, focusing on impactful English-language publications within esteemed scientific journals. We found multi-effect evaporation/distillation (MED); multi-stage flash distillation (MSF); thermal vapor compression (TVC) and mechanical vapor compression (MVC). Membrane processes include electrodialysis (ED), reverse osmosis (RO), and membrane desalination are the common techniques used across mainly in Australia, USA, UAE, Sub-Saharan and African nations, and Japan. The integration of innovative designs of these methods can enhance the efficacy and cost-efficiency of geothermal desalination systems. Furthermore, critical environmental, social, and economic concerns linked to geothermal-driven desalination were identified. We noted that high-capacity factor for stable heat supply, independent of seasonal changes, ideal temperatures (70-90° C) for low-temperature desalination, cost-effectiveness with simultaneous power and water production, environmentally friendly with no emissions, versatile to meet energy demand across scales are some of main advantages of selection of geothermal energy for desalination. Some studies showed that geothermal energy for desalination is practical and effective, especially in areas facing water scarcity, strengthening water security. However, challenges persist, necessitating inventive solutions encompassing the pursuit of robust materials designed for high-temperature operation and streamlining energy conversion and integration processes. Other foreseen difficulties include the potential environmental impacts on geothermal reservoirs and the necessity for careful resource management to maintain a fair socio-economic equilibrium. Thus, the future research direction should be mainly focus on harnessing geothermal heat to drive the process, significantly reducing energy consumption and mitigating carbon emissions to potentially be employed across the world.

Keywords: Carbon emission mitigation, Desalination, Energy conservation, Geothermal Energy, Water security

(ID 236)**Efficiency Comparison of Floating, Ground, and Rooftop Solar Systems: Environmental and Social Impacts of Floating Solar Grids****Rajapaksha, R.U.H.K.R.^{1*}, Chandrathilake, G.G.T.¹, Karunarathne, R.R.²***¹Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**²Sri Lanka Sustainable Energy Authority, Sri Lanka***himarshakaushan@gmail.com***Abstract**

The global fossil fuel shortage and environmental concerns underscore the imperative for transitioning to renewables. Developing nations like Sri Lanka are prioritizing green technologies, notably solar energy, to bridge the gap between current usage and its substantial potential. This study compares technical efficiency among floating, ground, and rooftop solar in Sri Lanka. Analyse local perceptions of floating solar. Assess the environmental impact and sustainability of floating solar systems in Sri Lanka. This study compares the energy production efficiency of floating solar, ground solar, and rooftop solar systems in Sri Lanka. This study compares the technical efficiency of floating, ground-mounted, and rooftop solar systems. Kilinochchi, chosen for floating solar, a nearby ground solar site facilitates a direct comparison, and Mass Vidiyal in Kilinochchi represents rooftop solar. The study strategically gathers data from inverters to assess performance metrics. The goal is a representative analysis, minimizing solar irradiance variations for accurate comparisons. Conducting a literature review to analyse the environmental impact of floating solar systems, drawing insights from past published research papers, and A socio-economic survey was conducted among the local community to assess the socioeconomic viability of a proposed floating solar plant near Chandrika Lake. The survey considered factors such as job creation, local employment opportunities, skill development, and alignment with national energy policies. Floating solar systems were found to have the highest energy generation capability and efficiency, followed by rooftop solar systems, while ground-mounted solar systems had lower energy output. The advantages of floating solar systems over ground-mounted systems were significant (43.69% advantage) and outperformed rooftop solar systems (30.81% advantage). According to the survey, stakeholder engagement and mitigation measures were identified as crucial, considering concerns related to water quality, safety, fisheries, agriculture, and the aesthetic value of the lake This study highlights technical efficiency, socioeconomic viability, and environmental impact of solar systems in Sri Lanka, emphasizing responsible deployment. While floating solar exhibits energy efficiency, addressing altered water flow and aquatic habitat concerns through mitigation measures is crucial for sustainable implementation.

Keywords: Solar energy, Floating solar, Environmental impact, Social impact, Renewable energy

(ID 238)

Sustainable Coastal-Based Tourism in Southern Sri Lanka: Assessing the Potentials of Blue Flag Certification's Criteria

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Abstract

As an Island nation, Sri Lanka depends on coastal ecosystems to develop its economy by enhancing coastal-based tourism activities. Sri Lanka's beaches are an essential part of coastal tourism as they attract many local and foreign tourists. With the ever-increasing demand for coastal tourism-based development, the beaches in Sri Lanka are susceptible to environmental degradation and pollution. The Blue Flag Certification (BFC), recognized globally for its stringent environmental standards, serves as a potential framework for promoting coastal tourism while ensuring the conservation of coastal ecosystems. The BFC requires any beach to achieve and sustain high standards in 33 criteria under the four categories: Environmental Education and Information, Water Quality, Environmental Management, and Safety and Services. Although many attractive beaches in the southern part of Sri Lanka usually receive a larger proportion of tourists annually, Sri Lanka has not obtained BFC for any of its beaches so far. Therefore, through a comprehensive assessment, including field surveys and analysis of the applicability of blue flag criteria, this study aims to gauge the feasibility and effectiveness of integrating BFC into the development of sustainable coastal-based tourism. Three beaches located in the Southern Province, namely Unawatuna, Mirissa, and Polhena were selected for this study. Observations and data gathered during the field investigations were analyzed for 30 criteria (excluding water quality criteria) using the guidelines and explanatory notes provided by the Foundation for Environmental Education (FEE). It was identified that Unawatuna has fully or partially achieved 13 criteria out of 30, while Mirissa and Polhena achieved only ninth and seventh criteria respectively. All three beaches have achieved most of the criteria under the environmental management category while lacking significant achievements in the safety and services category. However, all three beaches have achieved at least one criterion under the environmental education and information category. Enhanced cleanliness and aesthetic values of beaches were observed where the environmental management criteria were prioritized especially in Mirissa. This study ensures that accomplishing all BFC criteria helps to enhance the region's coastal tourism potential while continuing to preserve its unique and pristine coastal ecosystems. Further, this research also provides valuable insights and a holistic approach for policymakers, local councils, and tourism development stakeholders to implement the necessary strategies to fulfil all the criteria. Therefore, this study recommends a steady and efficient incorporation of all the criteria by relevant authorities to promote sustainable tourism and therefore contribute to economic development.

Keywords: Sustainable tourism, Environmental management, Blue flag, Water quality, Development

(ID 277)

Adaptive Reuse of Old Houses into Boutique Hotels: An Approach to Market Architectural Heritage

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Abstract

Adaptive reuse of old house with rich architectural heritage into a boutique hotels or speciality tourism sector becoming a popular strategy while catering to sustainable use of resources. In addition, adaptive reuse helps to preserve architectural uniqueness, strength the local economy through environmentally friendly manner. This study focused to explore reuse house as boutique hotels in Sri Lanka, the vernacular and colonial approach by analysing the process and changes that occur on its application and identify the tourist perception on unique experience. Mixed method approach was instrumental in data collection. Site visits, walkthrough tour to identify building performance, analysis of the photographs, videos and online user satisfaction reviews were used to obtain tourist perceptions on reuse of old houses. Case studies approach used to study the 15 old houses converter to boutique hotels. Adaptive reuse of boutique hotels carter to the high-end tourist market and specially cratering to families and groups. Renovating old houses into boutique hotels enhances the value of the structures while preserving the passive design strategies inherent in vernacular and colonial buildings. Tourists appreciate the remarkable design layout, refined decor, aesthetic appeal of the space, and the ability of the interior to maintain its charm despite the tropical climate, offering mesmerizing views of the architecture. The result shows that a significant number of vernacular and colonial residences belonging to rich individuals have been transformed into boutique hotels, attracting a discerning clientele of high-end tourists. Conservation and restoration of economically and culturally important but abandoned buildings through its adoptive reuse contributes to the enhancement of tourist attraction, liveability, tackle the challenges of resource scarcity, waste prevention and preserve heritage.

Keywords: Old houses, Tourist perception, Adaptive reuse, Sri Lanka

(ID 137)

Investigation into the Environmental Sustainability Actions Adapted by Small and Medium Enterprises of the Accommodation and Tour Operator Sectors of Sri Lanka

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Abstract

Tourism is a key driver of development for many countries, including Sri Lanka. In 2018, it generated USD 4.38 million in foreign exchange, contributed by 4.9 percent to the GDP, and generated over 380,000 direct and indirect employment opportunities. The contribution of Small and Medium Enterprises (SMEs) to this industry prevents economic leakages and increases the multiplier effect. The tourism industry also can destroy the very environment it depends on for sustenance, through heavy emissions from energy use and waste production. Research has highlighted the importance of the quality of the environment as a pull factor for destination profitability in the long run. The tourism transport-related emissions for Sri Lanka are high, the accommodation sector's GHG emissions at 3 percent is more than the global average of 1%, indicating major areas for improvement. With the accommodation sector's energy consumption predicted to surpass that of the industrial sector, the attention given to sustainable tourism practices by the SMEs that make up the industry must be investigated. In that context, this research aims to investigate the energy-saving and waste-reduction practices towards emission reduction, adopted by the Tour Operator (TO) and Accommodation Provider (AP) SMEs in the tourism industry of Sri Lanka. To do so, a qualitative methodology was adopted with a narrative inquiry over a virtual platform with 06 TOs and 17 APs identified through convenience sampling, and data analysis performed through thematic content analysis technique. Notable results for AP revealed that 12 APs consume electricity off the grid, with solar energy utilization still being limited to obtaining hot water for guest bathrooms for 5 APs, due to the high initial cost involved, and lack of adequate technical know-how in solar battery maintenance (3Aps in Tissamaharama). Poor government support towards renewable energy discouraged 17 APs from adopting the same. Energy use for TO is minimized through the use of hybrid along with conventional fossil-fuel-powered vehicles for tours. Single-use plastic items reintroduced during the COVID-19 pandemic for AP are gradually being replaced by reusable glass bottles, wooden/ metal cutlery, and paper/metal straws. All AP practice waste segregation, and the 3R concept (reduce, reuse, recycle). 4 TOs provide reusable metal bottles that are refilled during the tour using larger water cans and a handheld pump. As the sustainable practices of TO are currently optional, it is recommended to include sustainability criteria into registration process with the SLTDA. For AP it is recommended for the government to play a more active facilitating role in the renewable energy sector and to ensure the skills requirement for device maintenance is promptly met.

Keywords: Small and medium enterprises, Sustainable tourism development, Energy saving practices, Waste reduction

(ID 170)

Assessing the Ecotourism Potential in Sarasalai-Kuruvikkadu and Adjacent Areas in the Jaffna Peninsula, Sri Lanka

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Abstract

Ecotourism is environmentally responsible, enlightening travel and visitation to relatively undisturbed natural areas in order to enjoy and appreciate nature (and any accompanying cultural features both past and present) that promotes conservation, has low visitor impact, and provides for beneficially active socio-economic involvement of local populations. Sarasalai Kuruvikkadu and adjacent areas such as Anthanathidal and Kapputhu in the Jaffna District are rich with significant extents of mangroves that are notable for their waterbirds' diversity. The diversity and abundance of birds and the ecotourism potential of those areas have not been evaluated probably due to the three decades long civil unrest. The objective of the present study was to evaluate the nature-based ecotourism potential of Sarasalai Kuruvikkadu and adjacent areas. Geographic Information System was used as tool for identify the potential status of entire Jaffna District. Suitability analysis was applied and Multi Criteria Decision Method (MCDM) and criteria ranking method were used. Three aspects such as Flamingo sites (13), other birds' sites (40) and mangroves areas (66) in the district including study areas were considered for suitability analysis. The evaluating process for ecotourism sites were conducted based on criteria *viz.* species richness (of birds), tourist preferences, proximity to residential areas, proximity to accommodation, distance from roads, scenic beauty and density and distribution. Based on each three analysis, Potentials sites were derived based on priority ranking such high, moderate, and low potential. Through the overall analysis, the study areas, Sarasalai and Anthanathidal come under the high potential areas (> 75%) and Kapputhu represents lower potential (<45%) based on flamingo and other birds aspects but based on mangrove sites' analysis, both areas represent high potential status and Kapputhu represents lower status. Our recent studies have shown that Sarasalai is home to at least 82 species of waterbirds (Margalef's Index 6.74) and Anthanathidal represents 47 species (Margalef's Index 9.23) and Kapputhu 22 species (Margalef's Index 3.04). In addition to some of mammals, crocodiles and fishes were recorded in the study areas that have a high potential for promoting ecotourism. The areas had a high abundance of flamingos, which are a major Avi-tourist attraction. The study areas have large extents mangroves (896.6 ha) with four true mangrove species, *Excoecaria agallocha*, *Lumnitzera racemosa*, *Rhizophora mucronate* and *Aegiceras corniculatum* which is a unique ecotone and attraction and sources for ecotourism. Hence these areas have a great nature-based tourism potential. There is also a great potential for the participation of local people for promotion of ecotourism in the Jaffna peninsula, elevating their poverty.

Key words: Sarasalai, Kuruvikadu, Ecotourism potential, Mangroves, Flamingo

(ID 254)

Exploring Tourist Flow Patterns through Geotagged Social Media Data: A Case Study from Sri Lanka**Senarathne, M.P.^{1*}, Hewakuruppu, D.T.², Perera, P.¹, Wickramaarachchi, D.C.², Silva, R.M.²***¹Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**²Department of Statistics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**[*mediniv99@gmail.com](mailto:mediniv99@gmail.com)***Abstract**

Tourism studies often rely on conventional methods such as interviews and site-specific surveys to collect data on tourist behaviour, mobility patterns, and preferences. However, these methods can be expensive, time-consuming, and limited in scope. Additionally, accurately tracing tourist travel paths can be challenging due to recall bias. Recently, user generated content on social media platforms have emerged as an alternative data source in tourism studies. In this study, we used geotagged posts on Flickr to understand the dominant paths taken by inbound tourists in Sri Lanka. The methodology consisted of three steps. First, geotagged photographs were collected from the Flickr API spanning a ten-year period, from 2012 to 2022. These photographs included metadata such as user ID, the timestamp of photo capture, and geo coordinates indicating where the photo was taken. Second, a density-based clustering algorithm was utilized to identify tourist hotspots. Finally, the Markov Chain model was employed to calculate transition probabilities among different attractions, revealing dominant travel routes within the country. Study's findings indicate that Cultural heritage attractions were the most popular, comprising 55% of all attractions identified by the algorithm, and are particularly popular in districts such as Anuradhapura, Polonnaruwa, Matale, Kandy, and Galle. Nature-based attractions, constituting 37% of the total, were mainly located in Nuwara Eliya and Badulla Districts, as well as Yala National Park in Hambantota District. For coastal tourism, Galle and Matara Districts were the top preferences. The analysis confirms dominant travel patterns between North Central, Central, and Southwest coast regions. Notably, Galle, Kandy, Matale, Matara, Nuwara Eliya, and Colombo attract tourists from a more diverse array of regions compared to other districts in the country, showcasing their significance as tourist hubs. The study findings highlight opportunities in Jaffna for cultural-heritage tourism, the Eastern coast for coastal tourism, and the central highlands for tea tourism. It also emphasizes the need to develop the less-visited natural sites to ease pressure on popular National Parks. This research's significance lies in its contribution to informed decision-making and the sustainable management of tourist destinations. By understanding tourist mobility patterns and identifying popular attractions through social media data, policymakers can effectively manipulate visitor flows and mitigate excessive tourist pressure, while preserving the authenticity and allure of these destinations.

Keywords: Sustainable tourism, Geotagged photographs, Social media, Tourist mobility, Flickr

(ID 188)

Impact of Agro-Tourism on Travel Experiences of Domestic Tourists in Sri Lanka

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Abstract

Agro-tourism as a branch of tourism refers to a form of commercial enterprise that links agricultural industries and tourism to attract visitors to a farm or other agricultural businesses with the objectives of generating income and entertaining or educating the visitors. As the research problem, it was identified that limited number of research has been done on agro-tourism and its impact on the experiences of domestic tourists to travel as a path to establish a sustainable tourism industry in Sri Lanka. Hence, this study aimed to study the impact of agro-tourism on travel experiences of Sri Lankan domestic tourists. A mixed research design method was used in the study. It was mainly based on the primary data and the sample in the study was 50 which was randomly selected out of the total population of 233. As the variables, general demographic variables, main source of finance, trip length, major reasons to travel, the most favourite experience in selecting the destination and willingness to travel again were used for the study. Cross tabulation in SPSS analysis was mainly used with the descriptive analysis to obtain the results. As per the findings of the study, seventy percent of females and thirty percent of males were recorded representing the whole sample. Eighty four percent of domestic tourists had the willingness to travel again while sixteen percent had not. From the Cross-tabulation results, it was determined that 82.85% females from 70% and 86.66% of males from 30% showed interest to travel again to the same place. Further results showed that both female and male domestic tourists were interested to pick fresh fruits/vegetables from the farm recording 57.14% and 66.66% respectively. Rest of the domestic tourists was also interested in visiting agricultural farms, petting and feeding animals, and other activities. It is an evident fact that most of the domestic tourists are willing to gain live experiences in engaging into certain types of agriculture sectorial practices. Hence, it is highly recommended to concern on the agricultural practices of tourists' areas in Sri Lanka as both domestic and foreign tourists yearn to gain live experiences in current context. Further researchers are suggested to study on the foreign tourists and their travel experiences in connection with agro-tourism.

Keywords: Agro-tourism, Domestic tourists, Sri Lanka, Travel experiences

(ID 324)**Application of Geospatial Technology to Assess Pressures and Threats to Nature Related to Human Activities in Wilpattu National Park****Kumara, U.I.^{1*}, Jayawardana, D.T.², Gunathilake, B.M.¹***¹Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**²Center For Forest and Environment, Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***yenupul@gmail.com***Abstract**

Expanding agricultural land is one of the humanities largest and most considerable environmental impacts. It has transformed habitats and is one of the greatest pressures and threats to biodiversity. By 2020, with an estimated population of 22 million, the per capita arable land is about 0.158 hectares. This indicates heavy pressure on agricultural land use. This agricultural land use causes deforestation. Illegal deforestation results in the destruction of habitat and the restriction of wildlife movements. Apart from the direct destruction of habitats of flora and fauna that provide humans with valuable resources, removing forest cover puts many essential natural functions out of order, which may lead to a range of severe consequences. There have been many attempts at human encroachment at Wilpattu National Park, Sri Lanka, and its Forest Reserves; however, it has never been done at this scale with the awareness of the Government Authorities, who failed to act. The Easter end of the Wilpattu National Park lies between the divisional secretariat of Mahaviachchi, Karuwalagasweva, Nochchiyagama, and Rajanganaya. The buffer zone of 1.6km has been marked from the Wilpattu reserve boundary. This study uses the integrated land use assessment by applying a land use evaluation model that evaluates biophysical and human-related data in eight GN Divisions (Hunuvilagama, Kuda Vilachchiya, Track 13, Matha Kiramam, Palaikuli, Pahalapuliyankulam, Parana Eluwankulam, and Andiyapuliyankulam) in buffer zone in Wilpattu National Park. Environmental impact has been assessed based on image classification and area calculations. According to the analysis done in the human settlement, it indicates encroachment of the restricted zone for human settlement. The area of this buffer zone is approximately 33,147 ha. About 9,190 ha of this buffer zone area has been utilized by humans in various ways. Spatial-temporal data in 2003-2019 satellite image classification identified permanent building/housing units within the 1.6 km restricted zone, which has been increased in marginal villages. Mullikulam and Eluwankulam GN Divisions are the most critical and rapidly encroached areas in the forest village in the Wilpattu National Park. According to the GIS-based maps, cultivation, road construction, and residence are significant factors influencing the major ecosystems in the eastern part of the Wilpattu Park Boundary. Mahavilachchi and Nochchiyagama can be identified as the villages where elephants roam more and the areas where elephant-human conflict occurs regularly. Paddy and hay farming are primarily practiced in the areas close to the Wilpattu reserve zone. Additionally, coconut, banana, mango, and cashew crops are cultivated.

Keywords: Wilpattu, Agriculture, Deforestation, Buffer zone, Human

(ID 180)**Analysing Sustainable Urban Growth: Spatio-Temporal Dynamics of Urban Expansion in Gampola Urban Centre****Wilamune, P.B.K.*, Jayasinghe, K.D.P.P.***Department of Geography, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***Pramodibhagya06@gmail.com***Abstract**

Urbanization is a dynamic process which can be considered as one of the most significant indicators of development. It occurs both horizontally and vertically on the Earth's surface according to a pattern which has positive and negative implications. Some countries measure their development by the level of urbanization because it directly affects for a country's economy. During past decades, Gampola urban centre was experiencing a gradual urban growth and several implications. This study focuses on investigating urban expansion pattern of Gampola during 16 years by analysing three distinct years 2006, 2013, and 2022. Geographic Information System (GIS) and Remote Sensing (RS) techniques were employed to examine spatio-temporal transformations and urban expansion patterns of Gampola and its outskirts. Landsat images for three distinct years were classified using pixel-based supervised classification to determine Land Use Land Cover (LULC) of the study area which achieved an impressive overall accuracy of approximately 90%. Four major LULC types were identified those are prominent in the area namely, water, built-up, forest, paddy lands and bare lands. Temporal changes of vegetation cover for 16 years were analysed further using Normalized Difference Vegetation Index (NDVI). Consequent implications on Land Surface Temperature (LST) across the time period were analysed using thermal band of Landsat images. NDVI value has decreased from +0.7 to +0.5 during 2006-2013 and up to +0.4 during 2013-2022. LST analysis revealed a rise in temperature, increasing from 29.89° C up to 31.11° C during 2006-2013 and surging to 33.14° C by 2022. Quantifying the urban expansion of Gampola was performed using buffer analysis. Analysis of urban areas grown within 1km distanced five buffer zones from urban core was performed to quantify urban expansion. Fourth buffer zone exhibited the highest urban growth, while first buffer zone displayed lowest urban growth during 2006 to 2022. In the interval between 2013 and 2022, the fifth buffer zone appeared as the zone with the highest urban growth. Further, Landscape Expansion Index (LEI) was employed to identify the urban expansion patterns, and Gampola urban area displayed an Edge Expansion growth type. We recommend the development of urbanized areas in a sustainable and efficient manner to mitigate adverse consequences and promote balanced growth.

Keywords: GIS and RS, Urban expansion, LEI, LST, Sustainable development

(ID 322)

Towards Sustainable Cities: Challenges and Way Forward

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Abstract

A city is a sizable and enduring human settlement distinguished by its intricate network of structures, infrastructure, and social, economic, and cultural institutions. Cities play a vital role in a country's global economic growth and development, fostering agglomeration of economies, serving as centres of innovation and technological advancement, acting as major hubs for finances and employment, and facilitating infrastructure development while providing access to broader markets. Often specializing in specific industries or sectors, cities offer amenities such as healthcare, education, employment, and recreational opportunities that enhance their appeal to residents seeking a high quality of life. However, the majority of unplanned cities grapple with the challenge of balancing economic, social, and environmental perspectives. Key issues include rapid population growth, urban sprawl, inadequate infrastructure, limited resources, conflicting interests among stakeholders-particularly regarding development versus conservation and pressing environmental concerns like pollution, improper waste management, health issues, and climate change. Addressing these challenges requires cities to evolve into 'Living Cities,' where human settlements can flourish indefinitely as part of nature's beauty and diversity. Achieving this balance involves integrating economic, social, and environmental perspectives. This paper presents detailed strategies under various subheadings, including Integrated Urban Planning with a focus on promoting public transport, increasing green spaces, and conserving biodiversity. It also covers Water Conservation, measures to enhance resilience to climate change impacts, such as strategic infrastructure siting and nature-based solutions, and the promotion of renewable energy and green building concepts to conserve finite resources. Efficient waste management is highlighted to ensure a waste-free urban environment. The paper underscores the importance of stakeholder engagement, involving the public, private sector, NGOs, and communities in the decision-making process through participatory planning and citizen engagement. While acknowledging existing supportive policies and strategies in the country, the paper emphasizes the need for their enforcement and proper implementation to achieve the desired target of sustainable cities-living cities where human populations thrive harmoniously as part of nature's beauty and diversity.

Keywords: Living city, Sustainable city, Urban, Settlement, Integrated planning

(ID 053)

Effect of Thermal Modification on the Density, Durability, Dimensional Stability, and Mechanical Properties of *Pinus caribaea*

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Abstract

Pinus caribaea (Pine) is an underutilized timber species in Sri Lanka due to its low density, durability, dimensional stability, and undesirable colour. This research aims to examine the enhancements in the physical and mechanical properties of Pinewood through thermal modification (TM) and compare the properties of the TM wood with kiln-dried and untreated wood and with the properties of high-graded timbers of *Tectona grandis* (teak) and *Koompassia malaccensi* (kempas). TM is a process that involves heating wood to high temperatures (200⁰ C) in the absence of oxygen, which removes the moisture and creates changes in the wood at the cellular level. The effectiveness of the thermal modification on density, modulus of rupture (MOR), modulus of elasticity (MOE), moisture content, dimensional stability, durability, and colour was studied. Specific gravity of thermally modified wood was 6% higher than untreated wood, but lower than teak and kempas. MOR and MOE values were 35.75% and 46.46% respectively higher than untreated wood. Equilibrium moisture content was reduced after TM and volumetric shrinkage of TM was reduced to 2.16% and swelling under liquid water contact was reduced to 2.37%. Thermally modified timber was classified as not durable (DC 5) based on field test (EN 252, 2014) results. However, TM timber was slightly durable (DC 4) according to laboratory tests and showed better fungal resistance. The wood underwent a darkening effect as a result of thermal modification, resembling the colour of teak. The cost of TM was 13.1% higher than kiln drying. Improved dimensional stability, enhanced bending strength, and attractive appearance demonstrate the potential of thermal modification as a promising alternative for transforming *P. caribaea* wood into high-value raw material. TM timber finds suitable applications in indoor furniture and joinery projects. However, due to its lack of termite resistance, preservative treatment is recommended for outdoor ground contact usage.

Keywords: Thermally modified timber, Mechanical properties, Dimensional stability, Durability, *Pinus caribaea*

(ID 013)

Non-Destructive Assessment of Agarwood Resin Formation Status in *Aquilaria crassna* using Near-Infrared Spectroscopy

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Abstract

Agarwood is a unique and valuable resin synthesized within a few tree species of the tree family Thymelaeaceae primarily as a self-defence mechanism against stress causes such as fungal invasions. Instead, artificial inoculation leads to short-time harvesting practiced in intensive commercial-level cultivations. The extraction of this resin can be done only after the harvesting where accurate estimation of resin yield is crucial for avoiding immature or underdeveloped harvesting. However, the amount of resin accumulated in the trunk cannot be estimated by the outside inspection. As a result, trees are being cut down before they have reached their maximum harvest potential. Therefore, precise detection of fragrant resin formation status inside the tree has become one of the primary challenges in the agarwood production industry. Currently, the methods available are either destructive, inefficient, or inaccurate. As such, this study evaluates the possibility of the use of NIR spectroscopy as a non-destructive and quick detection method for agarwood formations status inside trees in the in-situ mode. Near-infrared (NIR) range (588–1,025 nm) spectra were acquired from resin-formed and non-formed areas from twenty tree trunks of agarwood with five different formation levels. The best agarwood formation areas of logs were assigned as class level 1 and the least was assigned as the class level 5. The spectra were acquired near the opening made for the artificial inoculation process of considered *Aquilaria crassna* tree trunks. The results of Soft Independent Modelling of Class Analogies showed consistent evidence of differences in the NIR spectral profiles of all levels of agarwood formations. The SIMCA discrimination between the resin developed versus not was achieved with 86% accuracy. The accuracy rates of the degree of the presence of agarwood were obtained as 80%, 100%, 85%, 90%, and 85% respectively, as assigned levels 1 to 5 in the SIMCA models. This research revealed the potential possibility of using NIR technology for the prediction of agarwood resin status inside the agarwood tree in *A. crassna* before harvesting the tree as a non-destructive and rapid method.

Keywords: NIR spectroscopy, Agarwood, *Aquilaria crassna*, Non-destructive, Agarwood formation

(ID 304)

Anatomical Study for Wood Identification of *Shorea* Species in Sri Lanka

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Abstract

Wood anatomy is a rapid method for identifying different timber species. *Shorea* is a diverse genus of trees in the subfamily Dipterocarpaceae and encompasses a group of some 470 tree species that dominate much of the tropical forests of South and Southeast Asia. Many of these are valued commercially for their hardwoods. However, the anatomical identification of *Shorea* sp. in Sri Lanka has not been fully studied yet. Six *Shorea* species available in the lowland wet agroecological zone in Ratnapura District, in Sri Lanka, were selected for this study. The study was conducted in the wood Science laboratory of the State Timber Corporation, Sri Lanka. Six *Shorea* species, including Beraliya dun (*S. disticha*), Navada dun (*S. stupularis*), Dun (*S. zeylanica*), Yakahalu dun (*S. trapezifolia*), Yakal dun (*S. astylosa*) and Thiniya dun (*S. congestiflora*) were used to identify the variation of wood anatomical features to differentiate the species. As a reference, the Publication List of the International Association of Wood Anatomists on anatomical characteristics was used. To determine the microscopic features, six wood sections (Radial, Tangential, and Transverse sections of the wood) representing each species were employed. The anatomical characteristics of the timber were examined using Micrometrics SE Premium 4 software. According to the results, Yakahal Dun species showed the highest number of vessels and Navada represented the lowest number of vessels. The highest value for the vessel diameter showed the Thiniya species and the lowest for the Dun. Beraliya species showed the highest no of rays and the lowest number of rays showed in Yakahalu dun. A Dichotomous key was developed for the exact identification of *Shorea* species based on the anatomical characteristics.

Keywords: Dichotomous key, IAWA features, Identification, *Shore* sp., Wood anatomy

(ID 058)

Surface Modification of Montmorillonite Clay Towards the Fabrication of Nanocomposites for Engineering Applications**Nayanthara, H.H.D.¹, Karunarathne, P.K.D.M.C.^{1*}, Narangoda, C.J.²**¹*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Chemistry, Centre for Advanced Material Research,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka***mck@sjp.ac.lk***Abstract**

Montmorillonite (MMT) is a layered clay mineral composed of silica and alumina sheets with a layer thickness of about 1 nm qualifies it as a two-dimensional nanomaterial. MMT is found in natural clay ores in the Murunkan, Kirinda, and Okanda areas in Sri Lanka. Nanocomposites with enhanced physical and mechanical properties can be prepared by dispersing MMT in a polymer matrix. However, the hydrophilic nature of MMT hinders the incorporation of MMT into hydrophobic polymer matrices. Hence, a suitable surface modification is required to make MMT compatible with polymers. The present study was based on the preparation and analysis of organically modified calcium Montmorillonite (Ca-MMT)-polypropylene nanocomposites as a green technology initiative. Homo-ionic Ca-MMT was prepared by treating commercial MMT-K10 with a CaCl₂ solution. The predominant exchangeable divalent cations present in MMT-K10 and Ca-MMT were determined using AAS. The cation exchange capacity of Ca-MMT was about two times greater than that of MMT-K10. Furthermore, XRD analysis showed a slight increase in d-spacing of Ca-MMT compared to MMT-K10. A novel ligand, triethylene glycol dodecyl methyl ether was synthesized by treating triethylene glycol monomethyl ether (TGME) with 50% w/w aqueous solution of sodium hydroxide followed by 1-bromododecane with the molar ratio of TGME:NaOH:1-bromododecane in 1:2:2. The crude product was purified by column chromatography and characterized by FTIR and GCMS analysis. Hydrophilic Ca-MMT was surface modified with the organic ligand presumably via the coordination of triethylene glycol moiety with Ca²⁺ cations at the outer edge of the MMT particles. The long aliphatic chains in the periphery of the modified MMT particle make it more organophilic. Modified Ca-MMT was characterized by XRD, TGA, and FTIR analysis. The XRD revealed a slight increase in the d-spacing related to the 001 plane of modified Ca-MMT compared to unmodified clay. The effect of modified Ca-MMT loadings (0.5%, 1%, and 1.5%) on the mechanical properties of the nanocomposite was studied. The results implied an enhancement of the mechanical properties in terms of impact resistance, hardness, and flexural properties in the nanocomposite compared to the virgin polymer. The fabricated nanocomposite is a promising engineering material that may have applications in automotive, construction, and packaging products.

Keywords: Montmorillonite, Polypropylene, Nanocomposite, TGME, Compatibility

(ID 200)**Soil Actinomycetes as Promising Alternative to Synthetic Herbicides****Rangika, W.C.¹, Gunasekara, R.D.A.², Masakorala, K.², Yapa, Y.M.A.L.W.³, Walpita, J.K.¹,
Gamage, W.S.M.K.^{2*}**¹*Department of Multidisciplinary Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Botany, University of Ruhuna, Matara, Sri Lanka*³*Department of Chemistry, University of Ruhuna, Matara, Sri Lanka***shirani@bot.ruh.ac.lk***Abstract**

Weed management is a key agronomic practice in agriculture. Since decades, synthetic herbicides played an indispensable role in weed control due to high effectiveness. However, recently there has been growing interest on exploring alternative weed control methods due to negative impacts of synthetic herbicides on the environment. Besides, there is an increasing demand for organic farm products. Actinomycetes, a group of filamentous, Gram-positive bacteria known for their bioactive secondary metabolites, have emerged as potential candidates for bioherbicides. In this study, we investigated herbicidal potential of twenty-three morphologically distinct actinomycetes strains isolated from soil using lettuce (*Lactuca sativa*) as a model plant. Eight weeks-old cell-free culture fermentation broth of actinomycetes strains were used for screening the effect on seed germination and seedling growth. Lettuce seeds were exposed to fermentation broth for two weeks while for control, sterilized distilled water was used. Ten seeds per treatment in three replicates were used. The results showed that sixteen actinomycetes strains, ACM25, 26, 29, 33, 34, 35, 36, 38, 41, 42, 43, 47, 48, 49.1 and 49.2 and ACM50 were able to completely inhibit seed germination while seeds treated with ACM32 did not produce roots although seed germination had initiated. It appears that these seventeen strains would be effective at pre-emergence weed control. Seeds that treated with the rest of the six strains had no effect on the seed germination. However, seedlings of ACM24, 45 and ACM46-treated seeds showed deaths by two weeks. Their gradual death started with discoloration of leaves followed by watery rotting of the entire plant. Seedlings of ACM30, 31, 37-treated seeds survived, and their growth performance were observed for two weeks compared to the control. Seedlings were dwarf and exhibited growth deformations such as reduced leaf size, chlorosis, leaf curling and stunted roots. Further, number of leaves, shoot length and root length were significantly different ($p < 0.05$) from that of the control. These observations suggest that the effect of ACM24, 30, 31, 37, 45 and ACM46 would be systemic. In conclusion, our results clearly showed strong herbicidal effects of all tested twenty-three strains of actinomycetes at pre- and post-emergence stages of seed germination. Thus, they can be promising candidates for bioherbicide formulations.

Keywords: Actinomycetes, Bioherbicides, Weed management, Sustainable agriculture

(ID 202)

Identification of Plant Growth-Promoting Rhizobacteria for the Development of Probiotic Consortia

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Abstract

Soil infertility is one of the major challenges in agriculture. Although chemical fertilizers provide promising solution for crop growth in infertile soil, excessive application cause negative impacts on the natural systems such as soil and water. Moreover, these fertilizers can be converted into insoluble forms soon after application which often result in increasing the application frequency and the quantity. Hence, for decades plant growth-promoting rhizobacteria (PGPR) have been considered as an environmentally friendly alternative for chemical fertilizers. In this context, the present study was focused on the identification of candidate PGPRs for the development of probiotic packages for chilli (*Capsicum annuum* L.) which is one of the most widely grown and highly demanding vegetable crops in Sri Lanka. Rhizobacteria were isolated from the roots of healthy, young chilli plants grown in Angunakolapelessa, Sri Lanka and their rhizosphere soil. In total, 75 morphologically distinct strains were isolated, and they were inoculated into different nutrient media to screen their ability to solubilize insoluble mineral nutrient sources. Those media were National-Botanical-Research-Institute's phosphate agar [NBRIP-agar] with $\text{Ca}_3(\text{PO}_4)_2$ as the P source, modified-Aleksandrov-agar containing mica as the K source and zinc-solubilizing-agar containing ZnCO_3 as the Zn source. Further, bacteria were screened for N fixation in the nitrogen-fixing-bacteria (NfB) medium. Sixteen P-solubilizing-bacteria (PSB), 4 K-solubilizing-bacteria (KSB), 15 Zn-solubilizing-bacteria (ZnSB) and 10 N-fixing strains were identified. We noticed that all KSB strains also have the capacity to solubilize $\text{Ca}_3(\text{PO}_4)_2$. All PSB strains, except *CSTM10*, can solubilize ZnCO_3 . The phosphate solubilizing index (PSI) was calculated to rank the P-solubilizing efficiency (PSE) of PSB. The highest PSI was found in *CSTM40* and *CSTM6*. We further screened all mineral-solubilizing strains for the indole-3-acidic acid (IAA) production which is a PGP hormone. Cultures were induced for IAA production by supplementing the medium with 0.2% (w/v) tryptophan and IAA concentration was determined using the Salkowski's method. Nine strains were capable of producing IAA. The *CSTM6* and *CSTM21* showed the highest IAA production of 181.94 and 178.59 mg/L respectively. In conclusion, bacterial strains, *CSTM6*, *CSTM14*, *CSTM21*, *CSTM24*, *CSTM40*, *CMTM1*, *CMTM2* and *CSTM10* showed multiple PGP characteristics and they were selected as candidates for the developing probiotic consortia. They can be viewed as promising strains in sustainable agriculture since they perhaps can enhance the availability of mineral nutrients in soil and promote plant growth.

Keywords: Biofertilizer, *Capsicum annuum*, Plant growth-promoting rhizobacteria

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(ID 036)

Hydrothermal Synthesis of Antimicrobial Carbon Dots from the Soot of Three Different Essential Oils

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Abstract

Carbon dots (CDs) have garnered the interest and demand of researchers over the years, and they are also favoured as a novel and better alternative to conventional antibiotics and other antimicrobial agents. While the antimicrobial properties of CDs differ with the precursors used, a synergistic effect is expected to arise from the use of antimicrobial compounds as precursors in the synthesis of CDs. Therefore, in this study, a novel green method was introduced for the hydrothermal synthesis of carbon dots using the soot of three essential oils (EOs) as the carbon source; clove (*Syzygium aromaticum*), cinnamon (*Cinnamomum zeylanicum*) and citrus (*Citrus aurantifolia*); in the absence of surface passivating agents. Here, the three essential oils were burned and the carbon soot from each oil was collected separately. Then the carbon soot was subjected to hydrothermal treatment by heating at 160° C for 3 hours without any doping or modification. The obtained carbon dots were characterized by Scanning Electron Microscopy (SEM), UV-Vis spectroscopy, FT-IR spectroscopy and Fluorescence analysis. The SEM images of the three types of essential oil-derived CDs were crucial for determining the size, shape, and surface morphology of the prepared CDs. While clove CDs and cinnamon CDs were mostly spherical in shape, citrus CDs exhibited irregular shapes, which could be attributed to the agglomeration of the particles as evident from the SEM images. The results showed that the average particle diameter of the CDs was found to be 56.50±7.75 nm, 56.11±8.11 nm, and 61.67±10.21 nm, for clove CDs, cinnamon CDs and citrus CDs, respectively. UV-Vis spectroscopy analysis further confirmed the formation of CDs as absorption peaks at wavelengths of 205 nm, 215 nm and 244 nm were obtained for citrus, cinnamon and clove CDs respectively. These peaks could be attributed to the $\pi \rightarrow \pi^*$ transition of C=C bonds of sp² carbons. FT-IR spectroscopy was carried out to determine the functional groups in the prepared CDs, as functional groups are responsible for the antimicrobial properties of CDs. In addition to these, the fluorescence analysis confirmed the synthesis of CDs, as CDs are known to be fluorescent. The antibacterial properties of the synthesized CDs were then investigated against *Pectobacterium* sp. isolated and characterized from the soft rot of carrot.

Keywords: Carbon dots, Essential oils, Hydrothermal synthesis, Antimicrobial, Aggregation

(ID 045)

Isolation of Phosphate Solubilizing Fungi from Soil and Their Application in Plant Growth Promotion

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Abstract

Phosphorus plays a significant role in numerous physiological and metabolic processes in plants. Soil phosphorus is immobilized due to the formation of insoluble complexes. The use of efficient phosphate-solubilizing microorganisms opens up a new prospect for better crop productivity and for greater yield performance without affecting the soil health. Phosphate-solubilizing fungi (PSF) enhance available phosphorus released from soil, which contributes to P requirement of plants. Hence, the present study was designed to evaluate the utilization of PSF as a biofertilizer. Pikovskaya's Agar medium was used to isolate fungal species from compost and open dumpsite soil. Isolated fungi were labelled as PSF-X, PSF-Y, and PSF-Z. A pot experiment was carried out to determine the effect of isolated fungal strains. The isolated fungal strain was introduced to the developed potting media which contained compost and soil at 1:1 ratio. Soya bean was selected as the experimental plant. Plant growth parameters (shoot length and root length) were measured to determine the effect of isolated fungal strains. Plant growth parameters were recorded after 21 days. Fungi inoculated pots showed a significant increase in both shoot and root lengths in comparison to the control (n=9, p<0.05). Potting media consisting of PSF-X showed the best result. The highest root length (4.7±0.1 cm) and shoot length (35.8±1.2 cm) were recorded in pots inoculated with PSF-X. Hence, isolated PSF-X, PSF-Y, and PSF-Z are recommended as suitable biofertilizer strains for potting medium.

Keywords: Fertilizer, Fungi strain, Phosphorus, Plant growth

(ID 107)

Unrevealing the Enhanced Laccase Activities of *Phlebiopsis flavidoalba* in the Presence of Lignin-Rich Raw Materials using Molecular Docking**Senavirathna, T.M.Y.H., Perera, P., Attanayake, R.N.****Department of Plant and Molecular Biology, University of Kelaniya, Kelaniya, Sri Lanka***renuka@kln.ac.lk***Abstract**

Laccase, a versatile enzyme that belongs to the multi-copper oxidase family, exhibits extraordinary lignin-degrading capabilities. Among the diverse types of laccases, white-rot fungal laccases are considered some of the best lignin degraders, with various biotechnological and industrial applications. In our previous study, it was found that a wood-decaying white rot fungus, *Phlebiopsis flavidoalba*, is one of the highest laccase producers in vitro in the presence of rice husks as the raw material. However, it is unclear the exact mechanism and whether laccase directly interacts with the raw material, in this case, rice husks and its lignin model compound. Hence, the objective of the current study was to obtain laccase gene sequence from *P. flavidoalba* and subject it to molecular docking with lignin model compounds that are particularly found in rice husks to determine binding affinities to the active sites of enzyme. The laccase gene sequence of *P. flavidoalba* was obtained from the next-generation sequence data set obtained in our previous study and subjected to *in silico* homology modelling and molecular docking using various lignin model compounds reported to be present in rice husks. Firstly, to predict the 3D structure of the laccase of *P. flavidoalba*, homology modelling was performed using SWISS-MODEL. Laccase from *Steccherinum murashkinskyi* was selected as the template for homology modelling using SWISS-MODEL. CB-Dock server was used to perform molecular docking studies with a range of lignin model compounds, including sinapyl alcohol, coniferyl alcohol, *p*-coumaryl alcohol, β -O-4' aryl ether, β -5' phenylcoumaran which are commonly found in rice husks. It was found that the above-mentioned lignin model compounds exhibited strong binding affinities such as -5.9 kcal/mol (sinapyl alcohol), -6.5 kcal/mol (coniferyl alcohol), -8.6 kcal/mol (*p*-coumaryl alcohol), -7.5 kcal/mol (β -O-4' aryl ether), and -7.5 kcal/mol (β -5' phenylcoumaran) with the laccase protein of *P. flavidoalba*. The amino acid residues of modelled laccase in contact with the lignin model compounds forming hydrogen bonds were Gln457, Ile434, Phe432, Arg370, Lys452, Ile365. The insights gained from these docking studies can help uncover the molecular level interactions and the potential of utilizing such low-cost carbon sources for boosting laccase production.

Keywords: Homology modelling, Laccase, Lignin model compounds, Molecular docking, Rice husk

(ID 142)

Potential of Pathogen-Derived Immunity Inducers to Manage Southern Blight Caused by *Sclerotium rolfsii* in Selected Horticultural Crop Species as a Greener Approach of Disease Management

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Abstract

Pathogen-derived molecules, when applied exogenously to the plants, are recognized by the host plant receptor proteins and in response to the recognition, defence-related activities in the host plant are triggered. Therefore, use of pathogen-derived immunity inducers is a greener and safer alternative to pesticides and live biological control agents in plant disease management. The present study aimed to determine the efficacy of different types of pathogen-derived molecules in managing Southern blight caused by *Sclerotium rolfsii*. In a plant house experiment, seven horticultural crop species, namely, pumpkin (var. Moragollagama), luffa (var. LA33), tomato (var. Rajitha), chilli (var. MI 2), bean (var. Malaysian cittimurunga), eggplant (var. Lenairi) and capsicum (var. CA8) were tested. As pathogen derived molecules, non-viable *S. rolfsii* mycelia (prepared by oven drying, moist heating and freezing of the pathogenicity-confirmed *S. rolfsii*, isolated from an infected melon plant) and fragmented DNA of the pathogen were used. Oven dried, moist heated and frozen mycelia of the pathogen were used at concentrations of 0.002 g/mL, 0.025 g/mL, and 0.025 g/mL, respectively. The concentration of fragmented DNA of the pathogen used was 50ng/mL. Twelve plants of each species, maintained as three replicates were treated with 12 mL of the preparations of the pathogen-derived DNA and mycelia. The plants under pathogen-derived preparations were inoculated with the mycelia disks of *S. rolfsii* at the base of the seedling, three days after treatment while maintaining a positive (i.e., inoculated only with the pathogen) and a negative control (i.e., no pathogen inoculation and no treatment with pathogen-derived molecules). Disease incidence was quantified and according to a disease scale ranging from 1-4, severity of the lesion development on the stem was recorded to calculate percentage disease index (PDI). On the 5th day after inoculation of the pathogen, a significant difference in the percentage of disease incidence among the treatments was reported only in bean, luffa, pumpkin and brinjal ($p < 0.05$). Capsicum variety did not develop symptoms over the observation period. Bean, pumpkin, luffa, and chilli significantly reduced PDI when treated with the pathogen derived DNA and non-viable mycelial preparations ($p < 0.05$). For luffa, PDI was significantly reduced when treated with the fragmented DNA and oven dried mycelia, though all types of pathogen-derived preparations significantly reduced the PDI in bean, pumpkin and chili demonstrating no significant difference among each type of preparations. Fragmented DNA (<1500 bp) when applied as a foliar application was effective in reducing the disease severity in all the tested crop species.

Keywords: Biological elicitors, Percentage Disease Index

(ID 213)

Development of a Grow-Bed for Constructed Floating Wetlands: A Feasibility Study in Kandy Urban Lake in Sri Lanka

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Abstract

Constructed Floating Wetlands (CFWs) have been used in Sri Lanka for over a decade to revitalize urban lakes. Design and fabrication of floating beds is an important task for the better performance of CFWs. Coconut Coir-pith (CCP) has been used as a media due to its availability and affordability in Sri Lanka. However, the erosion of CCP due to tidal waves in urban lakes is a challenge for the maintenance of CFWs. As an initial step, a geotextile reinforcement was introduced as a grow-bed to CFWs, align with other design criteria, and evaluated its effect on plant growth and nutrient uptake. The buoyant square-rafts ($0.8 \times 0.8 \text{ m}^2$) were made using 50 mm diameter PVC pipes. The CCP grow-beds were wrapped by geotextile covers ($0.05 \times 0.7 \times 0.7 \text{ m}^3$). Polypropylene (PP) and Polyester (PET) geotextiles were used as treatments by Completely Randomized Design in triplicates. Grow-beds with only CCP were used as control. *Canna indica* was planted at the density of 4 plants/ m^2 . Plant heights, number of leaves, root growth and flowering were recorded over 70 days. After harvesting, dry masses and nutrient contents of plant tissue were measured. Data was statistically analysed using One-way ANOVA and Tukey tests. Total Nitrogen (TN) and Total Phosphorus (TP) contents of a plant (g), as determined by its dry mass, were significantly higher in plants in both PP ($4.97 \pm 0.19 \text{ g}$, $1.61 \pm 0.21 \text{ g}$) and PET ($4.50 \pm 0.33 \text{ g}$, $1.89 \pm 0.39 \text{ g}$). A significant positive relationship was revealed between plant dry masses and TP (g) ($p < 0.05$) in both PP ($R^2 = 0.77$) and PET ($R^2 = 0.82$). Translocation Factors (TF), for TN and TP in both PP and PET plants were higher while significantly higher for TN in PET (4.34 ± 0.38). Conclusively, the developed CCP-geotextile grow-beds were able to show an increased growth and nutrient uptake of plants. These results can be attributed to the favourability of geotextiles for attached-growth microbes which enhance the plant-function, while emphasizing the need for further advanced research.

Keywords: Constructed floating wetlands, Coconut coir pith, Polypropylene geotextiles, Polyester geotextiles, Nutrient uptake

(ID 203)**Development of a Novel Value-Added Leaf Tea from the Introduced True Cinnamon (*Cinnamomum zeylanicum* Blume) Variety Sri Gamunu****Pabasara, K.A.D.¹, Wijeweera, A.A.^{2*}, Ranaweere, K.K.D.S.¹**¹*Department of Food science and Technology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*National cinnamon research and training center, Department of Export Agriculture, Matara, Sri Lanka***achiniawije@gmail.com***Abstract**

Herbal beverages prepared from various plant extracts have grown in popularity. True cinnamon leaves (*Cinnamomum zeylanicum* Blume) have proven to contain bioactive components that improve organoleptic and functional qualities and reduce non-communicable disease risk. A study was conducted to develop a value-added cinnamon leaf tea using the introduced true cinnamon, cultivar Sri Gamunu. The study used twelve authentic cinnamon aqueous extracts. Cinnamon leaves were harvested immature, half-mature, and mature for extracts. The extracts were also produced separately and compositely. To get extracts, leaves were oven-dried at 50, 70, and 100° C. Twelve leaf extracts were tested for moisture, water activity, pH, colour (L*, a*, and b*), and total phenolics. Three samples with the highest Total Phenolic Content (TPC) were sensory evaluated to select the best leaf extract. Results indicated that the 70° C immature cinnamon leaf tea sample had the best sensory qualities. The best cinnamon leaf extract's shelf life was determined by total aerobic microorganisms, yeast and mould count, and coliform counts. The physiochemical parameters tested were pH 5.20±0.1, total phenolic content 7.52±0.56a, colour L* 12.53±0.12f, a* 1.23±0.06g, b* 11.20±0.36e, moisture content 8.66±0.58bcde, and water activity 0.39±0.02cd. The physicochemical characteristics of the best leaf tea sample showed: water-soluble ash (64.34%), water-insoluble ash (35.66%), alkalinity (1.89%), acid-insoluble ash (1.62%), crude fibre (11.39%), and water extract (29.90%). According to microbiological analysis, the extract can be kept at least for two months but can be extended longer. Therefore, it can be concluded that, value-added cinnamon leaf tea from the new true cinnamon (variant Sri Gamunu) can developed as novel and health promising herbal teas.

Keywords: *Cinnamomum zeylanicum*, Value-added, Leaf tea, Non-communicable Diseases, Sensory evaluation

(ID 210)

Volatile Profiling and Assessment of the Bio-Efficacy of *Sandoricum koetjape* Essential Oil as a Botanical Insect Repellent Against *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae)**Liyanage, H.T.¹, Chinthaka, S.D.M.^{1*}, Perera, A.G.W.U.²**¹*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***sdmchin@sjp.ac.lk***Abstract**

Infestation caused by the ubiquitous cosmopolitan stored-grain insect pest, the rice weevil, *Sitophilus oryzae*, has become a globally significant problem owing to its heavy losses in post-harvest storage systems. Meanwhile, the escalating interest in the search for green alternatives to synthetic pesticides has become the impetus for the investigation, formulation, and evaluation of biorational pesticides that overcome the undesirable ecological and adverse human health impacts due to conventional pesticides. The major way these insect pests detect their substrates is through olfaction, and plant essential oils have been proven to result in promising repulsive properties by building repulsive odor barriers and thus acting as insect repellents. Therefore, the present study aimed at characterizing the volatile constituents of *S. koetjape* essential oil (SKEO) and evaluating the bio-efficacy of its insect repellent activity against *S. oryzae*. The essential oil was extracted from the wood of *S. koetjape* via hydrodistillation using a Clevenger-type apparatus, and the chemical composition was characterized through gas chromatography-mass spectrometry (GC-MS) analysis. Test insect cultures were maintained under ambient thermo-hygrometric conditions of 29±2° C and 84±10% relative humidity. One-week-old coetaneous mixed-sex cohorts of adult *S. oryzae* were used in all experiments. The area preference bioassay was conducted to assess the repellency of SKEO by determining the 100% repellent concentration (RC₁₀₀) of SKEO and 95% repellent concentration (RC₉₅) of SKEO was calculated through a probit analysis. The GC-MS analysis resulted in nine compounds accounting for 68.6% of the wood essential oil of *S. koetjape*, with Spathulenol (43.7%), a tricyclic sesquiterpene alcohol, being the predominant compound. Other major volatile compounds present were sesquiterpenoids: Viridiflorene (8.8%), and Viridiflorol (3.4%); Caryophyllene (4.8%), a sesquiterpene; and Myristicin (2.5%), an aromatic ether. All these compounds possess insect repellent activity, as per mentioned in literature. In the area preference bioassay, 100% repellency was observed at the highest dose, which was 3.77 µL cm⁻² after a six-hour exposure period, and the RC₉₅ value was recorded as 3.65 µL cm⁻². Thus, it can be concluded that the wood essential oil of *Sandoricum koetjape* can be utilized as a botanical insect repellent against *S. oryzae*, and in future studies, the volatile organic compounds identified can be utilized in the formulation of novel phytochemical bio-pesticides in stored-grain insect pest management.

Keywords: *Sandoricum koetjape*, *Sitophilus oryzae*, Essential oil, Repellency, Botanical insect repellent

(ID 030)

Effects of Polypropylene Microplastics on Soil Microbiome and Growth of Corn (*Zea mays*) Plants

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Abstract

Microplastics (MPs) are small plastic particles less than 5 mm in size. The pollution of the environment with MPs is increasingly recognized as a new and emerging risk to biodiversity, ecosystem, human health, and well-being. Although it is known that soil ecosystems, particularly agricultural lands, are a significant sink for MPs, the implications of MPs on soil ecosystems still need to be extensively investigated. In general, MPs consider a negative influence on plant and soil microbial growth. The main objective of this study is to examine the impact of polypropylene MPs, on soil microbiota and development of the corn (*Zea mays*) plants. The present study involved the incorporation of soil with two distinct concentrations (20 mg/g and 40 mg/g) and three varying sizes (1mm, 2 mm and 2.8-5 mm) of polypropylene (PP) MPs, followed by preparing six MPs soil mixtures for investigation of soil microbiota, enzyme activities and development of the corn plants (*Zea mays*). MPs have negatively influenced shoot elongation (34.74%) and dry biomasses (67.61%). In addition, seed germination (28.57%-42.86%) was reduced in all the tested MPs mixtures in this study. MPs increased root lengths (82.63 %) and chlorophyll production (39.75%) relative to plants grown in MPs-free soil. Although bacterial growth has shown an increase (57.31%) along with urease activity, few MPs mixtures showed a reduced dehydrogenase activity (25.81%). In soil incorporated with 40 mg/g MPs, urease activity increased (10.55%) relative to the control, but bacterial growth reduced (57.31%). However, fungal growth significantly increased when the concentration of MPs increased from 20 mg/g to 40 mg/g on day-30. In this study, MPs showed size- and concentration-dependent influence on microbial growth and development of corn plants. Further, adding MPs influenced the soil's physical properties. An increased pH and decreased electrical conductivity and bulk density in soil. The present study concluded that polypropylene MPs have different impacts on plant development, microbial growth, enzyme activities, and physical parameters of soil, which can subsequently affect the functioning of the soil ecosystem.

Keywords: Microplastics, Polypropylene, Soil microbiota, Corn plants, Soil physical properties

(ID 031)

Spatiotemporal Groundwater Status Modelling using Deep Learning Techniques

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Abstract

Groundwater monitoring is crucial for Sustainable Water Resource Planning and data-driven decision-making. Conventional approaches for modelling groundwater status have limitations in accurately capturing the complex nature of environmental processes. Deep Learning techniques are emerging tools for addressing groundwater patterns' non-linearity and dynamic nature. However, proper models are lacking in the way explicitly developed for groundwater status monitoring in Sri Lanka. This research aimed to overcome this issue by proposing a Deep Learning model for monitoring changes in groundwater status and comparing its effectiveness with traditional manual data logging systems and primary modelling approaches especially used in the country. The research focused on developing a robust Deep Learning model that integrated spatiotemporal variations of groundwater levels using a combination of Deep Learning techniques and geo-statistical kriging. The model was tested in Malwathu Oya River Basin in Anuradhapura covering the Regolith Aquifer System of Hard Metamorphic Rock region, a controlled geographic boundary as a pilot implementation and subsequently can be applied to the entire groundwater system in Sri Lanka. Overall, the Long Short Term Memory Neural Network-based model had shown promising results for groundwater prediction at over 90% of the stations with reliable accuracy. The findings of this research have contributed to the advancement of groundwater resource management practices in the country and provided valuable insights into the potential of Deep Learning for improving groundwater monitoring accuracy and efficiency.

Keywords: Groundwater status, Spatiotemporal forecasting, Sequence patterns, Geo-statistics, Deep Learning

(ID 035)

Morphometric Analysis of Uma Oya Sub-Basin for Sustainable Soil and Water Resources Management Using Spatial Data

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Abstract

The Uma Oya sub-basin of the largest Mahaweli River Basin encompassing mainly Badulla District of Sri Lanka, plays a vital role in agriculture, irrigation, drinking water supply, and hydropower generation. This study utilizes spatial data obtained via GIS and RS platforms for morphometric analysis of linear, areal and relief aspects of Uma Oya sub-basin where Tea plantations dominate the land cover. Various morphometric parameters, including bifurcation ratio, drainage density, drainage texture, stream frequency, circularity ratio, elongation ratio, form factor and relief ratio, were analysed to understand the soil and hydrological characteristics of the sub-basin. The study identified total of 4,800 streams in the Uma Oya River network spanning 2,017.3 km flowing up to 7th order as per the Strahler's classification. The mean bifurcation ratio was 4.01, indicating that geological structures have minimal influence on the drainage pattern. The drainage density was 2.81 km/km² confirming the availability of highly permeable subsurface materials under dense vegetative cover. The drainage texture of 30.79, confirmed that the basin has a fine drainage texture. And the stream frequency 6.7 indicated that this sub-basin has a high infiltration capacity generating less runoff reducing soil erosion potential within the basin. The elongation ratio 0.64 confirmed that the sub-basin is more towards an elongated shape. The basin relief was 1.5 km, and the relief ratio was 0.05 reflecting a lower potential for soil erosion within the sub-basin. The findings of this study finally reveal that, Uma Oya sub-basin has a well-distributed stream network and the presence of highly permeable subsurface materials under dense vegetation cover within the watershed area suggest good potential for water infiltration resulting lower flood risk and soil erosion. Hence morphometrically strong hydrological and soil characteristics of this watershed would lead to a less risk for flooding and soil erosion if the natural setup is not intensively disturbed. Overall, the results of this comprehensive study provide a strong foundation for informed decision-making and sustainable soil and water resource management when development activities will be implemented in the Uma Oya sub-basin.

Keywords: Geographic Information System, Hydrological characteristics, Morphometric analysis, Soil erosion, Watershed management

(ID 064)**Red-Earth Material as a Novel Adsorbent for the Removal of Phosphates from Aqueous Media****Poththawela, H.W.S.V.^{1*}, Liyanage, S.¹, Cooray, A.T.¹, Diyabalanage, R.S.^{2,3}**¹*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Instrument Centre, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*³*Ecosphere Resilience Research Centre, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***sainivinadhi96@gmail.com***Abstract**

Phosphate removal is now a major environmental concern as many aquatic ecosystems are affected by cultural eutrophication. Harmful algae blooms arising from eutrophication are seen on the surface waters, making water resources less appealing for domestic, industrial, and other recreational activities. Adsorption is recognized as an effective method of removing excess phosphate from aqueous solutions. This preliminary study centres on investigating the feasibility of the adsorption of phosphates (PO_4^{3-}) onto Red Earth, commonly found in the Northcentral and North-western provinces of Sri Lanka. In this study, red earth-based adsorbents have been prepared via acid activation and acid-thermal activation methods. X-ray diffraction (XRD), X-ray fluorescence (XRF), and Fourier Transform Infrared Spectroscopy (FT-IR) were performed to characterize the prepared adsorbent materials. The adsorption capacities and the effect of the column parameters on phosphate removal were examined using column studies. The column study employed nonactivated and activated soil particles in the size range of 125-250 microns, packed in a 1 cm diameter and 20 cm length column. Experimental data suggested that sorption mainly depends on column parameters of bed height, flow rate, and inlet feed concentrations and is less dependent on pH, and co-existing anions. Breakthrough curves were analysed for different bed heights (4.5 cm, 6.0 cm, 7.5 cm), initial concentrations (50.0 mg/L, 75.0 mg/L, 100.0 mg/L), and flow rates (1.15 mLmin^{-1} , 3.62 mLmin^{-1}). It has observed the highest adsorption capacity of 2.05 P mg/g at optimum conditions (7.5 cm, 100 mg/L, 1.15 mLmin^{-1}). Column Adsorption behaviours were evaluated with Thomas and Yoon-Nelson's mathematical models. Preliminary outcomes of sorption-desorption regeneration cycles depict that phosphate uptake is not entirely reversible. Since red-earth is still not utilized for any specific application, this study's results and outcomes magnify the red earth mineral's feasibility as an easily abundant, cost-effective, green sorbent to remove phosphate pollution from aqueous media.

Keywords: Red-earth, Phosphate, Adsorption, Column study, Breakthrough curves

(ID 171)

Geochemical Signature and Micromorphology of Ferruginous Gravel and Laterite Deposits in Northern Sri Lanka

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Abstract

Ferruginous gravel is an iron-cemented clastic sedimentary deposit that covers most of the northern province with interconnecting laterite and red earth deposits. The study is conducting a novel investigation of the detailed geochemistry and micromorphology of the ferruginous gravel and laterite deposits in northern Sri Lanka. Two profiles were selected for detailed investigation in the Mullaitivu district and collected samples from two profiles were analysed for micromorphology, phase identification, and the geochemical signature of the ferruginous gravel and laterite deposits using scanning electron microscopy (SEM), X-ray diffraction (XRD), and inductively coupled plasma mass spectrometry (ICP-MS), respectively. SEM images of thin sections revealed the nature of microfractures, cavities, and authigenic minerals, including goethite and kaolinite, in the ferruginous gravel and laterite deposits. XRD analysis confirmed the dominance of quartz and goethite, with minor kaolinite peaks. Fe-Al-V-Cr-Mn-Ge-Ba is the major element, and traces of rare earth elements were identified using ICP-MS data. The similar mineral and chemical compositions of ferruginous gravel and laterite deposits suggest a common formation pathway under intense weathering conditions, leading to silica-rich, iron-cemented, clastic sedimentary deposits highlighting their unique characteristics.

Keywords: Ferruginous gravel, Laterite, Micromorphology, Geochemistry, Clastic sediments

(ID 280)

Examining the Adsorption of Fluoride Ions in Fluoride-Bearing Groundwater using Suspended Particles of Thermally Activated Laterite Soil

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Abstract

The present study used thermally activated laterite soil as a novel adsorbent to remove fluoride from the selected groundwater. The main objective of this study is to examine thermally activated laterite soil to remove fluoride by the suspension. The optimum temperature for heating the raw laterite soil was determined using a temperature series from 100° C to 400° C for 4 hours in a muffle furnace. Based on the results, 350° C treated laterite soil was used as the optimum temperature (TALS350). The physicochemical characteristics of laterite soil were investigated by X-ray Diffraction (XRD) analysis, X-ray Fluorescence (XRF) analysis, Fourier Transfer Infra-Red spectroscopy (FT-IR), Scanning Electron Microscope (SEM), and Brunauer-Emmett-Teller (BET). The effect of active parameters such as pH of the groundwater sample, adsorbent dosage, and contact time was examined on fluoride adsorption by TALS350 using batch experiments. The batch experiments used a groundwater sample with an initial 2.5 mg/L fluoride concentration. The results showed that the maximum fluoride efficiency attained by TALS350 was at an initial pH of 5 after 50 minutes of contact time and with an adsorbent dose of 7.5 g. Experimental kinetic adsorption data fitted better with the pseudo-second-order kinetic model with the maximum adsorption capacity of 0.014 mg/g. The FT-IR spectrum confirmed fluoride adsorption onto the TALS350 after fluoride adsorption of TALS350. Forty groundwater samples were collected from three villages in Nikaweratiya to analyse fluoride removal efficiency on TALS350. In addition, physical and chemical parameters were examined to determine the quality of the groundwater. The groundwater was identified as sodium (Na⁺) and chloride (Cl⁻) type based on the results of Piper classification. The results concluded that the selected groundwater shows 98% maximum fluoride removal efficiency. Therefore, this study revealed that thermally activated laterite can act as an efficient adsorbent to remove fluoride ions from the selected groundwater under suspension.

Keywords: Batch-experiment, Suspension, Kinetic, Physicochemical

(ID 046)

Identification of *Salmonella* sp., *Shigella* sp., and Pathogenic *E. coli* in Dug Wells Water Around Karadiyana, Meethotamulla, and Kerawalapitiya Open Dump Sites

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Abstract

The contamination of groundwater by pathogenic microorganisms is a crucial health concern worldwide. *Salmonella* sp., *Shigella* sp., and virulent *E. coli* are the major pathogenic microbial species causing severe health consequences for the general public. Therefore, the present study focused on identifying *Salmonella* sp., *Shigella* sp., and pathogenic *E. coli* in the dug wells water around the Karadiyana, Kerawalapitiya and Meethotamulla dump sites in Sri Lanka. The samples were collected in October 2022, and they were filtered using sterilized 0.45 µm filter papers. The enrichment study for *Salmonella* sp., *Shigella* sp. was done using the Rappaport Vassiliadis Soya peptone broth (RVS) and Selenite Cystine broth (SCB) medium. Further, the broth cultures were streaked on Xylose Lysine Deoxycholate (XLD) selective medium, and the positive colonies were confirmed following biochemical tests. In addition, the Congo red method was followed to confirm the pathogenic *E. coli* strains and the water quality analysis were performed following the APHA standards method. Based on the study's results, 70% from Karadiyana and 100% of Meethotamulla and Kerawalapitiya were contaminated with *Salmonella*. In contrast, the *Shigella* contamination was recorded as 80%, 67%, and 50% from Karadiyana, Meethotamulla and Kerawalapitiya, respectively. The water quality analysis results for pH, DO, Electrical Conductivity (EC), Chemical Oxygen Demand (COD), N-NO₃⁻, N-NO₂⁻, N-NH₃, and total phosphate ranged between 4.25-7.8, 0.5-7.64 mg/L, 163.9-5,248 µS/cm, 150-596 mg/L, 1.05-5.25 mg/L, 0.52-5.04 mg/L, 0-0.58 mg/L, and 0-3.52 mg/L respectively. The results of water quality and pathogenic microorganisms in the selected dug wells were significantly correlated (p<0.05). Further, the COD in all the wells had exceeded the maximum tolerance level (10 mg/L) of SLSI ambient drinking water quality standards. Therefore, it can be concluded that all the ground water around these three dump sites is not suitable for drinking purposes.

Keywords: *Salmonella* sp., *Shigella* sp., *Escherichia coli*, Water quality, Municipal dump sites

(ID 056)

Determination on the Impact of *Azolla pinnata* Liquid Fertilizer on Growth and Yield of Tomato (Var-*Thilina*)

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Abstract

The tomato plant is one of the most popular and widely grown vegetables in Sri Lanka. Even though usage of inorganic fertilizers improves the yield, these chemicals could cause several detrimental impacts on environment and human health. Therefore, the current study was conducted to investigate the effects of *Azolla* liquid fertilizer (ALF) on growth and yield of tomato, variety *Thilina*. The field experiment was designed with four treatments namely T1-100% of ALF, T2-50% of Department of Agriculture (DOA) recommended fertilizer+50% of ALF, T3-100% of DOA recommended fertilizer and T4-Control, each with three replicates and laid out in a randomized complete block design. The fertilizers were applied as foliar and ground application from one week after transplanting and continued until pod formation. Then the growth parameters such as mean plant height, number of leaves, number of branches, number of flowers, number of pods, and individual pod weight per plant were recorded for analysis. According to the results, T2 performed well in terms of mean plant height (68.83 cm), number of leaves (30), number of branches (4), number of flowers (13), number of pods (11), individual pod weight per plant (43.33 g) and total yield (490 g) while poor performance was recorded in control for all parameters with the values of 53.33 g, 23 g, 3 g, 6 g, 3 g, 30 g, and 100 g respectively. As significant differences were noticed in the statistical analysis for all parameters excluding the individual pod weight per plant only, it can be concluded that applying the combination of 50% ALF with 50% DOA recommended fertilizer improves the growth and yield of tomato significantly. Further, it would reduce the cost of production by minimizing the money spent on inorganic fertilizers and mitigates the environmental damages.

Keywords: Foliar application, Ground application, Inorganic fertilizers, Liquid fertilizer

(ID 152)

Assessment of Water Quality in the Main Waterbodies in Anuradhapura Town, Sri Lanka

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Abstract

Water is a valuable natural resource important for sustaining life and the environment. This priceless resource is now in danger of pollution, mainly due to the high usage of agrochemicals, urbanization, and industrialization. The quality of water has deteriorated in the water resources of Sri Lanka over time. Consumption of deteriorated water in daily life has led to serious issues with human health in many parts of the country. Hence, assessing water quality is an important thing to examine the impact on human health. Anuradhapura town in Sri Lanka is an ancient city with hundreds of sacred places and manmade tanks. These tanks are used to fulfil drinking water and other domestic water needs, for natural beauty and cooling the surrounding environment. Nuwara wewa and Thisa wewa are the two main tanks which provide water to people in Anuradhapura town. The objective of this study was to assess the important water quality parameters and to identify the major contaminants in those water sources. Water samples were collected from several points in both tanks every month of the year from January 2020 to October 2023. On-site measurements such as pH, total dissolved solids (TDS), temperature, dissolved oxygen (DO) and electrical conductivity (EC) were taken using portable multipara meter, respectively. Nitrate, Phosphate and Ammonia were analysed using spectrophotometric methods. The results were compared with Central Environmental Authority (CEA) Standards for inland waters. Some bathing places in both tanks showed increased average pH and Ammonia levels which were not within the standard value in August, September and October after the Poson festival in July and returned to normal in the rainy and paddy cultivation season starting from October. The result further revealed that the Ammonia content increased in bathing places due to human urination, and it leads to an increase in the pH levels. Since Thisa wewa and Nuwara wewa are the main drinking and domestic water sources of the majority of communities in Anuradhapura town, maintaining the tank's health is vital for the health of consumers as well as aquatic life in the catchment. Therefore, it is suggested to introduce proper methods to stop bathing in domestic and drinking water sources.

Keywords: Water quality, Thisa wewa, Nuwara wewa, Water pollution

(ID 247)

Inhibition the Harmful Cyanobacterium *Spirulina* using *Moringa oleifera* Functionalized Iron Oxide Nanoparticles in the Beira Lake, Sri Lanka

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Abstract

Harmful algal blooms (HABs) often result from eutrophication in freshwater lakes due to the excessive growth of algae. These colonies can be detrimental on human beings, fish, shellfish, aquatic mammals, and birds due to the production of toxins and depletion of oxygen in the water. Among all HABs, *Spirulina* is the type of cyanobacteria, often considered a type of blue-green algae that grows in both fresh and saltwater and a bloom-forming species that is common in eutrophic lakes and reservoirs. *Spirulina* typically consumed as a dietary supplement due to its high nutritional value. However, *Spirulina* produces cyanotoxins as microcystin and hepatotoxin that cause to acute poisoning. Moreover, it can absorb heavy metals from its aquatic environment. As an inhibitory agent, this study explores potential of *Moringa oleifera* functionalized iron oxide nanoparticles (MO-IONPs) in inhibiting *Spirulina* growth through coagulation. Iron oxide nanoparticle were synthesized using co-precipitation method and functionalized with *Moringa oleifera*. A series of MO-IONPs concentration combinations were tested for their efficacy. The Jar test was conducted to evaluate the inhibitory effects of MO-IONPs on *Spirulina* using water samples from Beira Lake, Sri Lanka. Algal growth inhibition was assessed by monitoring cell density. Notably, the inhibitory activity of *Spirulina* was increased when increasing the concentration combinations of MO-IONPs. The results demonstrated that there are significant inhibitory effects of MO-IONPs on *Spirulina*. Specifically, after a 30-minute exposure to 20 mg of IONPs combined with 400 mg of MO, *Spirulina* cell concentration reduced to $68.17 \pm 0.20\%$ compared to the control group. Thus, the results suggest that MO-IONPs can be an effective coagulant in mitigating *Spirulina*-induced HABs in Beira Lake, Sri Lanka.

Keywords: Harmful algal blooms, *Spirulina*, Inhibition, *Moringa oleifera*, Iron oxide nanoparticles

(ID 263)

Impact of Different Types of Soil Amendments and Their Hydrophobicity on Soil Aggregate Formation

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Abstract

Soil aggregate formation is a combined action of soil's physical, chemical, and biological activities. Soil hydrophobicity is a phenomenon that influences various physicochemical and biological processes in soils. It may thereby influence the formation of soil aggregates. Soil hydrophobic conditions are influenced by various organic and inorganic materials. There is a possibility for soil amendments utilized in agriculture to induce hydrophobic properties in soils, subsequently influencing soil aggregate formation. This study aimed to examine the impacts of soil amendments on aggregate formation using four amendments, namely cattle manure (CM), hydrophobic leaf litter (*Casuarina equisetifolia*, CE), biochar produced from CE leaf litter (BC_{CE}), and quick lime (CaO). Sieved (<2 mm) surface soil was mixed with 3% of CM, CE and BC_{CE} and 1% of CaO. Surface soil (no amendment) was used as the control. There were five treatments, including the control, and the treatments were triplicated. The prepared mixtures were moistened up to 80% of the field capacity and incubated under laboratory conditions. The moisture content was maintained by spraying water on moisture-loss basis at 7-day intervals. The formed aggregates were separated, and weights of the total aggregates were recorded at 5, 10, 20 and 30 weeks of incubation periods using separate sets of samples (N=60). The 3% CE amended soils showed the highest total aggregate formation at each measurement (5.00%, 6.95%, 6.70% and 6.27% at 5, 10, 20 and 30 weeks, respectively). Only the 3% CE amendment showed significantly higher aggregate formation than the control at 5 and 10 weeks after incubation. Both 3% CE and 1% CaO amended samples showed significantly higher aggregate formation than the control at 20 and 30 weeks after incubation ($p < 0.05$). Results revealed that the addition of hydrophobic litter material enhanced the formation of soil aggregates. Hydrophobic organic components in CE might be the reason for the enhanced aggregate formation at each time interval. Besides the hydrophobicity, inorganic ions, especially Ca^{2+} , increased soil aggregate formation. Further experiments are necessary to identify exact phenomena related to hydrophobicity and aggregate formation, considering different types of amendments and longer periods.

Keywords: Aggregate formation, Hydrophobicity, Soil amendments

(ID 271)**Chemical Index for Assessment of Groundwater Palatability: A Case Study from Vavuniya****Rathnayaka, R.M.D.T.^{1*}, Weerasooriya, R.², Pratheepkumar, M.¹**¹*Department of Bio Science, University of Vavuniya, Vavuniya, Sri Lanka*²*National Institute of Fundamental Studies, Kandy, Sri Lanka***rathnayakarmdt@gmail.com***Abstract**

Vavuniya, located in the northern province of Sri Lanka, primarily relies on groundwater as its main drinking water source. However, the area witnessed rapid population growth during and after the civil war, driven by extensive development projects like resettlement programs. Consequently, heightened water demand strains groundwater resources, compromising quality due to overexploitation. This study aimed to evaluate the fluctuation patterns in groundwater quality within Vavuniya (coordinates) and develop a comprehensive water quality index, namely the O-index. This index was built upon chemical speciation analysis, allowing an assessment of water palatability. Sixty groundwater samples were collected from 42 dug wells and eighteen tube wells. Sodium (Na), potassium (K), calcium (Ca), and magnesium (Mg) were measured in total, whereas anion species were also measured. These samples were then analysed for Ca^{2+} , Mg^{2+} , K^+ , SO_4^{2-} , and SiO_2 for the index. Questionnaire data was also collected from consumers of the sampled water sources to assess their perceptions of the water's taste. According to the O-index, palatable water is ranked above 2.0. Calcium, potassium, and silica were positively correlated with palatable water, while sulphate and magnesium were negatively correlated. The O-index data was refined based on the chemical speciation of the sampled water quality. Tube-well water samples had a slightly higher mean O-index value (1.57 ± 0.68) than well-water samples (1.35 ± 0.55), indicating better taste. However, tube-well water samples also showed greater variability with higher standard deviations. Tube-well or dug-well water samples did not obtain a mean value of more than 2 for palatability, which is required to be considered palatable. However, a slightly higher percentage of tube well water samples (25%) complied with the standard than dug well water samples (6.24%). After obtaining the results, water was classified as palatable or non-palatable. This classification appears rational, as the findings align with everyday experiences. Overall, tube well water quality seems slightly superior based on median values, but both water sources are susceptible to contamination and should be tested regularly. The research contributes to understanding the palatability of groundwater and its relevance for human consumption.

Keywords: Groundwater palatability, Human consumption, O-index, Spatial distribution

(ID 278)

Formulation and Characterization of *Azolla pinnata* and Effective Microorganisms-Based Organic Vermi-Liquid Fertilizer**Ekanayake, E.M.C.A., Amarasinghe, S.R.****Department of Soil Science, Faculty of Agriculture, University of Ruhuna, Matara, Sri Lanka***rajika@soil.ruh.ac.lk***Abstract**

The challenges of modern agriculture should be addressed using environmentally sound, economically viable and socially supportive techniques. This study aims to determine the effects of *Azolla* based vermi-liquid fertilizers enriched with Effective Microorganisms (EM) as an organic liquid fertilizer. Cattle manure, loamy soil, paddy straw, rice husk biochar and banana peels were used as bedding materials and applied into 5 L plastic cans as layers and the red earth worms (*Eisenia fetida*) were introduced. Water was added daily, maintaining 60% moisture level and from day-15 to day-45, the liquid was collected at 15-day intervals for physicochemical characterization. The treatments were arranged as T1: only vermicomposting bedding materials (VBM), T2: VBM + 1 part of *Azolla*, T3: VBM+1 part of *Azolla*+EM, T4: VBM+2 parts of *Azolla*, and T5: VBM+2 parts of *Azolla*+EM. The characterization of the collected liquid fertilizer (day 15, 30 and 45) was done by measuring pH, EC, available NO_3^- -N, NH_4^+ -N, P, K, extractable Ca, and Mg. The pH of all liquid fertilizers in every treatment decreased with time and was alkaline. The EC values in every treatment were high on day-15 with the highest observed value in T5 ($7.45 \pm 0.42 \text{ mScm}^{-1}$). Then, EC decreased without significant difference between EC values on day-30 and day-45 in all treatments. The NO_3^- -N concentration increased with the time in every treatment while T1 showed the highest concentration on day-45 ($351.45 \pm 69.54 \text{ ppm}$). However, the NH_4^+ -N concentration was decreased with the time in all treatments except T5 obtaining the highest NH_4^+ -N concentration on day-45. In T5, NH_4^+ -N concentration decreased until day-30 and then increased again on day-45. The P concentration increased over time in every treatment, with T5 showing the highest concentration on day-45 ($19.93 \pm 9.21 \text{ ppm}$). The K concentration showed significant difference ($p < 0.05$) among all treatment in day-15 and T5 showed the highest ($554.54 \pm 27.73 \text{ ppm}$) concentration. The Ca and Mg concentrations increased significantly ($p < 0.05$) over time where T3 showing maximum concentration of $251.78 \pm 8.96 \text{ ppm}$ of Ca and T5 showing maximum concentrations of $55 \pm 8.66 \text{ ppm}$ of Mg on day-45. According to the results, the highest ammonium, phosphorus, potassium, and magnesium values were obtained in T5 with VBM, 2 parts of *Azolla* and EM on day-45 vermi-liquid fertilizer collection. Hence, this combination could be introduced as an effective vermi-liquid fertilizer.

Keywords: *Azolla*, Biochar, Earthworms, Effective microorganisms, Vermi-liquid

(ID 279)**Study of the Suitability of Dosing Polyaluminium Chloride made by Scrap Waste Aluminium for Water Treatment****Wijesinghe, L.P.R.A.N.¹, Tilakarathna, I.A.N.D.P.², Welikala, D.N.P.^{2*}**¹*College of Chemical Sciences, Institute of Chemistry Ceylon, Sri Lanka*²*National Water Supply and Drainage Board, Sri Lanka***dnpw0802@yahoo.com***Abstract**

Water treatment is essential to provide safe drinking water for human consumption. The National Water Supply and Drainage Board (NWSDB) is the national organization that provides safe drinking water in Sri Lanka. The conventional water treatment process includes aeration, coagulation, flocculation, sedimentation, filtration, and disinfection. Different types of coagulants - aluminium sulphate, poly-aluminium chloride, ferric sulphate, and ferric chloride are used in water treatment. NWS&DB uses aluminium sulphate and poly-aluminium chloride (PACl) as coagulants. PACl it is more effective than aluminium sulphate in water treatment. Since PACl is not being manufactured in Sri Lanka, it has to be imported. The annual requirement of PACl is 6,100 MT in NWSDB. Therefore, they have to spend around LKR 500 million to import it. When considering the prevailing economic crisis and the global pandemic, it has become a challenge. Therefore, manufacturing of PACl in Sri Lanka by using scrap aluminium will save foreign currency and will be a great opportunity for the country. This research is based on the use of scrap waste aluminium, a common by-product obtained from the Industrial Development Board, instead of Al_2O_3 (or a mineral containing Al_2O_3) which is commonly applied by most industrial producers and exhibits important benefits such as energy and time saving during the preparation procedure. Several efforts have been made to produce the pre-polymerized coagulant with properties similar to those of a commercially available PACl solution using appropriate, commonly found laboratory equipment and without the application of extreme conditions in terms of temperature or pressure. The laboratory prepared PACl was characterized mainly by means of aluminium content, basicity, density, and aluminium species distribution. Furthermore, the coagulation performance of PACl was evaluated for the treatment of water samples and compared with the performance of a commercially available PACl solution. Finally, the coagulation-flocculation kinetics were examined with the use of a jar test apparatus, and the floc growth rates between the two coagulants were compared. The results suggested that PACl can be alternatively produced under mild conditions, resulting in a product with better properties than the commercial PACl used for comparison. Additionally, if the preparation takes place on an industrial scale, a greater improvement is feasible due to the common equipment used.

Keywords: Polyaluminium chloride, Coagulant, Polymerization

(ID 289)

Comparison of Effects of Alum Sludge-Bound Seaweed Bio-Stimulant and Bentonite Clay-Bound Seaweed Bio-Stimulant on Seed Germination of Radish (*Raphanus Sativus* L.)

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Abstract

The marine algal seaweed and its extracts have been widely utilized as bio-stimulants in cultivation systems. They contain a lot of macronutrients (N, P, K), micronutrients (Mn, Zn, I), and bio-stimulants such as cytokinin, gibberellin, auxin, abscisic acid, and betaines. The application of these seaweeds bound by a binding material may increase its application possibility while slowly providing necessary nutrients to the plant media. The present study was conducted to characterize commercially available seaweed pellets and pellets produced by locally available seaweed variety (*Kappaphycus rhodophyta*) using alum sludge as a binding agent and to compare the effects of these pellets on seed germination bioassay of *Raphanus sativus* L. Four dilution series (100%, 75%, 50%, 25%) of aqueous extracts were obtained by extracting the pelleted bio-stimulants on 1:10 W/V basis. Distilled water was considered as the control treatment. Each treatment was replicated three times and arranged in a complete randomized design (CRD). *R. sativus* L. seeds were placed in Petri dishes, and 3 mL of aqueous extracts were added according to the treatment allowing seeds to germinate for 72 hours in a dark place. Relative Seed Germination % (RSG%), Relative Radicle Growth% (RRG%), and Germination Index (GI) were calculated for the aqueous extract series of each pellet. In locally manufactured bio-stimulants, the highest GI was obtained in 75% aqueous extract (210.6), and commercial bio-stimulants showed the highest GI in 50% aqueous extract (168.5). Accordingly, there were no phytotoxic effects in both pelleted seaweed bio-stimulants and their dilution series on *R. sativus* L. seed germination. Compared to the commercial bio-stimulant, the alum sludge-bound seaweed bio-stimulant obtained the highest germination. Also, the characterization results of pellets showed that organic matter is significantly high in alum sludge-bound seaweed pellets (29.9%) compared to commercial pellets. Furthermore, it showed that the total N, NO₃⁻-N, available P and K were highest in alum sludge-bound seaweed pellets. Further studies are needed to obtain the applicability and effectiveness of the new pelleted product for crop growth and yield performances.

Keywords: Alum sludge, Bio-stimulant, Binding material, Pellets, Seaweed

(ID 295)

Effect of Anaerobic Soil Disinfestation System on Soil Carbon and Nitrogen Mineralization of Tea Nursery Soils in Up Country Wet Zone

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Abstract

Anaerobic Soil Disinfestation (ASD), is a promising pre-treatment method that can alter the chemical methods by disinfecting the soil, creating an anaerobic condition. This method is implemented by incorporating soil with easily decomposable organic amendments and covering it with air-impermeable polythene. However, the dynamics of Carbon and Nitrogen contents in the ASD system has not been clearly defined yet. Therefore, this study was conducted to determine the dynamics of Carbon and Nitrogen using different organic amendments in this system. Easily decomposable organic matters were selected such as *Tithonia diversifolia*, *Gliricidia sepium*, cabbage crop residues, poultry litter and cattle manure and their combinations. Treatments were applied at a 5 t/ha rate to both aerobic and anaerobic systems and analysed for soil organic carbon, NO₃⁻-N, NH₄⁺-N, pH and redox potential on day-35 and a comparison was done between aerobic and anaerobic systems. Further, an incubation study was conducted for 35 days to determine C and N mineralisation by each treatment under the aerobic condition. After 35 days, redox potential has been noticeably reduced until -50 mV in some anaerobic-treated soils confirming the anaerobic condition. The organic carbon content in treated soil under anaerobic conditions was higher than the aerobic conditions. Higher carbon content in anaerobic condition was observed in soil incorporated with cabbage crop residue (16.551%±2.93) and the poultry litter 40%+*Gliricidia* 60% combination (18.85%±6.25). The highest carbon content (14.73%±6.26) was observed in the soil treated with cabbage residue in aerobic conditions. There were no considerable changes shown in anaerobic NO₃⁻-N mineralization compared to aerobic treatments. However, in aerobic condition, poultry litter 40%+*Gliricidia* 60% combination and cabbage crop residue treatments showed significantly higher NO₃⁻-N production. The highest NH₄⁺-N production was observed in *Tithonia* (41.15±1.63 ppm), cabbage crop residue (42.89±1.30 ppm), and the combination of cattle manure 40%+*Gliricidia* 60% (43.69±0.158 ppm) treatments in anaerobic conditions. Poultry litter 40%+*Gliricidia* 60%, poultry litter 40%+cabbage 60% and cattle manure 40%+*Gliricidia* 60% which showed a higher NH₄⁺-N yield content in aerobic conditions. The highest CO₂-C was obtained in Cabbage crop residue at day-35 of aerobic incubation (1423 mg/kg). There was a positive and significant increase in carbon (p<0.05) and NH₄⁺-N (p<0.05) in the ASD system compared to aerobic conditions by nourishing and reconditioning the soil using incorporated organic amendments under an anaerobic environment.

Keywords: Aerobic, Anaerobic soil conditions, *Gliricidia*, Organic matter, Poultry litter

(ID 134)

Vertical Profiles of Selected Soil Physico-Chemical Parameters in Natural, Restored, and Degraded Mangrove Ecosystems of Sri Lanka

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Abstract

The growth of mangroves is profoundly influenced by the physio-chemical properties of their pedosphere. For the successful management and restoration of mangrove ecosystems, information on these properties is crucial. In this study, vertical profiles of soil characteristics, including pH, salinity, electrical conductivity (EC), wet soil colour, and dry bulk density (DBD) were examined to a depth of 50 cm in five distinct mangrove restoration sites of Sri Lanka: Anawilundawa, Pubudugama, Achchankulum, Trincomalee, and Batticaloa. These sites encompassed natural mangrove ecosystems, adjacent restored areas, and degraded mangrove lands. The study assessed variations among different depths, sites, restoration statuses (natural, restored, degraded), mangrove composition (*Avicennia marina* dominant, *Rhizophora mucronata* dominant, mixed species), and time elapsed since restoration (10 and 18 months). Stratified random sampling was employed and three replicates were taken from each stratum in each site resulting in the analysis of a total of 1,650 soil samples. In natural mangrove areas, the mean soil pH was 7.4 ± 1.00 , displaying no significant variation with depth. Conversely, EC (mean $6.502 \pm 4.605 \text{ mScm}^{-1}$), salinity (mean $5,020 \pm 3,804 \text{ mgL}^{-1}$) and DBD (mean $1.217 \pm 0.4898 \text{ gcm}^{-3}$) of natural mangroves exhibited depth-dependent trends. The EC and salinity decreased with depth whilst bulk density increased. The lowest pH (7.4 ± 1.00) was recorded in the natural ecosystems and showed a distinct increase with the age of the mangroves (restored 7.92 ± 0.87 , degraded 8.02 ± 0.72). EC was lowest in restored areas ($4.9739 \pm 2.9931 \text{ mScm}^{-1}$) and highest in degraded lands ($7.880 \pm 6.651 \text{ mScm}^{-1}$). Bulk density was highest in degraded lands ($1.3894 \pm 0.2770 \text{ gcm}^{-3}$), with a similar inverse relationship with the age of mangrove as soil pH. Soil pH at Pubudugama and Trincomalee was significantly higher (8.4 ± 0.41) compared to the other three sites (7.4 ± 0.96), while the lowest EC ($2.1685 \pm 1.6002 \text{ mScm}^{-1}$) and the highest DBD ($1.4732 \pm 0.4743 \text{ gcm}^{-3}$) were observed in Batticaloa. Mangrove soil dominated by *A. marina* displayed the highest pH (7.8 ± 0.91) and EC ($6.21 \pm 4.678 \text{ mScm}^{-1}$). The brownness of the soil increased with depth while the blackness of the soil increased with the maturity of the mangroves. These findings establish essential baseline data for restoring degraded mangrove. The observed variations in soil physico-chemical parameters provide valuable insights into the dynamic changes induced by restoration. The regional variation and depth-based differences in studied parameters, should be further investigated with carbon loads.

Keywords: Mangrove soil, Physio-chemical parameters, Spatial variation, Vertical profile

(ID 033)

Preliminary Survey of Ants (Hymenoptera: Formicidae) in Dombagaskanda Forest Reserve, Sri Lanka**Wijewardana, M.P.D.S.*, Abegunawardhana, P.D.***Young Biologists' Association, Sri Lanka***dulnethwijewardana@gmail.com***Abstract**

Sri Lanka is renowned for its exceptional biodiversity, with a total of 341 documented valid species and subspecies of Formicidae, solidifying its status as an ant diversity hotspot. A preliminary survey to assess ant species diversity was conducted at Dombagaskanda Forest Reserve, Sri Lanka, on 24th of September and 20th of October 2023, from 9.00 a.m. to 3.00 p.m. Dombagaskanda is a tropical evergreen forest located in Kalutara District, Western Province, in the island's wet zone (rainfall > 2,500 mm/y). The study was conducted along a 150 m stretch of the access road to the Bodhinagala Temple. Survey techniques included rock flipping and visual observations aided by hand lenses, while detailed field notes were taken to record relevant data. However, our observations were somewhat constrained due to rain, which rendered the ground muddy and wet. The observed individuals were photographed using a camera equipped with a macro adapter and identified using standard guides. Identification was based solely on photographs. Ants belonging to five subfamilies were recorded, totalling 29 species. Notable species encountered during this survey included *Anochetus graeffei*, *Anoplolepis gracilipes*, *Brachyponera obscurans*, *Camponotus rufoglaucus*, *Carebara* sp. (1), *Cataulacus taprobanae*, *Cryptopone testacea*, *Diacamma indicum*, *Lophomyrmex* sp. (1), *Meranoplus bicolor*, *Myrmicaria brunnea*, *Nylanderia* sp. (1), *Odontomachus simillimus*, *Oecophylla smaragdina*, *Paratrechina longicornis*, *Pheidole parva*, *Pheidole rugosa*, *Pheidole spathifera*, *Pheidole* sp. (1), *Polyrhachis scissa*, *Prionopelta kraepelini*, *Pseudoneoponera rufipes*, *Tapinoma melanocephalum*, *Technomyrmex albipes*, *Tetramorium pacificum*, *Tetramorium insolens*, and *Trichomyrmex destructor*. Furthermore, we made a remarkable discovery by encountering a wood nesting ant species *Vollenhovia escherichi* and an endemical arboreal weaver ant *Polyrhachis curvispina* for the first time in the lowlands (previously known only from Peradeniya and Puwakpitiya respectively), thereby expanding our understanding of their geographical distribution. The former is Data Deficient while the latter is omitted from the 2012 National Red List. Despite human activity at the site (e.g., visiting the temple or collecting wood), the forest itself appears relatively undisturbed. The results suggest that the forest reserve is an important refuge of ant diversity. Our study underscores the importance of conducting surveys in various locations, such as the present study, to uncover the unseen diversity of ant fauna in Sri Lanka's lowland forests.

Keywords: Formicidae, Dombagaskanda, New localities, Ants of Sri Lanka, Diversity

(ID 189)

Method Development for Determination of Total Fatty Matter and Synthetic Surface-Active Agents in Bathing Bar

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Abstract

A bathing bar is a product containing both soap and non-soap detergents. It contains soap of fatty acids and synthetic surface-active agents as the active ingredients. Generally, the amount of these substances is verified at the Sri Lanka Standard Institute. However, the results obtained from the test methods available in SLS 1220:2016 are found to give a higher variation in both total fatty matter (TFM) and synthetic surface-active agents. Therefore, the objective of this study was to develop a test method to reduce the variation. In our finding we managed to reduce the variation of synthetic surfactants from 63.9% to 39.7% by using the centrifuged portion of the sample solution at the very initial step of the protocol. For the determination of TFM, two modifications have been made. First modification was to use diethyl ether for solvent extraction step, and it reduced the variation from 17.7% to 1.48%. The second modification was to use anhydrous sodium sulphate at the final stage of the analysis which reduced the variation from 11.2% to 3.60%. From this study, it was found that the variation could be reduced by following the suggested modifications, especially for TFM determination.

Keywords: Bathing bar, Total fatty matter, Synthetic surface-active agents

(ID 121)

Zonal Distribution of Biota on the Sheltered Side of Intertidal Rocks at Mount Lavinia

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Abstract

The rocky shore of Mount Lavinia Beach in the Colombo coastal area boasts a rich diversity of fauna and flora, with a particular emphasis on the intertidal rocks. Our study, initiated on October 25, 2023, is designed as a qualitative visual observation study to gather scientific data on the intertidal zonal distribution. For our site, we selected an area near to the Mount Lavinia Hotel, primarily focusing on the Oragala rocky shore, and randomly chose around six rocks for our analysis. Five distinct zones were identified based on the distribution of major biota on these rocks, which included a band of sedentary bristle worm tubes, a band of red algae, a band of green algae, a band of supratidal oysters and limpets, and the top of the rocks. The width of these zones was carefully measured. Intertidal biota exhibits a vertical distribution based on the rocks' surfaces, periodically submerged by water and exposed to air and sunlight. The lowest zone of sedentary worm tubes was 5-40 cm wide, red algae above was 25-55 cm, green algae zone 25-30 cm and the zone of supratidal oysters and limpets 20-35 cm. The fauna and flora were photographed for later identification. Our study revealed several key findings. Fauna and Flora were placed according to their feeding behaviours and survival strategies. Red algae received most immersion, green algae were exposed for longer periods and the higher areas with oysters were near the high tide line with wave splash zone above with periwinkles. A rock in the Oragala group displayed a distinct lack of water submersion and an unclear top. With an abundance of green algae that received intermittent exposure to intense sunlight. A rock in the Oragala group received water infrequently, resulting in a very low biota distribution. In conclusion, our study highlights the significance of tides and light in the extensive distribution of biota on this beach. Moreover, it highlights the pressing issue of coastal mismanagement and the need for conservation efforts to preserve the zonal distribution of biota in our coastal areas.

Keywords: Mount Lavinia, Zonation of biota, Rocky shore, Intertidal

(ID 164)

Faunal Diversity Assessment in the Newly Established Left Bank of Kalu River Mouth: Implications for Ecosystem Restoration

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Abstract

Rapid biodiversity assessments are essential to understanding species density within specific sites at any given time. As part of an ecosystem assessment for site restoration, an ecosystem diversity survey was conducted on the left side of the Kalu river mouth from October 8 to 10, 2023, spanning from 7:30 a.m. to 3:00 p.m. The surveyed stretch, approximately 1.5 km in length, represents a sand dune formation resulting from the diversion of excess floodwater from the Kalu River from May 2017 during the significant flooding event. This government-led river mouth changing initiative aiming rapid floodwater discharge significantly impacted beach dynamics, leading to change of the existed beach stretch that had persisted for three decades. A new sand reclamation process, initiated soon after the immediate monsoon, has autonomously evolved into a lagoon-like environment, showcasing natural regeneration and the colonization of pioneer species. Visual observation surveys, supported by photographs and field notes, identified a total of 75 faunal species, encompassing various taxa, such as snails (5), venerida (2), reptiles (5), decapods (1), spiders (10), orthoptera (5), hemiptera (4), coleoptera (5), hymenoptera (1), diptera (7), lepidoptera (10), birds (11), fish (7), and mammals (2). An intriguing discovery in the form of *Cerberus rynchops*, commonly known as the dog-faced water snake, underscores the potential diversity of the habitat. The newly established sandy area is predominantly covered by wild cowpea (*Vigna luteola*) and Beach Morning Glory (*Ipomoea pes-caprae*), providing a conducive habitat for invertebrates. However, invasive plant species, facilitated by bird droppings and river outflow, pose a threat to the area's ecological balance. Observations reveal a significant accumulation of non-biodegradable domestic waste, including plastics, glass bottles, and aluminium cans, along the beachfront, originating from river outflow. Additionally, abandoned ghost nets, carried by ocean currents, emphasize the urgency of addressing coastal and marine pollution prevention. The study suggests the introduction of regionally available non-invasive pioneer plant varieties as a restorative approach to enhance ecosystem health. Aims to mitigate environmental threats, enhance recreational capacity, and promote aesthetic and environmental qualities for the local community and surrounding biodiversity. Continuous observations throughout the year are recommended for a comprehensive understanding of the site's evolving biodiversity.

Keywords: Faunal diversity, Ecosystem, Kaluthara coastal area, Restoration, Conservation

(ID 029)

Recovery of a Rocky Shore at Mount Lavinia Following Extirpation of its Biodiversity

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Abstract

In 2020, the Coast Conservation Department conducted a 'beach nourishment' project with the aim of widening the beach at Mount Lavinia Bay. During this exercise, sand was dredged offshore and dumped on the beach, burying all the rocks. Over time, wave action washed away the sand, and the rocks emerged, revealing that all the intertidal fauna and flora of the rocky shore had been killed. Compounding this event was the episode of the ship X-Press Pearl catching fire on May 20, 2021 and sinking off the west coast of Sri Lanka on June 2, 2021. There were concerns that the surrounding water would be affected by chemical substances in the ship's cargo, which could have an adverse impact on the marine biodiversity of the area. Therefore, with the objective of documenting the recolonization of flora and fauna, a Qualitative Visual Observational survey was conducted from February 2021 to March 2023 along the rocky shore between the base of the hotel promontory to the south and the northernmost rock group (6°50'3.84" N, 79°51'44.68" E-6°50'10.11" N 79°51'46.23" E, a distance of 200 meters). This survey consisted of nine random visits. During the survey, specific notes were made about pioneer species and the species that followed. Furthermore, the species observed during the secondary ecological succession process were compared with historical records of species documented at the same site by one of the authors (MF) since the nineteen-eighties (unpublished personal records). MF identified the species during sampling sessions, and photographs captured by data collectors were also used in the identification process. Throughout the survey, 11 species of algae, 14 species of molluscs, and 6 species of other fauna were recorded. All of these species had been previously recorded at this site, indicating the reestablishment of biodiversity. The pioneer species during the reestablishment process included the algae *Chaetomorpha antennina*, *Grateloupia lithophila*, the limpet *Cellana rota* and a hermit crab species. Associated findings on the beach were nudles washed ashore from the X-Press Pearl. The results indicate that there were no lasting ill effects of the burial, and there was nothing to suggest lasting toxicity of the waters in the surrounding area following the sinking of the X-Press Pearl.

Keywords: Mount Lavinia, Rocky shore, Recolonisation

(ID 110)

Investigation of the Locomotory Behaviours of Water Striders (Gerrini)

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Abstract

Though the locomotion of water striders of tribe gerrini has been extensively studied, many if not all of these studies focus on the mechanical and physical aspects of the water strider's ability to reside and locomote atop the surface film of water bodies, and do not investigate the functionality and behavioral aspects of its locomotion. This study utilizes existing knowledge on the mechanics of water strider locomotion to build a more comprehensive understanding of the locomotory behaviors of water striders belonging to tribe gerrini. Observations were made on a population of water striders in a freshwater pond in Homagama, Western Province, Sri Lanka. Initial observations were made ad-libitum with the naked eye, and further observations were made by analyzing photographs and slow-motion videos. Through such analysis, two novel locomotory behaviors were identified: diagonal gliding, and reverse gliding and reorientation. These behaviors, both of which are comparatively complex and consist of several distinct movements, were observed to be utilized as the water strider navigated confined spaces. Furthermore, locomotory behavioral responses to extrinsic stimuli, specifically escape behaviors in response to potential threats (significant disturbances atop the water surface) were observed, and it was noted that water striders nominally responded to such stimuli with rapid successive gliding or leaping movements, the dynamics of which appear to be as described in existing literature. It is also notable that the water striders under study were habituated to the presence of freshwater fish, as well as humans who were regularly in proximity to the study site.

Keywords: Water strider Locomotion, Gerrini

(ID 163)

**Investigating Foraging Behaviour Patterns of *Porphyrio poliocephalus*
(Grey-Headed Swamphen)**

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Abstract

The Grey-headed Swamphen, *Porphyrio poliocephalus* is a species of the recently reclassified “Supertramp” superspecies, *Porphyrio*. It has been observed that the foraging behaviours of Grey-headed Swamphens are affected by behavioural responses to unrelated stimuli, the specifics of which have not been studied after its reclassification as a species in 2015. This study qualitatively investigates the energetic profitability of foraging behaviours, as well as the effects of unrelated behavioural responses on the foraging behaviours of Grey-headed Swamphens. Observations were made at a site within the Talangama wetland, in the Western Province of Sri Lanka. Observations were made through focal sampling and scan sampling, utilizing videography captured from a significant distance to avoid the Hawthorne effect. It was concluded that their foraging patterns were primarily influenced by the type and abundance of food, as well as food preference. Surprisingly, rainy weather had only a minimal impact on their foraging frequency, as they seemed adapted to forage efficiently even during rain. Morning and evening foraging behaviours did not significantly differ, but during the breeding season, adult swamphens displayed increased territoriality and vigilance due to the presence of young ones. However, their choice of nesting sites suggested an effort to optimize foraging even during breeding seasons. When faced with predators, the swamphens typically engaged in laboured flight or running with open wings and avoided the area for some time. They also exhibited social relationships with White Breasted Waterhens while foraging, even during breeding seasons. In summary, these factors collectively contribute to optimizing the swamphens' foraging behaviours and help them achieve a net positive energy gain.

Keywords: Grey-headed swamphen, Foraging behaviour, *Porphyrio poliocephalus*

(ID 245)

Cellulase Activity of the Halophilic Fungal Degraders

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Abstract

Cellulases are pivotal enzymes involved in cellulose degradation making them highly valuable in industries such as biofuel, paper, textile, brewery and in waste management. Due to the recalcitrant nature of cellulose and the low efficiency of available enzymes, exploring novel cellulases from the underexplored environments is crucial. Mangroves are an ecologically unique environment characterized by dynamic temperature, salinity, and tidal fluctuations, which are responsible for recycling organic matter accumulation in their sediments. Although mangroves house many detritivores, fungi are known to be more efficient biomass degraders than bacteria. Salt-tolerant cellulases are of particular interest compared to ordinary cellulases. Cellulases have a great application prospect in the improvement of saline-alkali soil. Lignocellulosic biomass in saline-alkali soil is difficult to be degraded due to high salinity and water-logged conditions, leading to poor circulation of organic material. Hence, this study delves into the cellulolytic potential of halophilic fungi isolated from leaf litter. The fungi were isolated from mangrove ecosystems neighbouring the NARA Regional Research Centre in Kalpitiya (8.25° or 8°15' North latitude, 79.77° or 79°46'15" East longitude). For the isolation and growth of fungi, media were prepared using the aged and filtered water from the same mangrove. Putative isolates were obtained by (i.) directly plating litter fragments in Water Agar and (ii.) incubating the litter in a moist chamber. Isolates were transferred to 2% malt extract agar (MEA) plates using the hyphal tip method. Of the 87 putative halophytic fungi isolated, 34 different morphotypes were identified based on detailed macroscopic and micromorphological features. The morphotypes were screened preliminary on carboxymethyl cellulose (CMC) plates. The hydrolysis rate of CMC served as the indicator, and only 23 of the isolates (26.42%) displayed positive cellulolytic results. From the pool of 23 promising isolates, the best 10 producers were coded and used for further investigation through the standard filter paper assay (FPA). These isolates were cultivated in Cellulase Basal Media (CMB) and subjected to an 8-day incubation in a shaking water bath. Whatman no. 1 filter paper strips were used as the primary source of cellulose. Crude enzymes were prepared through centrifugation, appropriately diluted, and then used for the FPA. The study also examined the impact of temperature (37° C, 50° C, and 60° C) and pH (pH 4, pH 5, and pH 6) on the cellulolytic activity of the crude enzymes. Notably, isolates A001, A030, B041, B047 and E082 showed promising results and isolate B047 showed good thermal stability in all three temperatures tested. Furthermore, the research extended to the extraction and assessment of the genomic DNA of the promising isolates. The identification of the promising isolates is underway.

Keywords: Cellulase activity, FPA, Halophilic fungi, CMB, Lignocellulosic

(ID 090)

The Survival of Antagonistic Fungi Against the White Root Disease of Rubber (*Hevea brasiliensis*) Under Field Conditions

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Abstract

White root disease of rubber caused by *Rigidoporus microporus* is considered as a very destructive root disease in Sri Lankan rubber plantations. The disease has a significant impact on annual rubber production. Therefore, use of a proper disease management method to control the white root disease is critical. Although, chemical fungicides are commonly used to control the disease, excessive usage is harmful to human and natural environment. However, usage of chemical fungicides cannot be avoided due to their high effectiveness and fast action. Hence, development of an integrated disease management method using chemical, cultural and biological methods is essential. Biological methods have many advantages compared to the chemical methods. *Trichoderma* is a fungal genus that is often employed as a bio control agent. *Trichoderma* spp. have been previously isolated from different rubber plantation soils by the Rubber Research Institute of Sri Lanka. Their antagonism against *R. microporus* has been investigated. *T. koningii* and *Hypocea lixii* (teleomorph of *T. harzianum*) have been selected as the best antagonists against *R. microporus*. A mixture of the two fungi has been cultivated in a compost-based carrier medium. However, investigation of the viability of the fungi in the final product under field condition is critical before application. Hence, the current study was conducted to investigate the survival of the selected antagonistic fungi under field conditions. Five healthy rubber plants were selected and planted on the ground. Four plants were planted around one middle plant. The middle plant was artificially infected with white root disease pathogen. One kilogram of compost inoculated with *Trichoderma* product was added to the root system of other 04 plants. Control was carried out with compost added plants without *Trichoderma* spp. inoculum. Ten sets of plants were maintained for each test and control. Plants were observed after 06 months, and soil samples were tested. In control, the middle plant and other 04 plants showed symptoms. In *Trichoderma* inoculated plants, only middle plant showed symptoms. Moreover, *Trichoderma* spp. had grown on culture plates which inoculated with soil samples taken around *Trichoderma* spp. inoculated plants. Microscopic characters also confirmed that the grown fungi are *Trichoderma* spp. According to the results of the study, the product actively works against white root disease and their viability also expands up to 06 months of application. *Trichoderma* isolates are helpful as a bio-pesticide for the improvement of a sustainable and eco-friendly agriculture.

Keywords: Antagonistic fungi, *Hevea brasiliensis*, *Trichoderma* spp., Viability, White root disease

(ID 206)

Current States of Medicinal Plants Diversity at Ponnalai, Jaffna**Karunya, S.*, Sathiyaseelan, V.***Unit of Siddha Medicine, University of Jaffna, Jaffna, Sri Lanka**[*srikaru030@gmail.com](mailto:srikaru030@gmail.com)***Abstract**

In Sri Lanka, Siddha Medicine is one of the oldest medical systems. Medicinal plants play a crucial role in this system. The objective of the study is to identify the medicinal plants in Ponnalai, Jaffna for in situ and ex situ conservation. This area is a coastal region (*Neidhal nilam*). This area map was used to locate and count the number of medicinal plants. The medicinal plants in this area were calculated using the Belt Transect Method. The Herbarium, Unit of Siddha Medicine, University of Jaffna was used to authenticate all identified specimens collected from the field for further clarification. The research was conducted from October 2021 to December 2021. A total of 90 medicinal plants species belonging to 36 families were identified and Fabaceae family being particularly noteworthy. Based on morphology herbs (33.33%), shrubs (26.67%), climbers (18.89%), trees (16.67%) and cactus (4.44%). This comprises of annuals (36.67%), biennials (14.44%) and perennials (48.89%). According to the parts used of medicine leaves (n=57), fruits (n=20), seeds (n=14), roots (n=42), stem (n=09), bark (n=17), young pot (n=06), root bark (n=05), gum (n=04), tuber (n=02), flower (n=14), whole plant (n=20), milky juice (n=05) and toddy (n=02). Among these medicinal plants, there were poisons plants (n=04), mangrove associates plants (n=07), edible fruits (n=09) and edible medicinal plants (n=20). *Aloe vera* was found abundantly in this region. Considering the diseases, among the identified medicinal plants 15 plants were used to treat *Kheel vayu* (Arthritis), 10 for *Kapha noi* (respiratory diseases), 16 for *Sarma noi* (Skin diseases) and 08 for *Mathumegam* (Diabetes mellitus). This area is extremely rich in medicinal plants which has high medicinal value due to the presence of natural compost. The diversity of coastal medicinal plant is being threatened due to the unsustainable harvesting practices and growing commercial demand for these plants in local and international markets. To preserve coastal medicinal plants in their natural habitats, effective conservation measures must be implemented.

Keywords: Medicinal plants, Ponnalai, Conservation

(ID 248)

Diversity and Distribution of Medicinal Plants in Vedukkunarimalai, Located at Nedunkeny, Northern Province of Sri Lanka

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Abstract

Medicinal plants are the primary source of Indigenous healthcare system in Sri Lanka. This study aimed to document and analysed the diversity and distribution of medicinal plants in *Vedukkunarimalai*, a forest area situated in *Nedunkeny*, at Northern Province of Sri Lanka. The forest area was identified using map and also with the help of local public. To identify medicinal plants in the forest area, systematic sampling method was done using belt transect method for the duration of three months. Medicinal plants are identified based on phytomorphology. Altogether there are 104 medicinal plants species belonging to forty-two families are identified and documented. Leguminosae, Euphorbiaceae and Malvaceae are the dominant families. Trees are the most dominant life form with 47%, herbs with 25%, shrubs with 17% and there are only 10% of climbers. 62 perennial medicinal plants are identified. Leaves, root, flowers, tubers, whole plant, fruits, seeds bark are the most commonly used plant parts and gum, resin, galls are the most commonly used secretory materials. The highest number of identified medicinal plants are used to treat gastrointestinal tract disorders (26%), then for skin (22%) and then for respiratory disorders (20%) and for skeletal system disorder, urinary disorders, fever, Diabetic mellitus with 10%, 8%, 8%, 2% respectively. Only one medicinal plant is identified for the treatment in gynecology disorder and one for the snake bite. In Siddha Medicine, property of a plant depends on *suva* (taste), *veerya* (potency) and *vipaka* (post digestive effect of ingested substance). Among the identified medicinal plants, most of them have bitter taste (44%), seconded with astringent taste (24%). Sweet, pungent and sour taste with 13%, 8%, 7% respectively. And only 18% of the identified medicinal plants have cold *veerya* & sweet *vipaka* and the other medicinal plants have hot potency and pungent *vipaka*. An alternative species for *Wrightia tinctoria*, has a dense diversity in *vedukkunarimalai* which is a specific dye separating plant. Identified medicinal plants from this study area indicates the abundant availability of natural resources in our forest. *Vedukkunarimalai* has rich diversity of medicinal plants so that it should be declared as a protective zone by the authority to conserve the natural resource.

Keywords: Diversity, Medicinal plants, Vedukkunarimalai, Nedunkeny

(ID 089)

Effective Protocol for In Vitro Callus Induction from Different Explants of *Rosa centifolia***Welikala, D.K.¹, Lakmali, G.B.T.¹, Bandara, S.A.R.R.W.M.¹, Priyadarshan, A.I.S.^{1,2*}, Senanayake, R.A.S.P.^{1,2}**¹*Floriculture Research Centre, University of Kelaniya, Kelaniya, Sri Lanka*²*Department of Plant and Molecular Biology, University of Kelaniya, Kelaniya, Sri Lanka**ashasri@kln.ac.lk**Abstract**

Genus *Rosa* belongs to the family Rosaceae and has a high floricultural demand all over the world. It is most often used for decorations, aromatic purposes, and medicinal value. Roses can be propagated by seeds, cuttings, layering, and grafting. Seed propagation often is not genetically identical, while other methods of rose propagation are slow and time-consuming. The objective of the present study was to develop an effective protocol for in vitro callus induction of *Rosa centifolia*. Nodal and leaf explants from *R. centifolia* were surface sterilized and cultured separately in Murashige and Skoog (MS) medium supplemented with 30 g/L brown sugar, 8 g/L of agar, and different concentrations. 6-benzyl amino-purine (BAP) (0.50, 1.50, 2.00, 2.50, 3.00 mg/L) combined with Indole-3-butyric acid (IBA) (0.40, 0.30, 0.20, 0.10, 0.00 mg/L) for nodal explants and BAP (0.50, 1.50, 2.00, 2.50, 3.00 mg/L) combined with Naphthalene acetic acid (NAA) (0.40, 0.30, 0.20, 0.10, 0.00 mg/L) for leaves disc. Explants were used beside the control without Plant Growth Regulators (PGRs) by adjusting the pH to 5.7. There were five replicates in each treatment. After three months of incubation in the dark at 26° C, the highest percentage of nodal explants producing callus was 88.0%, and the mean weight of callus per nodal explant was 5.68 g in the MS medium supplemented with BAP (2.50 mg/L) and IBA (0.10 mg/L). While the highest percentage of leaf disc explants producing callus (72.3%,) and mean weight of callus per leaf explant (6.23 g,) were reported in the MS medium supplemented with BAP (2.00 mg/L) and NAA (0.20 mg/L). The findings suggest that MS medium supplemented with BAP (2.50 mg/L) and IBA (0.10 mg/L) for nodal explants and MS medium supplemented with BAP (2.00 mg/L) and NAA (0.20 mg/L) for leaf explants are suitable for effective regeneration of callus of rose (*Rosa centifolia*).

Keywords: BAP, IBA, In vitro callus induction, NAA, *Rosa centifolia*

(ID 091)

Effective In-Vitro Culture Medium for Multiplication of *Phalaenopsis* cv. Pink Lip via Protocorm-like Bodies

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Abstract

Phalaenopsis are the most commercialized cut or pot flowers due to their long-lasting and varied flower morphology. At present, the technique of plant tissue culture has been used as the most effective and widely used way to overcome the limitations of conventional cultivation and for the rapid mass propagation of high-value *Phalaenopsis* plants. In tissue culture, the plantlets produced from protocorm-like bodies (PLBs) are genetically identical to the parent plant and important for the rapid multiplication of plants with desirable traits. PLBs need to be transferred to a nutrient-rich growth medium for rapid multiplication. Therefore, the selection of an effective culture medium for the multiplication of PLB is crucial to the enhancement of *in-vitro* propagation of *Phalaenopsis*. The objective of the present research was to identify an effective in-vitro culture medium for the multiplication of *Phalaenopsis* cv. Pink lip via PLBs. Initially, PLBs (0.5 g) were transferred to selected three culture media, such as 1/2 MS, VW, and Hyponex media separately. Cultures were maintained for four months, and growth performance was evaluated. A significant difference in the mean fresh weight increment of PLBs grown in 1/2 MS, VW, and Hyponex media was observed after four months of incubation. The highest fresh weight increase of PLBs was observed in 1/2 MS medium compared to VW and Hyponex. After identifying that the 1/2 MS medium was highly supported for PLB multiplication, the 1/2 MS medium was modified by adding BAP (6-Benzylaminopurine) to enhance the rate of multiplication of PLBs. A series of 1/2 MS media supplemented with various concentrations of BAP [0 mg/L(control), 1.0mg/L, 2 mg/L, 3.0 mg/L, 4 mg/L, 5 mg/L, 6 mg/L, 7 mg/L], were prepared. PLBs (0.5g) were transferred to media series separately and were maintained for three months. The increase of fresh weight of PLBs was observed in all 1/2 MS media with different concentrations of BAP, compared to the control. The highest increment of fresh weight of PLBs was observed in 1/2 MS medium with 3.0 mg/L BAP. In conclusion, 1/2 MS with 3.0 mg/L BAP medium is the highly supported effective *in-vitro* culture medium for the multiplication of PLBs of *Phalaenopsis* cv. Pink lip.

Keywords: *Phalaenopsis*, Protocorm Like Bodies (PLBs), In-vitro culture medium, Half-strength Murashige and Skoog (1/2 MS), BAP(6-Benzylaminopurine)

(ID 086)

Diversity and Restorative Assessment of Fragmented Cloud Forest Ecosystem in Bopaththalawa; Central Highlands of Sri Lanka

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Abstract

The central highland cloud forest of Sri Lanka serves as the primary source of water for the nation, playing a pivotal role in preserving biodiversity, preventing soil erosion, and sustaining the flow of 103 rivers. This ecosystem harbours a diverse array of endemic and endangered species within unique ecological niches. However, anthropogenic activities, including invasive species spread, illegal logging, forest encroachment, and manmade fires, have subjected certain forest patches to heightened stress. This project proposes a restorative initiative focusing on the degraded central highland cloud forest in Agarapathana, Bopaththalawa (6°80'95.06" N, 80°69'58.25" E) by Olu Water. Project aims to enhance the health of the local cloud forest vegetation, prioritize wildlife conservation, and establish safe pathways for wildlife movement, thereby mitigating the impacts of fragmentation. Recognizing the importance of preserving vital connections within the ecosystem, project addresses the long-term well-being of both flora and fauna. Over the initial 20 months (March 2022-November 2023) of the project, a comprehensive biodiversity survey was conducted on the 23-hectare restoration site and its wider buffer area. Utilizing visual encounter survey methodology with random sampling, opportunistic observations, and confirmation records from scat, skulls, and recorded dead species, the study documented 12 amphibians, 11 butterflies, 12 dragonflies, seven reptiles, two freshwater fish, nine mammals, 63 birds, and 121 plants. Notably, 33.3% of the recorded species fell under threatened categories. To facilitate restoration, local pioneer cloud forest plant species were identified, and community plant nurseries were established to cultivate *Shorea spp.*, *Syzygium rotundifolium*, *Calophyllum spp.*, *Neolitsea cassia*, *Melicope lunu-ankenda*, *Elaeocarpus subvillosus*/ *E. glandulifer*, *Symplocos spp.*, *Neolitsea fuscata*, *Arundinaria densifolia*, *Macaranga peltata* and *Ochlandra stridula* plant varieties. The project empowered 11 local smallholder families to participate in home garden planting for forest restoration, providing an alternative livelihood fostering community-based restoration. Saplings will be continuously purchased and planted along the restoration border during the rainy season to aid natural regeneration. Additionally, a 3 m wide fire prevention belt was implemented during drought periods to mitigate the risk of man-made forest fires. In line with restoration efforts, community awareness activities are ongoing communicating the importance of the cloud forest preventing illegal activities such as poaching, gem mining, and deforestation. The project is committed to continuing its restorative initiatives until 2026, with the support provided in the first year by the Adaptation Research Alliance. Furthermore, the initiative is poised to implement a volunteer carbon and biodiversity offsetting mechanism in the coming five years.

Keywords: Cloud forest restoration, Bopaththalawa, Biodiversity offsetting, Olu water, Water catchment enhancing

(ID 192)

Abundance, Diversity, and Distribution of Butterflies (Order Lepidoptera) in Selected Forest Patches and Home Gardens in the Mahagama Area of Kalutara District, Sri Lanka**Wijerathna, Y.S.M., Chathuranga, W.G.D.****Department of Zoology, Faculty of Science, University of Ruhuna, Matara, Sri Lanka***chathurangawgd@zoo.ruh.ac.lk***Abstract**

Butterflies are one of the most conspicuous species of Earth's biodiversity. Being exceptionally reactive to any alterations in their environment (*i.e.*, temperature, humidity, light, and rainfall), these creatures are recognized as useful bioindicators. They have distinct requirements for different habitat types for mating, breeding, and nectaring and are, thus, in sync with the diversity and condition of their habitats. This study was carried out from August 2023 to October 2023 to examine the abundance, diversity, and distribution of butterflies in ten different fields representing two major habitats, *i.e.*, five selected home gardens (HG) and five selected patchy forests (PF), of the Mahagama, Kalutara District, Sri Lanka. The line transect method was used to conduct research sampling throughout the study by setting two line transects each per habitat (2 x 100 m). The time allocated for one line transect was 15 minutes to avoid the double counting. All the encountered butterfly species were identified using standard photographic field guides. Statistical analysis was done using the Minitab v. 21 statistical package. Shannon Wiener Index (H') and Magalef's Index (D_{Mg}) were used to compare the diversity and abundance of butterflies in selected habitats. A total of 686 individual butterflies (PF-414; HG-272) from 19 species (PF-18 species, and HG-7 species) representing five families (*i.e.*, Nymphalidae, Lycaenidae, Papilionidae, Pieridae, and Hesperidae) were identified. Among all the 19 butterfly species present in the Mahagama area, Grey Pansy, *Junonia atlites* (HG-15.04% and PF-18.30%) showed the highest abundance representing the family Nymphalidae. The lowest abundance was shown by *Euploea phaenareta* (0.84%) and *Orsotriena medus* (0.84%) from home gardens, and *Orsotraena medus* (0.01%) and *Elymnias hypemnestra* (0.01%) from the patchy forests which also represent the family Nymphalidae. The diversity and abundance of butterflies were higher in the home gardens (H' -2.3972; D_{Mg} -2.8471) than in the forest habitats (H' -2.0886; D_{Mg} -2.5048). The findings of this study highlight the fact that the home gardens of the Mahagama area support a lot for butterflies than forest patches.

Keywords: Butterfly diversity index, Species richness, Butterfly abundance

(ID 251)

Optimizing Environmental Conditions for Amoxicillin-Resistant Bacterial Strains in the Degradation of Amoxicillin and Exploring the Degradation Mechanism

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Abstract

Amoxicillin is a type of penicillin antibiotic, which is commonly prescribed as a medication for bacterial infections, such as pneumonia, bronchitis, ear infections, and urinary tract infections. However, its excessive usages have resulted in unfavourable environmental consequences. The present study aims on analysing the effect of Nitrates and Phosphates on Amoxicillin degradation by *Micrococcus luteus*, *Bacillus cereus* (DJ080579.1), *Bacillus subtilis*, *Lactobacillus bulgaricus*, *Lactobacillus* sp. (DI4388712.1), *Enterobacter aerogenea*, *B. cereus* (EU678635), *Lactobacillus* sp. (HW413258.1) which were previously isolated as potential amoxicillin degraders and identify their degradation mechanisms. In the first study, the previously starved bacteria were exposed to three different concentration of Nitrate (NaNO₃) and Phosphate (KH₂PO₄) based on the environmental detection level (0.05 mg/L, 0.5 mg/L, 0.005 mg/L), while control samples were established, excluding bacterial suspension. The absorbance of samples was monitored at 595 nm over 14 days using ELISA. Based on ELISA assay absorbance values, the bacteria showed maximum Amoxicillin degradation potential at 0.05 mg/L and 0.5 mg/L nitrate concentrations. *B. cereus* (EU678635) showed a significant degradation potential at 0.05 mg/L nitrate while *L. bulgaricus* showed a highest degradation potential at 0.5 mg/L. When bacteria were enriched with phosphate, the optimal growth potential of the selected bacterial strains was found to occur in a phosphate concentrations range between 0.005 mg/L and 0.05 mg/L. *B. cereus* (EU678635) represented a noticeable ability for amoxicillin degradation at 0.005 mg/L and 0.05 mg/L phosphate concentrations. Significant degradation of amoxicillin was not detected in the controls. Results of this study revealed that the bacterial remediation of amoxicillin is controlled by nutritional status with special emphasis of nitrate enrichment in the environment. To identify the degradation mechanisms, eight selected bacteria which were activated and starved in 0.9% saline solution were separately exposed into the equal concentration of amoxicillin for 3 days. After incubation period, the filtrate and filter paper (Cell Extract) were separated through filtration and then analysed by HPLC. Considering the results of degradation mechanism, six out of eight bacterial strains, named *Micrococcus luteus*, *B. cereus* (DJ080579.1), *B. subtilis*, *L. bulgaricus*, *Lactobacillus* sp. (DI4388712.1), and *E. aerogenea* were investigated possess an intracellular enzymatic mechanism for amoxicillin degradation. Conversely, two of the bacterial strains, namely *Bacillus cereus* (EU678635) and *Lactobacillus* sp. (HW413258.1), exhibit an extracellular enzymatic mechanism. This study provides a basic understanding of the practical application of bacteria on amoxicillin degradation and their responsiveness to variations in nutrient availability within the environment.

Keywords: Amoxicillin, Antibiotics, Amoxicillin-resistant bacteria, Extracellular enzymatic mechanism, Intracellular enzymatic mechanism

(ID 207)

Assessment of Plankton Diversity in Madunagala Hot Water Springs, Sri Lanka**Batugedara, B.D.I.M.^{1,2}, Manage, P.M.¹, Senanayake, S.A.M.A.I.K.^{1*}**¹*Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***indunil@sci.sjp.ac.lk***Abstract**

Hot water springs present unique ecological niches due to their elevated temperatures and distinctive chemical compositions. This study aimed to investigate the plankton diversity of Madunagala hot water springs, one of the major hot springs in the Hambantota district, Sri Lanka. Plankton samples were collected using a 55µm standard plankton net from the surface waters of three interconnected wells (n=6) during July and August of 2023. In addition to that, temperature, pH, electrical conductivity (EC), Total Dissolved Solids (TDS), salinity, and Dissolved Oxygen (DO) were measured using portable meters at the site itself. Standard methods were used to determine the Total hardness (TH), nitrate (N-NO₃⁻), and orthophosphate concentrations at the laboratory. Plankton were morphologically identified to the nearest possible taxonomic level. There were 15 phytoplankton taxa and 22 zooplankton taxa which were identified at least to the genus level, and some of the observed plankton species remained unidentified. Identified phytoplankton belonged to cyanophyta, bacillariophyta, euglenophyta, and chlorophyta; chlorophyta was the dominant phytoplankton group. *Pediastrum* spp. was identified as the most diverse one, reporting three species, including *P. simplex*, *P. duplex*, and *P. tetras*. Copepoda, rotifera, and microcrustaceans were reported as zooplankton groups. The average zooplankton density (40×10^4 individuals/m³) was higher than the average phytoplankton density (29×10^4 individuals/m³). The calculated Shannon-Wiener Diversity index value (H) and Simpson's index of Diversity (SID) values ranged from 2.6 to 3.1 and 0.6 to 0.8, respectively, indicating moderate to high diversity levels of plankton in Madunagala hot water springs. H and SID values were not significantly different among the wells ($p > 0.05$). The average value for temperature was 43.2 ± 1.2 °C while pH, EC, TDS, Salinity, and DO were reported as 7.98 ± 0.11 , 5.13 ± 1.10 mS/cm, 2.57 ± 1.23 ppt, 3.1 ± 0.2 ppt, 2.13 ± 1.12 mg/L respectively. TH was reported as 982 ± 24 mg/L as CaCO₃. The N-NO₃⁻ and orthophosphate were reported as 0.8 ± 0.1 mg/L and 0.2 ± 0.1 mg/L respectively. There were no significant differences in any parameter among the wells ($p > 0.05$). The plankton species that have been identified can be considered temperature tolerance species, which are found in water above 42° C. These plankton might have specialized adaptations to high-temperature conditions, including heat resistance, metabolic versatility, etc.

Keywords: Madunagala hot water springs, Plankton diversity, Temperature tolerance species, Shannon-Wiener Diversity Index, Simpson's index of diversity

(ID 231)

Species Identification and Length-Weight Relationship of Sardine in Southern Coast, Sri Lanka

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Abstract

This study was conducted to identify different sardine species found in the Southern coast of Sri Lanka and to evaluate their relative well-being in the environment. It is important to know the length-weight relationship to facilitate the conversion from one length measurement to another type of length and weight measurement and for stock identification. A total of 136 fish samples were collected from three landing sites in Galle (49), Matara (57), and Hambantota (30) on the Southern coast of Sri Lanka. Species identification was performed up to the species level using morphological characters. Within these three sites, only *Sardinella gibbosa*, *Sardinella fimbriata*, and *Sardinella longiceps* were occurred and they were identified using fish keys. *Sardinella gibbosa* occurred in both Matara and Hambantota while *Sardinella fimbriata* occurred in Matara and Galle. *Sardinella longiceps* occurred only in the Matara. The condition factor (K) and length-weight relationship (LWR) were estimated for 62, *Sardinella gibbosa* obtained from Matara and Hambantota sites, and for 61, *Sardinella fimbriata* obtained from Matara and Galle. The linear regressions for length and weight data of *Sardinella gibbosa* were significant ($P < 0.05$) and had a weak positive relationship ($r = 0.57$) between length and weight, in the Hambantota while a strong positive relationship ($r = 0.76$) was reported in Matara. The condition factor (K) of *Sardinella gibbosa* in Hambantota was 0.8 while it is 0.9 in Matara. The regression coefficient (b) of weight and length were 1.1639 and 1.1651 respectively in fish obtained from Hambantota and Matara. The linear regressions for data of *Sardinella fimbriata* were significant ($P < 0.05$) and had a positive relationship ($r = 0.70$) between length and weight, in the Galle while the relationship was not significant ($P > 0.05$) in Matara. The condition factor of *Sardinella fimbriata* in Matara was 0.9 while Galle was 0.8. The regression coefficient of weight and length were 0.9038 and 1.0926 respectively in fish obtained from Matara and Galle. The regression coefficient (b) of weight and Condition factor values indicated that *Sardinella gibbosa* obtained from Matara were in good and healthy condition compared to the fish obtained from Hambantota. Student t-test proved that the regression coefficients were statistically different from the value of isometric growth ($b = 3$) in both species obtained from different sites and, therefore it is concluded that *Sardinella gibbosa* and *Sardinella fimbriata* collected from different locations on Southern coast show negative allometric growth ($b < 3$).

Keywords: *Sardinella gibbosa*, *Sardinella fimbriata*, *Sardinella longiceps*, Length-weight relationship, Condition factor

(ID 209)

**Preliminary Assessment of Seaweed Diversity in an Extended Beach Rock Ecosystem,
Bopitiya, Ja-Ela**

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Abstract

Bopitiya Beach located in Gampaha District, Western Province (between 7°05'38.0"N, 79°50'46.9"E and 7°04'08.5"N, 79°51'05.9"E), the beach comprises with an extended beach rock which makes a diverse range of habitats including rock pools, creases, and float rock surface. Rocky shores display a remarkable biodiversity as a result of its immense microhabitat diversity. However, in Sri Lanka, only a limited amount of literature is available regarding the biodiversity assessment of rocky shore ecosystems. The present study was conducted to fulfil this gap. The study was conducted from February to June 2023. Samples were collected once a month during the low tide period. The study area was divided into seven sites. Line transects method and field observations were used in the study. A line transect (50 m) was employed parallel and perpendicular to the shore and randomly placed quadrats (50 cmx50 cm) were used and the number of individuals falls within the quadrat area has been counted. For seaweeds, visual estimation of percentage cover has been determined using Braun-Blanquet scale. Standard guides and catalogues were used to identify flora. During the study, 24 seaweed species taxa have been identified, representing three classes and seventeen families and three classes. *Sargassum sp.*, *Ulva pertusa* Kjellman 1897., *Padina boergesenii* Allender et Kraft, *Jania intermedia* P. Silva in Silva et al. 1996, *Caulerpa racemosa*, *Carpopeltis maillardii*, *Champia ceylanica* Harvey 1857, *Gracilaria corticata* J. Agardh 1852, *Dermonema virens*, *Gracilaria hikkaduensis* Durairatnam 1962, *Ahnfeltiopsis pygmaea* P.C. Silva et DeCew 1992, *Padina minor* Yamada 1925, and *Grateloupia lithophil*, were among the dominant common species in the study area.

Keywords: Beach rock, Biodiversity, Seaweed

(ID 290)

Comparative Nutritional Analysis of Six Selective Small Pelagic Fish Species in Sri Lanka

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Abstract

Fish constitutes a crucial dietary staple in Sri Lanka, largely due to the economic significance of fishing in local communities. However, a disparity exists between the recognition of small pelagic fish and larger common pelagic species. They are often identified as less economically important in fish marketing, and very much popular among the economically disadvantaged local community, compared to large pelagic fish. Small pelagic fish are undervalued because of their higher bone-to-flesh ratio. This study seeks to highlight the nutritional importance of these underappreciated six small pelagic fish species, particularly among low to middle-income communities as a cheap protein source. The species were chosen for their cost-effectiveness and abundance during off-seasons and collected from the Negombo and Chillaw fish market. The samples were confirmed with The Marine Fish Source of Sri Lanka; identified as Salaya (Goldstripe Sardinella/ *Sardinella gibbosa*), Sura-paraw (Yellowstripe scad/ *Selaroides leptolepis*), Mas-Panna (Toothpony/ *Gazza minuta*), Katilla (Bald glassy/ *Ambassis gymnocephalus*), Katumassa (Kelee shad/ *Hilsa kelee*), and Oleya (Saddleback silverbiddy/ *Gerres lucidus*). The Total Length (TL), Fork Length (FL), and Standard Length (SL), were measured in cm (n=30), and samples were further subjected to proximate analysis such as moisture, crude-protein, crude-fat, and ash contents at dry-basis (n=3) by following AOAC standards and results were statistically analyzed using Minitab-19. Among the six selected fish species, Katumassa was recorded the highest TL (14.75 ± 1.06), FL (12.57 ± 0.84) and SL (11.62 ± 0.87), while Katilla was recorded the least values as TL (7.14 ± 0.37), FL (5.96 ± 0.37) and SL (5.38 ± 0.25). The significant differences were observed in moisture, crude-protein, crude-fat, and ash percentages for the fish species of Katilla and Oleya; Katumassa and Salaya; Oleya and Katilla; and Mas-panna and Oleya ($p < 0.05$, 95% confidence level) respectively. Minimal attention in nutritional studies and the impact of cooking and consumption on the nutritional profiles of the aforementioned species has not been extensively studied from both local and global studies, hold potential for the development of functional processed food sources. It is imperative to encourage the community to comprehend the significance of small pelagic fish in fostering sustainable dietary practices and emphasize the importance of further research, particularly technology-driven investigations, aimed at harnessing the untapped potential of these underutilized resources in the food industry.

Keywords: Small pelagic fish, Marine fish source, Proximate composition, Underutilized fish species

(ID 103)

A Study on CO₂ Emissions from Aircraft Taxi at Colombo Airport with Special Reference to a Specific Air Carrier of Sri Lanka

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Abstract

Aviation industry covers almost all aspects of air travel and its subsidiary activities which consist of several operations and activities on both air and ground levels. Thus, the industry may have an impact on the environment at every stage of its value chain, from different sectors such as aircraft operations, maintenance, passenger services, supply chain, etc. Given the anticipated increase in demand and obligations from global regulatory requirements, the aviation industry has been urged to become carbon neutral in the near future by technological innovations and operational advancements. Higher altitude aircraft operations have a greater impact on the atmosphere; nonetheless ground emissions are rarely emphasised due to their relative insignificance. Thus, this study endorses the importance of aircraft ground operations for emission inventories, in line with previous studies on aircraft ground-level emissions. The study mainly focuses on the evaluation of carbon dioxide emissions by aircraft engines during the taxi in and out and is confined to the taxiing at CMB airport with special reference to the flights of a specific air carrier in Sri Lanka. The data collection was carried out on a fleet of 24 aircraft of both narrow body and wide body. The carbon dioxide emission calculation methodology for the taxi phase uses actual operational taxi times from industrial data rather than internationally recognised reference timings. A statistical test has been applied to actual taxi times by referring to ICAO recommended TIM (Time in Mode) values as population means. The average emissions were calculated under 5 types of operated aircraft, separately for taxi out and taxi in for the airborne flights from and to CMB airport during the mentioned period. Thus, the findings identify that the cumulative estimated emissions of the total taxi phase of both arrivals (11,031) and departures (11,031) for the year 2022 contribute around 9 958 metric tonnes of CO₂ and have a considerable impact on the local air quality as well as on climate change, despite their less significance compared to cruise level emissions. This forewarns that the anticipated growth in aviation traffic and aggregated impact of CO₂ emissions from other airlines operating at CMB airport, could result in notable air quality issues and potential health concerns for the local community, as well as long-term climatic effects, unless proactive measures are implemented to mitigate the repercussions.

Keywords: CO₂ emissions, Aircraft taxi, Ground operations, CMB airport, Air carrier

(ID 214)

Evaluation of Potential Coastal Resources for Promotion of Ecotourism, Climate Resilience and Blue Economy Development in the Vadamarachchy East Region of Jaffna, Sri Lanka

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Abstract

Coastal resources have a great potential for promotion of ecotourism and blue economic development, and they act as a natural defence playing a vital role in mitigating the impact of coastal hazards. These resources are important to conserve and reduce coastal disaster impacts, ensuring the human security, sustainability of livelihood and blue economy and strengthen climate resilience. The present study area is situated on the North-eastern coast of Jaffna District. The study attempted to evaluate the resource potentials for the promotion of ecotourism, climate change adaptation and blue economy development in the Vadamarachchy East area. The detail survey was conducted between 2016 to 2019. The Multi Criteria Decision Method (MCDM) and Criteria ranking method in GIS were used considering aspects of sand dunes, beaches, mangroves, birding sites, and cultural places for evaluating the potential status of ecotourism. The evaluation process for potential sites were conducted based on several criteria viz. tourist preferences, proximity to residential areas, tourist accommodation, distance from roads, scenic beauty, distribution, and available facilities. Risk analysis was performed to identify the hydro-climatic disaster risk areas using Semi structured questionnaire survey. Focus group discussions were conducted for identify the challenges in protecting the coastal resources. The final suitability map for ecotourism status was generated through Multi criteria analysis and vulnerable disaster risk areas were identified associated with sand dunes. The findings indicate that Vadamarachchy east area represents high potential based on sand dunes, bird diversity and cultural places. *Casuarina* forest of Manatkadu, Chundikulam estuary, beaches and blue economic resources are key features for ecotourism promotion. Sand dunes and casuarina forest are major protection barriers for resilience from hydro-climatic disaster. The study area from Vallipuram, and Manatkaddu to Chundikulam is associated with deep sea fishing for blue economic development. Unfortunately, at present, these areas are being threatened by climatic disasters due to unsustainable and illegal sand mining operations and lack of conservation and governance mechanism of vegetation. The study provided a set of recommendations to increase the effective use of ecotourism potentials, including sand dunes and coastal line vegetation because it can contribute to reducing negative effects of the climatic disaster and ensure the sustainable blue economy development. Hence, this study emphasized the multi stakeholder agencies' participation for development planning, resource management which are required to reduce impact of climate change, increase adaptation, use the coastal resources for ecotourism promotion and blue economic development in sustainable manner.

Keywords: Blue economy, Climate adaptation, Ecotourism, Sand dunes, Vadamarachchy East

(ID 229)

Plankton Assemblage and Potential Indicator Species for Water Quality Assessment in Selected Wetlands in Ramsar Wetland City, Colombo

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Abstract

Wetlands are considered as one of most productive ecosystems in the Earth. Plankton is an essential part of wetland biodiversity and plays a vital role in wetland functioning. For assessing water quality and environmental status of wetlands, plankton are considered as ideal bioindicators. The study was carried out to determine plankton assemblage and potential indicator species for water quality assessment in selected wetlands in Colombo Ramsar wetland city including Nawala Wetland Park, Diyatha uyana, Diayasaru Park and Beddagana. Water samples and plankton samples were collected and analysed for four months (October 2022 to February 2023). Both zooplankton and phytoplankton were studied. During the study period, a total 39 phytoplankton species and 24 zooplankton were identified. The identified phytoplankton species were categories in to main three families namely: *Bacillariophyceae*, *Chlorophyceae* and *Cyanophyceae*. *Asterionella* sp., *Attheya* sp., *Cymbella* sp., *Melosira* spp., *Navicula* sp., *Nitzschia* sp., *Synedra* sp., *Actinastrum* sp., *Chlorella* sp., *Coelastrum* sp., *Monactinus* spp., *Pediastrum* spp., *Scenedesmus* spp., *Staurastrum* spp., *Tetraselmis* sp., *Tetraedron* sp., *Anabena* sp., *Lyngbya* sp., *Microcystis* spp., *Ocillatoria* sp., *Nostoc* spp., *Spirulina* sp., *Euglena* sp., *Phacus* spp., *Pandorina* sp. and *Gonium* sp. were recorded during the study period. Genus *Melosira* was recorded as highest number of individuals in all wetlands (more than 50% of total). Identified zooplankton species were categories in to main three groups namely: rotifers, copepods and ichthyoplankton. Rotifers were the dominant zooplankton group and *Keratella* spp., *Brachionus* spp. were dominant in all wetlands. *Pediastrum* spp., *Chlorella* sp., *Closterium* sp., *Phacus* sp., *Euglena* sp., *Melosira* sp., *Microcystis* sp., *Navicula* sp., *Oscillatoria* sp., *Scenedesmus* sp., and *Synedra* sp., *Keratella* sp., *Brachionus* sp., and *Lecane* sp. were identified as potential bioindicators for pollution. According to Shannon-Wiener diversity index phytoplankton species diversity is higher than zooplankton species diversity. A total of fourteen indicator species were observed, exhibiting varying levels of abundance. More than 75% of total were indicators of pollution. Hence, it may be inferred that the population density of these species was relatively high, and the degree of contamination in the wetland was also found to be high.

Keywords: Plankton, Bioindicators, Wetlands, Water quality, Plankton abundance

(ID 169)

Abundance, Diversity, and Distribution of Potential Mosquito Vector Fauna in the Wellamadama Premises of the University of Ruhuna, Southern Sri Lanka

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Abstract

Mosquitoes play a significant role in causing disease outbreaks among humans and animals in many parts of the world. Assessing the risk of disease outbreaks related to vector-borne diseases requires a thorough understanding of the population dynamics of vectors in a specific area. The present study was conducted weekly from August 2023 to October 2023 at the Wellamadama premises of the University of Ruhuna, Sri Lanka. Mosquitoes were collected in two major habitat types, *i.e.*, areas with high anthropogenic activities (HAA) and low anthropogenic activities (LAA), to assess the population structure of potential vector mosquito fauna. Bird-baited traps, mammal-baited traps, CO₂ traps, and light traps were used for mosquito surveillance. All traps were placed at the ground level (1.5-3.0 m), except the bird-baited traps, which were placed 6 m above the ground level. An equal number of traps from each trap type were placed in both HAA and LAA on each sampling date. Collected mosquitoes were identified using standard taxonomic keys. Environmental factors with species abundance and diversity were assessed with canonical correspondence analysis from PAST 4.13. Shannon's diversity index (H') (HAA:1.767, LAA:2.064) and Margalef's index (Mg') (HAA:1.486, LAA:3.194) were used to compare the abundance and diversity of selected habitat types. A total of 423 mosquitoes that belong to 18 species and eight genera (*i.e.*, *Anopheles*, *Aedeomyia*, *Aedes*, *Armigeres*, *Culex*, *Lutzia*, *Coquillettidia*, and *Mansonia*) were identified. Even though the diversity was higher in the LAA (18 species) than in the HAA (9 species), the abundance of mosquitoes in the HAA ($n=218$) is not significantly different from LAA ($n=205$) ($t=0.09$, $p=0.932$). The *Lutzia halifaxii*, *Ad. catacticta*, *Ma. unifromis*, *Cx. sinensis*, *Cx. pluvialis*, *Cx. malayi*, *Cx. gelidus*, *Ae. vexans*, and *An. jamesii* were only found in LAA, while *An. culicifacies*, *An. subpictus*, *An. varuna*, *Aedes aegypti*, *Ae. albopictus*, *Ar. subalbatus*, *Cx. tritaentorhynchus*, *Cx. quinquefasciatus*, and *Cq. crassipes* were common to both study sites. With the environmental parameters except for *Coquillettidia* and *Culex*, the rest of the genera were positively correlated with the temperature ($r=0.209$) and negatively correlated with RH ($r=-0.480$). The study identified a total of 11 human vector species and 7 non-human vector mosquito species. The high abundance and widespread distribution of vector mosquitoes underscores the potential for mosquito-borne diseases to spread within the university premises.

Keywords: Mosquito taxonomy, Environmental factors, Disease outbreaks, Traps, Risk assessment

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(ID 020)

Plantation Fence System as a Sustainable Method to Reduce Human- Elephant Conflict in Contemporary Sri Lanka: A Sociological Study

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Abstract

Development is a multi-dimensional concept, and it cannot be limited to the economic growth and can be defined as the progressive growth that occurs in all social, cultural, economic and environmental sectors. In Sri Lanka, we can identify many development projects that have been carried out with the sole aim of economic growth without sustainable goals. As one of the side effects of this development projects, wild animals have lost their habitats. The human-elephant conflict can be identified as one of the crises caused by this. For several decades, management strategies have been implemented to control human-elephant conflict, such as driving away elephants, trapping, erecting electric fences around reserves, and enriching wild elephant habitats. But due to the ever-increasing elephant and human deaths, it can be recognized that these strategies have failed to achieve the desired results. The aim of this study was to propose the plantation fence system as a sustainable program to reduce human-elephant conflict in Sri Lanka. A village in Anuradhapura district was selected as the research field. In-depth interviews conducted with 6 respondents were used in primary data collection. According to the research findings, it can be shown that the elephants' invasion of villages was related to their food problem. All the 6 members of the research sample (100%) said that elephants coming to the village in search of food caused maximum damage to their agricultural fields, leading to substantial crop damage. Farmers suffer economic losses, exacerbating the conflict. According to the data collected through my research sample, there have been 60 crop losses, 1 elephant loss and 1 human loss in the relevant research field in the year 2021. The amount of crop damage is very high and compared to that, the amount of property damage is less. Although there were 60 crop losses, only 5 property losses were reported. Accordingly, in order to prevent wild elephants from invading villages and agricultural areas, it is necessary to provide a solution to the food problem of those animals. Recently, a voluntary organization called "Practical Action" has come forward to discuss a method that provides solutions to prevent elephants from attacking villages and to solve their food problem. Through that proposal, they point out that planting the Palmyra tree at an acceptable distance and erecting it as a fence, the necessary physical barrier against elephants from attacking the village will be solved as well as the food problem. If we consider the Palmyra fence solution, it is a positive situation that it also creates a food supply for elephants that goes beyond a physical barrier. At the same time, Palmyra trees can be suggested as a trend of providing a good source of income to the local residents. This fence, which creates a physical barrier for elephants and also, becomes an economic source of income for the local residents. Considering these factors, this method can be proposed as the most successful solution to reduce the human-elephant conflict.

Keywords: Sustainable goals, Human-elephant conflict, Plantation fence, Physical barrier

(ID 221)

Effects of Foraging Resources, Anthropogenic Risks, and Mating Opportunities on Grouping Behaviour of Male Elephants in Wasgamuwa, Sri Lanka

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Abstract

Male elephants maintain larger home ranges than female family groups, and as a result, they come into contact with humans, resulting in a high level of casualty to them. Therefore, understanding the ecology of male elephants, including their grouping strategies, is an essential aspect of the conservation of male elephants. Grouping strategies of male elephants, defined by group size and age categories, depends on the availability of forage, anthropogenic risks, mating opportunities, and musth state. We present the findings of male grouping behaviour in relation to those governing factors using three years of data. We monitored male elephants and their grouping behaviours for three years from 2017 to 2019. We monitored elephants in Wasgamuwa National Park and human-dominated areas outside the park. We recorded 1,665 independent sightings. The most noticeable grouping behaviour of mature adult males was staying solitary irrespective of the anthropogenic risk and foraging opportunities. Yet, the occurrence of male-only groups was significantly high outside the protected area. Mature adults formed larger male-only groups during the ripening stages of the paddy in both Yala and Maha cropping seasons when crop guarding intensity was high. This behavioural pattern suggests that mature adult male elephants were willing to take risks for better foraging opportunities by adopting a high-risk high gain strategy and pairing with similar peers was the adaptive strategy when taking high risks. The associations of young males and sub-adult males with mature adult groups during the crop ripening months were weak, indicating social learning, especially regarding crop raiding, was not a behavioural adaptation in Asian elephants in Wasgamuwa, unlike in some African elephant populations. Adult male elephants joined the mixed-sex groups temporarily to check the availability of females in estrous and mating opportunities. Their association with the mixed-sex group was random. Sub-adult males associate more frequently with the mixed-sex group, indicating social learning from the group members. Mature adult males in musth predominantly associated with mixed-sex groups to seek mating opportunities. Musth male's interaction with young males and sub-adult males in mix-sex groups when no females in estrous were not threatening and escalating. Musth males were not part of male-only adult groups that were frequent outside the protected areas, indicating the motivational state for the associations of musth males was purely reproductive, not foraging. Our finding highlights the different aspects and complexity of grouping strategies of male elephants; therefore, conserving male elephants should be based on accurate scientific information.

Keywords: Asian elephants, Male elephants, Sociality, Anthropogenic risks, Foraging opportunities, Musth, Sri Lanka

(ID 224)

A Comprehensive Butterfly Checklist and Conservation Assessment at Baddagana Wetland Area, an Urban Ecosystem in Sri Lanka

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Abstract

Butterflies are obtrusive creatures of the nature belonging to Class Insecta, Order Lepidoptera in biodiversity classification hierarchy. The primary objectives of this study were valuating the diversity of butterfly species found in the Baddagana wetland, assessing their current conservation status, and proposing conservation action to protect these enigmatic creatures in their unique habitats. Data was collected in Baddagana wetland area from August to October 2023. In order to maximise sampling effort, three sessions per day were allocated for the visual encounter survey, which was carried out between 8:00 am, and 6.00 pm at pre-determined locations. Thus, most of the butterfly species were observed 8:00 am to 11.00 am and 12.00pm to 02.00pm. Field notebooks were used for documenting comprehensive observations. The identification of butterfly species was based on field guides. Throughout the study, observations showed that 15 butterfly species, belonging to 4 families, were present. 30 butterflies were the average per day. Most common and frequent species were Psyche (*Leptosia nina*), Glassy Tiger (*Parantica aglea*), Common Crow (*Euploea core*), and White-four ring (*Euploea core*) in the wetland habitat. On the other hand, the Lime Butterfly (*Papilio demoleus*) and Great Eggfly (*Hypolimnys bolina*) were noted as uncommon or rare species in the area according to the study. Of the species of butterflies that were observed, one was classified as vulnerable (Blue Glassy Tiger/*Ideopsis vulgaris*) and 14 were considered least concerned according to the 2012 Red List assessment. These finding shed light on the basic understanding of the diversity of butterflies that inhabit the Baddagana Wetland. The butterflies observed in this area emphasise how crucial this unique habitat is for conservation efforts as most of the species were absent or less common outside the wetland habitat. In order to increase butterfly populations while promoting the conservation of these creatures, this study suggest growing appropriate feeding and host plants in the wetland area. The dataset created by this study will be starting point for future research and plan future habitat enrichment in this area.

Keywords: Butterfly diversity, Lepidoptera, Baddagana wetland, Conservation, Urban ecology

(ID 320)

Habitat Characterization of *Pethia nigrofasciata* Inhabiting Wak Oya Stream at the Kelani River Basin, Sri Lanka

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Abstract

The habitat characterization of the endemic fish species *Pethia nigrofasciata*, belonging to the family Cyprinidae found in wet-zone basins of Sri Lanka, was examined in the present study. The species is at risk due to anthropogenic activities that may degrade its habitat and collection for ornamental fisheries. The study was conducted from August 2022 to January 2023 in the Wak Oya Stream at the Kelani River basin. The relationship between the abundance of *P. nigrofasciata* and various habitat and environmental parameters, such as dissolved oxygen, temperature, biological oxygen demand, total dissolved solids, conductivity, stream width, and depth, flow rate, stream edge and, bed conditions, and associated flora and fauna species, were studied in 20 sampling sites along the Wak Oya Stream. Data were collected monthly against the species abundance of *P. nigrofasciata*. According to the results, there is a significant variation in the mean abundance of *P. nigrofasciata* across the sample sites. The mean abundance of *P. nigrofasciata* in the stream edge conditions with Soil (26.45 ± 16.75) is significantly higher ($\alpha=0.05$) than that of Rocky edges (13.71 ± 07.91). Additionally, there is a significant difference ($\alpha=0.05$) in the abundance of the species among Sandy, Rocky, and Silty bed conditions. The mean abundance of *P. nigrofasciata* is highest in Sandy bed conditions (22.53 ± 12.58), followed by Rocky bed conditions (10.33 ± 2.43), and lowest in Silty bed conditions (5.25 ± 02.30). According to the study the species was found in shallow tributaries with a mean stream depth of 0.43 ± 0.15 meters and a mean width of 5.35 ± 2.01 meters and it prefers moderate canopy cover of 31-40%. *P. nigrofasciata* exhibited a preference for habitats with considerably higher mean Dissolved Oxygen (DO) of 6.81 ± 0.62 ppm, low mean Biological Oxygen Demand (BOD) 0.43 ± 0.30 ppm, and low mean Total Dissolve Solids (TDS) 0.018 ± 0.004 ppm, indicative of a minimal preference for organic pollution. Also, the average temperature of $26.8 \pm 0.6^\circ$ C and low mean electrical conductivity of 0.037 ± 0.007 mS further characterized the species' preference for cool and low-polluted habitats. *P. nigrofasciata* preferred slightly acidic and stable pH 6.41 ± 0.21 and slow-moving habitats, with an average flow rate of 0.10 ± 0.11 ms⁻¹. Moreover, the prominent edge-associated plant species were identified as *Glyceria maxima*, *Ochlandra stridula*, and *Lagenandra praetermissa*. Furthermore, prominent riparian habitat types were identified as Rubber cultivation, Forest Covers, and Marshy land in the sampling area. Overall, this research provides comprehensive insights into the environmental characteristics shaping the habitat of *P. nigrofasciata*, offering valuable information for conservation efforts.

Keywords: *Pethia nigrofasciata*, Habitat, Abundance, Environmental parameters, Wak Oya

(ID 051)

Preliminary Study on the Effect of Agrochemical Application on Freshwater Algae

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Abstract

The addition of agrochemicals to freshwater ecosystems can have a significant impact on the growth of algae. This study investigated the effects of fertilizers, herbicide, and insecticide on the growth of freshwater algae in selected ponds in Jaffna peninsula, Sri Lanka. Cultures of freshwater algae were grown in modified Blue green-11 (BG-11) media under laboratory conditions for three weeks and haemocytometer counts (cells/ml) were made. Similar count was made after adding eight different concentrations of fertilizer, herbicide, and insecticide. Cultures of freshwater algae were grown in glass house in trays resembling paddy field conditions for three weeks. Statistical analysis was done using Minitab 17. The results showed that the fertilizers used significantly ($p=0.05$) increased the growth of algae at all concentrations tested. The high- dose treatment of urea ($3.33 \times 10^{-3} \text{ mol/dm}^3$) and triple superphosphate (TSP) ($1.219 \times 10^{-3} \text{ mol/dm}^3$) had the greatest effect on growth, followed by low-dose treatment having lowest effect under the experimental conditions used. The results also showed that the herbicide (Kensolo bispospyribac sodium) significantly ($p=0.05$) decreased the growth of algae at all concentrations tested. The highest concentration of herbicide ($0.0307 \times 10^{-8} \text{ mol/dm}^3$) had the greatest effect on growth under the experimental conditions used. However, the results for Insecticide (Thiamethoxam) showed that it had no significant effect on the growth of algae under the experimental conditions used. The control treatment without the addition of fertilizer, herbicide and insecticide had no significant ($P=0.05$) effect on growth

Keywords: Freshwater algae, Insecticide, Herbicide

(ID 176)

Assessment of Heavy Metal Accumulation in Freshwater Fishes in Irrigation Tanks, Anuradhapura

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Abstract

Sri Lanka is well known for its dense freshwater irrigation tanks, especially in dry zones, which play an important role in sustaining both the environment and human livelihoods by providing essential resources such as drinking water, irrigation for agriculture, and nutrition through fish proteins. However, heavy metal contamination poses a significant threat to the sustainability of these valuable freshwater irrigation tanks due to their persistence and non-biodegradability. These heavy metals tend to accumulate in living organisms and biomagnified and have harmful effects on high tropic level organisms like humans who rely on aquatic fish species via food chains. This study was carried out to assess the heavy metal accumulation in muscle and liver parts of freshwater fishes, Tilapia (*Oreochromis* sp.), and striped snakehead; *Lula* (*Channa striata*) in Kammalakkulama, Hammillewa, Kirindegama, and Madawalagama tanks in Anuradhapura district, Sri Lanka. The Inductively coupled plasma mass spectrometry (ICP-MS) was used to analyse the randomly collected fish samples for total Cadmium (Cd), Arsenic (As), Lead (Pb), and Mercury (Hg) in the tanks. The results indicated a significant difference ($p < 0.05$) in the detected concentrations of heavy metal levels in tested samples among the four tanks. The highest concentrations of Cd (2.098 mg/kg) and As (0.366 mg/kg) were recorded in the liver of Tilapia in the Kammalakkulama tank. The highest Pb (5.509 mg/kg) and Hg (2.015 mg/kg) concentration was recorded in the Tilapia muscle in the Hammillewa tank and the Lula muscle in the Madawalagama tank respectively exceeding the WHO/FAO standards. The accumulation levels of these heavy metals were higher in the fish liver compared to their muscle in most of the samples. Arsenic (As) showed a significant positive linear relationship ($R^2 = 0.531$) between their dry body weight and accumulated concentration in the Tilapia muscle. The canonical discriminant analysis showed a significant differentiation among the four tanks concerning heavy metal levels in fish tissues.

Keywords: *Channa striata*, Heavy metals, Irrigation tanks, ICP-MS, *Oreochromis* sp.

(ID 179)

Land Cover Change Detection Using Geo-Spatial Technologies: A Spatio-Temporal Study on Muthurajawela Marsh-Negombo Lagoon Wetland Complex

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Abstract

Biodiversity conservation and management encompass protecting Earth's life diversity including species and ecosystems. Conservation efforts involve protecting endangered species and maintaining healthy ecosystems. Muthurajawela Wetland is one of the listed Ramsar sites of Sri Lanka which contains a rich biodiversity and productive ecosystem. Currently, this valuable landscape undergoes a radical change of its form over decades. Therefore, this study aimed to examine land cover changes in this wetland complex over three decades using satellite imagery. For in-depth change detection analysis, both pre-classification and post-classification land cover/use methods were used to assess changes from 1997 to 2023. The study of the Muthurajawela marsh-Negombo lagoon wetland complex used per-classification methods like Normalized Difference Vegetation/Water Indices (NDVI/NDWI) to identify vegetation and water bodies. The Maximum Likelihood Supervised Classification (MLSC) technique categorized the land cover into classes, water, marshland, settlements, vegetation, and barren land. To ensure accuracy, statistical methods such as Confusion Matrix was applied for each land cover class. Furthermore, a detailed post-classification analysis was conducted through Thematic Change Detection, which compared historical changes in land classes to their current status. Thematic Change analysis helped to assess and visualize the changes in each land class over time in relation to the present conditions on the ground. Change detection analysis illustrated that, about 46% land cover of total study has been converted from one land class to another over 3 decades. In 1997, highland vegetation of agriculture, forests, and marshy areas covered 41% of total land while Built-up areas comprised 18% of the land, with agriculture being more prevalent than construction. By 2023, there have been significant changes. Built-up areas make up 38% of the land due to the development of settlements, construction activities and the Katunayake highway project. The study shows a decrease in vegetation and marshland to 6%, possibly due to deforestation. In 2023, bare lands increased due to land reclamation and garbage dumping in the wetland complex. 90% of deep-water areas converted into shallow water. 28.35 km² of deep-water bodies degraded. Prawn farming also contributed to mangrove destruction in the Negombo lagoon. The study emphasizes the need for sustainable management of valuable ecosystems and eco-friendly human approaches to mitigate wetland degradation.

Keywords: Change detection, Land cover, Muthurajawela marsh, Negombo Lagoon, Wetland

(ID 115)

Preliminary Analysis of Air Conditioner Condensate Water Generation in Buttala, Monaragala, Sri Lanka**Fransisku, P.T.D.*, Naveendrakumar, G., Jayawardhane, K.K.D.D.***Department of Bio Science, University of Vavuniya, Vavuniya, Sri Lanka***pasindufransisku@gmail.com***Abstract**

In tropical countries like Sri Lanka, a significant amount of air-conditioner (A/C) condensate water is often discharged into the environment without being utilized. Although considerable number of reports available for South and East Asia, research related to AC condensate in Sri Lanka is scanty. The aim of this research was to analyse the quality and quantity of the discharged condensed water after understanding the potential environmental concerns. Monaragala district was chosen for this study due to its dry climate and the widespread use of air conditioners in most shops, resulting in a substantial discharge of condensed water into the environment. Water samples were taken from 31 institutions within Buttala area. These samples were collected in triplicate, and the mean value was used for analysis. When considering all parameter values, pH, TDS, Turbidity, Electrical Conductivity, and color showed good compliance with the SLS 614:2013 and NEA standards. (Mean values were 7.317, 28.37 ppm, 1.47 NTU, 54.21 μ S, 10.74 and standard deviation values were 0.1138, 13.46, 0.1961, 26.01, 5.047 respectively). Therefore, the condensed water from air conditioners is unlikely to have environmental impacts and can be safely used for irrigation and agricultural purposes. In the case of potable water, all the parameters analyzed in this research were well-fitted with the potable water standards. However, if it is intended for drinking purposes, further analysis for heavy metal contamination is required. By considering 11 number of A/C units, an amount of condensed water 0.97L/h/ton is released to the environment; equivalent to approximately 7.76 L/ton per day. The values were taken in duplicates. The volume of condensate water, while considerable, doesn't need to be released into the environment without purpose. Instead, this water can be efficiently utilized for various applications, including garden irrigation, toilet flushing, cooling applications, cleaning, fire suppression, and construction. This suggestion is imperative, not only for the Buttala area but for the entire country of Sri Lanka, as this approach can yield several positive effects on both the environment and the economy.

Keywords: Air conditioners, Condensed water, Quality analysis, Quantity analysis

(ID 243)

Suppression of Carbon Dioxide Emissions from Soil Amended with Autoclaved Lightweight Aerated Concrete Under Different Compaction and Moisture Conditions**Rathnayake, N.R.R.W.S.¹, Maeda, M², Leelamanie, D.A.L.^{1*}**¹*Department of Soil Science, University of Ruhuna, Matara, Sri Lanka*²*Graduate School of Environmental and Life Science, Okayama University, Okayama, Japan**leelamanie@soil.ruh.ac.lk**Abstract**

Carbon dioxide (CO₂) emissions has been highlighted worldwide as a contributor to the greenhouse effect. Soil physical characteristics such as bulk density and moisture content can influence the emissions of greenhouse gasses (GHGs) from soil. Soil conditioners applied to soil can also affect the terrestrial CO₂ emissions. Autoclaved lightweight aerated concrete (ALC) is in use at present as a soil conditioner or calcium silicate fertilizer, it is a type of porous material made from industrial waste. In this study, we determined the effect of ALC (Inenica, Clion Co., Ltd, Japan) on CO₂ emissions from paddy soil with considering soil compaction and moisture content. Laboratory experiments were conducted using soils with and without ALC (0 and 5%), under two levels of compaction (compacted and non-compacted), and two soil moisture contents (60% and 100% water holding capacity: WHC) in 200 mL glass vials. All treatments with triplicates were incubated at 25° C for 21 days under aerobic conditions. Emissions of CO₂ were determined at 0, 1, 3, 7, 14, and 21 days using gas chromatography with the thermal conductivity detector. The addition of ALC significantly decreased CO₂ emissions from soil at the early stages of incubation. Emissions of CO₂ were significantly lower at 100% WHC than at 60% WHC. Non-compacted treatments showed significantly higher emissions of CO₂ than compacted treatments during the incubation time period. This is possibly due to improved soil aeration and porosity, which enhanced the activity of soil microorganisms responsible for the decomposition of organic matter. The interactions between moisture content with ALC addition and compaction on cumulative CO₂ emissions were statistically significant ($p < 0.05$). The effect of ALC addition on CO₂ suppression was more effective at compacted and 100% WHC (51% reduction compared with control). Our study suggested that precise dosage of ALC application (5%) can effectively reduce CO₂ emissions from soil, under 100% WHC and compaction conditions than 60% WHC and non-compaction conditions.

Keywords: Aerobic, Autoclaved lightweight aerated concrete, Carbon dioxide, Compaction, Moisture content

(ID 274)

**Enhancing Sustainability and Performance of Pineapple Leaf Fibres in Textile Applications:
A Comprehensive Review****Dissanayake, T.W.M.I.I.*, Samarasinghe, S.A.S.C.***Department of Polymer Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**[*irunikaimanshani98@gmail.com](mailto:irunikaimanshani98@gmail.com)***Abstract**

The utilization of pineapple leaves (*Ananas comosus*) has gained significant momentum as a source of value-added products, owing to the myriad benefits offered by Pineapple Leaf Fibres (PALF). PALF presents a range of advantages, including its contribution to a greener environment and sustainability. PALF production plays a pivotal role in reducing environmental pollution and minimizing waste. Moreover, PALF stands out due to its availability, remarkable thermal and acoustic insulation properties, cost-effectiveness, and exceptional tensile strength. Further, the extraction of PALF can be accomplished manually or mechanically, and various methods have been explored to enhance its compatibility with textile applications. In this context, extensive research has been carried out to modify PALF for its application in the textile industry. Researchers have primarily focused on surface modifications. These modifications encompass chemical treatments, physicochemical treatments, physical treatments, and thermal treatments. All of these contribute to improved interfacial adhesion and enhanced physical, mechanical, and thermal properties of PALF. Additionally, investigations into bleaching and dyeing of PALF have led to achieving superior whiteness and the ability to impart various colours to the fibres. PALF fibres exhibit remarkable qualities, including excellent sweat absorption, breathability, durability, and notable air and water permeability. These attributes make PALF a sought-after material for creating blended fabrics in conjunction with other polymers, such as polyester and wool, enhancing the performance of resulting textiles. The versatility of PALF enable its integration into an extensive range of textile products, underscoring its significance in the industry. This review also explores innovative approaches, such as blending PALF with jute, resulting in the creation of home textiles and carpets, while simultaneously improving the quality of blended yarns. Furthermore, within the textile industry, PALF fibres find diverse applications in the production of an array of products. This involves the crafting of wedding dresses, casual attire, and formal garments. It also includes the manufacturing of table linens, mats, bags, shoes, belts, cords, transmission cloths, airbag tying cords, and carpets. This comprehensive review delves into the wealth of research conducted on PALF modifications, shedding light on the potential of PALF as a sustainable and high-performance material in the textile industry, contributing to further eco-friendly and innovative future.

Keywords: Pineapple Leaf Fibres (PALF), Textile Industry, Sustainability, Greener environment

(ID 100)

**Comparative Analysis of Rainfall Data Sources in Agro-Ecological Zones of Sri Lanka:
Expensive Meteorological Measurements vs Freely Available NASA Data**

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Abstract

Rainfall information contributes significantly to weather-related research as it can be directly applied to many theories and models such as climate change, disaster management, environmental assessments. Therefore, the availability of long-term meteorological data and their accuracy are crucial. At the same time the access to these data from different sources have their own drawbacks. For example, meteorological department of Sri Lanka is responsible of collecting rainfall data. However, their data are very expensive, and their data are not available for all desired locations. On the other hand, the freely available satellite data sources have a question of reliability of the data although no missing data are found. Thus, a comparative assessment of rainfall data was carried out from two distinct sources: meteorological department of Sri Lanka and freely available National Aeronautics and Space Administration (NASA) satellite-based data. The objective of this study was to compare and discern the distinctions in rainfall data obtained from these sources for the benefit of future usage of the data in various studies. The study was carried out in different agro-ecological Zones (wet, dry, and intermediate) of Sri Lanka for the period of 1981-2021. The stations were selected randomly to represent the zones. Identified missing values in the meteorological dataset were subsequently addressed using the mean imputation method. Statistical procedures were conducted on the non-normal rainfall data to identify similarities between the sources within individual agro-ecological zones. Results revealed that there is a statistically significant difference at 5% between the sources (NASA and meteorological measurements) in wet and intermediate zones. However, the comparison of the dry zone resulted in inconclusive decisions both at 5% and 1% significance levels. In conclusion, it is statistically advisable to use meteorological rainfall measurements over NASA data for the wet and intermediate zones.

Keywords: Rainfall, Agro-ecological zones, Meteorological data, NASA data, Non-normal data

(ID 201)

Aquifers Recharge Potentiality Evaluation using Bivariate and Multivariate Statistical Analysis: A Case Study in Malwathu Oya River Basin

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Abstract

An aquifer is a body of porous rock or sediment saturated with groundwater that plays a vital role in the hydrological cycle. Due to rapid population growth and urbanization, these valuable resources face threats like climate changes, pollution, and over-exploitation. Overdraft, where extraction exceeds recharge, can lead to groundwater depletion. Although Sri Lanka is not considered a water-scarce country, it faces rising water demands due to rapid population growth. Especially in dry zones, groundwater is crucial for drinking and agriculture; unauthorized agro-wells exacerbate groundwater issues. Therefore, this research aims to assess groundwater recharge potential zones in Malwathu Oya river basin using Bivariate and Multivariate statistical analysis. Comparing these techniques will lead to the precise identification of potential recharge areas. And this study primarily focuses on the implementation of GIS to find solutions for this kind of challenge without performing field investigations. Therefore, eight conditioning factors; water level, electrical conductivity, lithology, soil, slope, lineament density, drainage density and land use were selected as groundwater recharge influencing factors. The well inventory database consisted of 380 well locations and, out of these, 70% was considered as the training dataset, and the remaining 30% was taken as the testing data set. Groundwater recharge potential maps (GRP) were developed in ArcGIS 10.8, based on the results obtained from Frequency Ratio (FR), Logistic Regression (LR) and their ensemble method. For testing the accuracy of the FR model, test well locations were cross tabulated with the GRP map, and the highest well percentage was achieved in high groundwater recharge potential zone (37.39%). In the LR model, cross-tabulation results showed that 62.61% of testing wells were in the very high potential zones. The ensemble method of FR and LR revealed that 53.04% of test wells fall into the very high potential class. Hence, it can be assumed that LR predictions are more reliable than the FR model. To further validate the LR model and ensemble model, Receiver Operating Characteristics curve method was used. The Area Under the Curve (AUC) values for Success rate curve (SRC) and prediction rate curve (PRC) in LR method were 63% and 57% respectively. In ensemble method, the AUC values for SRC and PRC were 89% and 75%. These results indicate that the LR model is relatively poor estimator, whereas FR and LR ensemble method is relatively good estimator to evaluate groundwater recharge potential in Mulwathu Oya river basin.

Keywords: Area under curve, Frequency ratio, GIS, Groundwater recharge, Logistic regression

(ID 144)

Harnessing Hyper-Accumulator Plants for an Innovative Green Technology to Recover Nickel from Serpentine Soils in Sri Lanka

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Abstract

Phyto-mining is an environmentally sound green technique that has been employed for metal recovery from low-grade sources using hyperaccumulator plants. Due to its economic viability and wide social acceptance, this technology has been favoured over many conventional mining applications. Nickel (Ni) phyto-mining was introduced to the world with the identification of many Ni hyperaccumulator species grown in Ni-enriched metalliferous soils like serpentine, where they accumulate more than 1,000 mg/kg of Ni. Along the boundary of Highland and Vijayan Complexes in Sri Lanka, Ginigalpelessa, Indikolapelessa, and Ussangoda serpentinite deposits are closely located by showing similar geographical features. According to previous studies, these deposits contain a high concentration of Ni in the soil causing the evolution of serpentinite flora unique to these areas. This study aimed to identify the diversity and the presence of hyperaccumulator species that can be employed in Ni phyto-mining. More importantly, the study focused on identifying annual or biannual crop species with short lifespans that can be used in phyto-mining. The plant diversity and abundance analysis were carried out using a grid sampling method (3×3 m), and the highly abundant species were harvested and subjected to aqua regia digestion to determine hyperaccumulator levels using Inductively Coupled Plasma Mass Spectrometer (ICP-MS). Ginigalpelessa and Indikolapelessa showed similar diversity, abundant with grass and small herb species, such as *Apluda mutica*, *Imperata cylindrica*, *Eupatorium odoratum*, and *Tephrosia villosa*, where the *A. mutica* was dominant. In addition, plants like *Morinda tinctoria*, *Vitex pinnata*, and *Azadirachta indica* were dispersed throughout the deposit. Ussangoda deposit exhibited few herb species, including *Hybanthus enneaspermus*, *Evolvulus alsinoides*, and *Desmodium triflorum*, and localized thick vegetation patches. Diversity analysis of all the deposits showed very low plant diversity, ranging from 0.1 to 1.3. Moreover, the areas containing high Ni concentrations (6,000-10,000 mg/kg) were abundant with stunted trees and grass species. The present study identified the *Apluda* grass species as a potential Ni hyperaccumulator for phytomining since it accumulates a high concentration of Ni (900-2,800 mg/kg) and can be grown biannually. Even though the grass species was dominant in both Ginigalpelessa and Indikolapelessa deposits, it was not observed in Ussangoda deposit, probably due to the arid climate and the deposition of salt spray from the coast. The findings of this study would be promising to establish phytomining in serpentine soils to support the increasing demand for Ni in the global market, especially for clean energy transition.

Keywords: Low-grade soils, Clean energy transition, Ni phyto-mining, Serpentinite deposits

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(ID 208)

Assessment of Groundwater Quality in Attaragoda Grama Niladhari Division in Galle, Sri Lanka

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Abstract

Insufficient quality can make water unfit for a range of human purposes. As a result, water is becoming scarcer globally as population growth continues. Water quality assessment is essential for effective water resource management. The present research fills the gap in scientific knowledge and information regarding the groundwater quality status in Attaragoda Grama Niladhari (GN) Division in Galle, Sri Lanka. Randomly selected 33 groundwater samples were collected from 142/A Attaragoda GN division monthly from November 2021 to March 2022. Together, 13 selected general water quality parameters, including temperature, pH, total dissolved solids, electrical conductivity, salinity, dissolved oxygen, biological oxygen demand, total nitrate, total phosphate, total alkalinity, total hardness, ammonia, and fluoride, were measured once a month during the study period using standard methodologies. Additionally, four metals, including Iron, Calcium, Magnesium, and Sodium, were analysed for the randomly selected 15 locations during the study period. Statistical analysis was done using Minitab 17 and MS Excel 13. Weighted Arithmetic Water Quality Index (WQI) was calculated using electrical conductivity, TDS, pH, hardness, phosphate, alkalinity, and nitrate parameters in Attaragoda GND. Results indicated that, except for Fe, none of the tested parameters exceeded the maximum permissible levels for drinking water throughout the study. Accordingly, all locations were categorized as good for drinking purposes. For a more precise evaluation of water quality, the WQI can be improved by future research focusing on heavy metal and microbial contaminants.

Keywords: Groundwater, Water quality, Weighted arithmetic water quality index

(ID 300)

Introducing *Gliricidia sepium* as a Fuel Wood in Rubber Smallholdings of Sri Lanka: A Case Study in Kalutara District

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Abstract

A pilot project has been initiated to introduce *Gliricidia sepium* with *Hevea brasiliensis* under three different spatial arrangements ((i.)8'×27', (ii.)8'×40', and (iii.)88'×60') as a fuel wood to improve the income status of rubber smallholders in Kalutara District by Rubber Research Institute of Sri Lanka in 2018. Primary data were collected through a questionnaire survey and field observations. The financial analysis was done for one hectare of smallholding. Certain assumptions were made in the financial feasibility analysis as financial analysis was done for 30 years giving consideration to the 30 year life span of rubber. Costs and benefits were discounted at 10% discount rate as practiced by the Department of National Planning to obtain 2019 market prices. The farm gate prices of 1kg of rubber and *Gliricidia* were considered as LKR 280.00 and LKR 4.00. The cost for hired labour was considered LKR 1,500.00 per day. Period of intercropping of *Gliricidia* under rubber in the 88'×40' and 88'×60' models was considered as 30 years and in the 88'×27' model, it was considered as eight years. Financial feasibility of models was tested using the indices of Net Present Value (NPV) and Benefit Cost Ratio (BCR). A qualitative SWOT was conducted to identify the strengths, weaknesses, opportunities and threats relevant to introduction of *Gliricidia* as an intercrop in rubber plantations based on a thorough documentation review and on the opinions of Rubber Extension Officers. From the three models introduced, the highest fuel wood value can be obtained by intercropping *Gliricidia* with rubber under the spacing of 88'×60'. NPV for growing *gliricidia* with rubber under three different spatial arrangements, (i.)88'×27', (ii.)88'×40' and (iii.)88'×60' would be LKR 0.74 million, LKR 5.47 million and LKR 5.89 million respectively. The values obtain for BCR for growing *gliricidia* with rubber under three different spatial arrangements, (i.)88'×27', (ii.)88'×40' and (iii.)88'×60' would be 1.37, 2.26 and 2.27, respectively. All fuel wood growing models indicated positive NPV and BC Ratios were greater than one, suggesting that these introduced models are economically viable. Although there are no established market channels available for fuel wood especially in the smallholder rubber sector of Sri Lanka, there is a demand for *Gliricidia* which is fulfilled through adhoc markets. Also, development of sustainable supply chains through setting up of Pilot Biomass Energy Terminals with the objective of collection and distribution of fuel wood under the Project of Promoting Sustainable Biomass Energy Production and Modern Bio-Energy Technologies has widened the opportunity of using *Gliricidia* as a promising fuel wood species *Gliricidia* with rubber has the potential to improve income generation of rubber smallholders substantially especially during the immature stage of rubber and provide a solution to overcome uncertainty in rubber prices and low productivity of rubber lands.

Keywords: Fuel wood growing models, Rubber farming

(ID 042)

A Review on the Utilization of Herbarium Data in Phenological Research Addressing Climate Change Implications

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Abstract

In recent years, the profound impact of climate change on biodiversity has become increasingly evident, with significant consequences for critical life events in the natural world. It underscores the significant influence of climate variations on seasonal life events within the biotic environment of flora, such as blooming response, leaf growth, leaf senescence and fruit ripening. These phenological shifts, particularly in temperate and tropical ecosystems, serve as vital indicators of climatic changes. This review study delves into the intricate relationship of herbarium data for bridging the gap in plant phenological observation for the investigations on climatic change. This comprehensive literature review of 30 key research papers published in the past two decades, which focus on the utility of herbarium specimens as tools to document phenological changes, was critically analysed in this research study. Long-term observation of phenological data by various phenological observation networks has paved the way for advanced environmental analysis in climatic change studies. However, despite the importance of phenological data from field observation, its collection and long-term observation records, present challenges, emphasizing the need for spatiotemporal depth of phenological data. A noticeable gap in field data collection has hindered various studies reliant on plant phenological data. In response to these challenges, herbaria serve as invaluable repositories of plant specimens, boasting rich historical records spanning over a century, providing a deep spatiotemporal and taxonomic insight. Research findings indicate the fidelity of herbarium records to fill the gap in field observations, with no significant differences between the field observations and herbarium data, highlighting the reliability of herbarium data in capturing phenological information. Overcoming the challenges associated with extensive herbarium datasets, digitalization and the implementation of crowdsourcing platforms have emerged as effective strategies, granting researchers easy online access to these data. Moreover, it is evident that in Sri Lanka, there exists a research gap in utilizing herbarium data for phenological studies in climate change observation and the implementation of online accessibility for herbarium data, highlighting the need to address this gap in future research endeavours.

Keywords: Climate change, Herbarium data, Biodiversity, Phenological data

(ID 059)

Climate Smart Tea (*Camellia sinensis*) Cultivation Practices in Rathnapura District

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Abstract

Tea (*Camellia sinensis*) cultivation in Sri Lanka, which plays a key role in the nation's economy, is facing unprecedented challenges due to the impacts of climate change. Climatic changes led to adverse outcomes, including deteriorating soil conditions marked by erosion, hindered tea plant growth, reduced quality, yield and market value of the tea. For many small-scale tea farmers, tea cultivation is their primary source of income. Climate-related challenges make their livelihoods more vulnerable, with poverty, especially extreme rain led to high maintenance costs and some cultivators to abandon tea plucking, hindering maintain efforts due to insufficient facilities and high expenses. Therefore, mitigating climate challenges is important. Objectives of this study is to find out the effects of climate change on tea cultivation, identify awareness levels and explore climate smart mitigation practices employed in Ratnapura District. Primary data was collected using in-depth interviews and field observations. Secondary data was collected from Tea Research Institute (TRI) databases. The region faces challenges from climate change, with high rainfall, occasional temperature fluctuations, droughts, and flood events. Terracing techniques are utilized to create level surfaces, effectively controlling soil erosion by slowing the flow of rainwater down slopes, cover cropping with grasses and legumes being planted between tea rows to shield the soil from the erosive force of raindrops, efficient drainage systems, such as trenches and channels, redirect excess rainwater away from the fields, preventing waterlogging, shade management, through strategic tree planting, and the use of mulch, tea pruning practices, aid in protecting tea bushes from heavy rainfall, planting high rainfall resilience varieties and preserving soil structure. Tea cultivators lack awareness regarding climate-smart practices and have limited knowledge about TRI recommendations. The research findings important to empower local tea farmers with innovative adaptation, thereby enhancing the adaptive capacity of the tea industry.

Keywords: Climate smart, Tea cultivation, Climate changes, High rainfall, Innovative adaptation

(ID 001)

Feasibility of Biofilm Biofertilizer in Halving Nitrogen Waste in Paddy Cultivation

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Abstract

In an attempt to achieve the target of the Colombo Declaration in 2019, we, the Centre for Advanced Research on Nitrogen Management in Agriculture (CARNMA) at the National Institute of Fundamental Studies (NIFS) conducted 112 field trials in 13 districts of Sri Lanka. Here, two practices being used extensively by the farmers were compared for the Nitrogen (N) fertilizer use efficiency in paddy; (a) chemical fertilizer (CF) practice [340 kg CF/ha (Urea 225, TSP 55 and MOP 60 kg/ha) and, as recommended by the Department of Agriculture] (b) Biofilm biofertilizer (BFBF) practice [2.5 L of BFBF/ha split into two applications, at two and six weeks after sowing, together with 225 kg CF/ha (Urea 150, TSP 40 and MOP 35 kg/ha), a reduction of CF by 34% because of the ability of the BFBF in increasing fertilizer use efficacy via microbial turnover]. Results showed that the BFBF application cut down N-fertilizer use by 33%, and hence the waste is also by the same amount with a simultaneous increase in grain yield by 23% (i.e., the average of all the 112 trials: the BFBF practice 5,860 kg/ha, and the CF practice 4,748 kg/ha). Moreover, the N fertilizer use efficiency by paddy crop increased by 6% in the BFBF practice indicating a higher N uptake, and hence lower N waste compared to the CF practice. The fertilizer cut down and the increased N uptake collectively reduced N waste by over 50%. In conclusion, the BFBF practice can be considered as a promising approach to meet the target of the Colombo Declaration in 2019 i.e., halving N waste in agriculture by 2030.

Keywords: Biofilm biofertilizer, Colombo declaration, N-waste, Paddy

(ID 057)

Investigation on Efficacy of *Azolla* with Different Organic Fertilizers as Plant Growth Enhancer on Chili (Var.*Super*)

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Abstract

Chili is one of the widely used spices all around the world. Over usage of inorganic fertilizer to satisfy ever growing demand for food leads to detrimental impacts on human health and environment. Therefore, this study was intended to investigate the efficiency of azolla with different organic fertilizer on growth and yield of chili, variety Super. A field experiment was carried out with five different treatments, T1-*Azolla*+Compost, T2-*Azolla*+Vermicompost, T3-*Azolla*+Panchagowvya, T4-*Azolla*+Vermitea, and T5-Control with five replicates and laid in randomized complete block design. The prepared organic fertilizers were applied from two weeks of transplanting and continued for 12 weeks in one week interval. Then the growth parameter such as mean plant height, number of leaves per plant, leaf width, number of flowers, pod length, pod diameter, pod weight and total yield were measured in different time duration according to the type of measurement. According to the results, T2 showed better performance in terms of mean plant height (45 cm), number of leaves per plant (43 cm), leaf width (2.8 cm), pod length (4.34 cm), individual pod weight (6.94 g), and total yield (176.8 g) whereas comparatively lower performance was observed in control. Considering the significant differences recorded in the statistical analysis for all the parameters other than the mean number of flowers, it can be concluded that the application of *Azolla* solution with vermicompost improves the growth performance and yield of chili. Therefore, it is recommended to adapt this combination as an organic fertilizer among the farmers to reduce the usage of inorganic fertilizers.

Keywords: *Azolla* solution, Demand, Growth parameters, Inorganic fertilizer

(ID 099)

Utilization of Palm Oil Effluent and Empty Fruit Bunches as a Fertilizer Marginal Oil Palm Fields at Talgaswella Estate, in the Low Country Wet Zone Agro-Ecological Zone of Sri Lanka

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Abstract

Oil palm (*Elaeis guineensis*) was first introduced to Sri Lanka, as a commercial crop, about 55 years ago and was first established in Galle District as a rain fed perennial cash crop. Palm Oil Mill Effluent (POME) is identified as a problematic waste while releasing directly to the water streams. Both POME and Empty Fruit Bunches (EFB) consists of all these required nutrients in higher proportions for oil palm plants. This study was carried out with the dual intentions (objectives) of finding a solution to the disposal of waste material accumulated in oil palm factories over many years and to improve the productivity of marginally yielding oil palm fields in Thalgaswella estate Talgaswella. The study was designed using RCBD and there are eleven treatments. Fertilizer/mixtures were prepared based of the Nitrogen amount (0.63 kg/palm/year) supplied from the recommended inorganic fertilizer mixtures and rest of the organic fertilizer mixtures were prepared with using different proportions of POME and EFB to balance Potassium (K) & Prosperous (P). A ten-year-old oil palm field was selected in year 2019 for this experiment and maintained the field for three years before the data collection. There were 33 plots, each containing six palm trees. Organic treatments included different quantities of Empty Fruit Bunches (EFB), Palm Oil Mill Effluent (POME). Oil content of the fruits was analyzed at AEN oil palm factory using (Instrument-FOSS DA1650) in year 2023. All the data were analyzed with Minitab and mean separations were done using DMRT at $\alpha \leq 0.05$ level. Results clearly show that the application of organic fertilizer to the oil palm cultivation gives significantly higher oil yield. These findings can help to improving the productivity of marginal oil palm cultivations, while providing a sustainable solution to the disposal of POME and EFB.

Key words: Oil palm, Palm Oil Mill Effluent (POME), Empty Fruit Bunches (EFB), Waste, productivity

(ID 258)

Effects of Liquid Fertilizers on Growth Performances of *Ipomoea aquatica* in Coir-Based Growing Media**Subashini, J.K.W.N.^{1*}, Madhusanka, W.P.C.¹, Ranaweera, B.¹, Karunarathne, K.H.M.I.²**¹*Department of Horticulture and Landscape Gardening, Wayamba University of Sri Lanka, Gonawila, Sri Lanka*²*Department of Plantation Management, Wayamba University of Sri Lanka, Gonawila, Sri Lanka*
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In the process of crop management, fertilization must be practiced in an appropriate way to maintain the sustainability. Hence, the right type of fertilizer and the correct mode of application is crucial. The source and the physical nature of the fertilizer is having a significant effect on the performance of plants. In that context, liquid fertilizers are generally a convenient and effective way to enhance the nutrients availability. Hence, the present study was conducted to evaluate the effect of several liquid fertilizers on the growth performance of the popular leafy vegetable *Ipomoea aquatica*. Plants were established in coir grow blocks and treated with five different commonly known and available liquid fertilizers namely, Albert's solution (T1), Compost tea (T2), Vermiwash (T3), Sanstha liquid fertilizer (T4) and *Gliricidia* leaf extract (T5) once a week by applying a constant volume of 100 mL. The experiment was arranged in a randomized complete block design (RCBD) inside a semi protected plant house. The growth parameters of the plants (plant height, number of leaves, leaf area, fresh weight, and dry weight) were recorded up to 60 days. One-way Analysis of Variance (ANOVA) was used for statistical comparisons. According to the results all the parameters denoted significant differences among the treatments ($P < 0.05$), except for chlorophyll content. However, T1 denoted the highest mean values for the vegetative parameters including, plant height, number of leaves, leaf area, fresh weight, and dry weight while T3 (Vermiwash) reported the second highest values for the respective parameters. Regarding the chlorophyll content the highest mean value was recorded by T2 (Compost tea) followed by T5 (*Gliricidia* leaf extract). The results of the present study indicated that liquid fertilizers can be used effectively for the production of *I. aquatica* in coir-based media. It suggested Albert's solution and vermiwash as high potential liquid fertilizers while vermiwash can be recognized as a nutrient supplement for organic production of *Ipomoea aquatica* in coir-based media.

Keywords: Compost tea, *Ipomoea aquatica*, Liquid fertilizer, Vermiwash

(ID 212)

Biochar Derived from Pond Apple (*Annona glabra*) as a Fertilizer to Enhance the Crop Yield: A Sustainable Approach**Ravishani, B.P.R.¹, Jayathilake, K.M.P.I.^{1,2}, Manage, P.M.¹, Idroos, F.S.^{1*}**¹*Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*²*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka**sumaiyaidroos@sci.sjp.ac.lk**Abstract**

The intensive use of inorganic fertilizers causes many economic, ecological, and social issues around the world. In the search to discover an effective fertilizer, biochar has been in the spotlight in recent years. Hence, the present study was focused on utilizing biochar derived from pond apple (*Annona glabra*), which is an aquatic invasive plant as a fertilizer without harming the environment. A pot experiment was carried out to determine the effects of biochar on plant growth. Biochar was applied to soil and growth differences were identified by comparing it with the control. Banana pepper (*Capsicum annum*) was selected as the experimental plant. Plant growth parameters (seed germination percentage, growth rate, root length, and number of leaves) were measured to determine the effects of biochar on plant growth. In each pot, 5 seeds of *C. annum* were sowed and examined for 14 days to get the germinate percentages. The other plant growth parameters were recorded after 45 days. Biochar treated with soil showed a significant increase ($p < 0.05$) in average growth rate ($14.46 \pm 6.67\%$), root lengths (4.94 ± 0.27 cm), and number of leaves (5.83 ± 0.76) in comparison to the control while seed germination percentages were kept as same value. An optimizing process was carried out by increasing the amount of biochar (5%, 7%, 10% by weight) to determine the ideal amount of biochar on plant growth. Considering the average growth rate, the best result ($21.43 \pm 1.01\%$) was shown in pot treated with 7% biochar by weight. Henceforth, the utilization of biochar derived from *A. glabra* as a fertilizer is an effective approach to enhance crop yield while limiting the spread of these invasive aquatic plants in a sustainable and eco-friendly manner. As a result, the current study has suggested a green, sustainable strategy for the efficient use of aquatic invasive plants.

Keywords: Biochar, Fertilizers, Plant growth, Aquatic invasive plant

(ID 008)

Efficacy of Flavonoids from Selected Plants in Controlling *Callosobruchus maculatus* on Cowpea Seeds (*Vigna unguiculata*)

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Abstract

Phytochemicals act extensive active against stored pest have long been exciting alternative to synthetic pesticides besides, evidenced flavonoids that among the plant constitute a rich source of bio-active chemical which are much safe with eco-friendly that applicable to protect insects. The experiment especially aims to investigating influence of flavonoids from the selected plants leaves such as *Moringa oleifera* (moringa), *Lantenna camera* (nayunni), *Justicia adhatoda* (adhathodai), *Pepper nigrum* (pepper), *Annona reticulate* (annona), *Eichhornia crassipes* (water hayasinth), *Eucalyptus globules* (eucalyptus), *Citrus aurantiifolia* (lime), *Azadiracta indica* (neem), *Achyranthes aspera* (nayuruvi), *Ocimum tenuiflorum* (thulsi), *Cymbopogan citratus* (lemon grass), *Capsicum annuum* (chilli), *piper longum* (thipilli) and *Vitex trifolia* (nochchi), located in Eastern Regions of Sri Lanka against cowpea weevil, *Callosobruchus maculatus* on stored cowpea seeds (*V. unguiculata*) during storage. 10 g of each leaf dry powder separately extracted with 100 mL of 80% aqueous methanol at room temperature and filtrates were transferred in to 100 mL conical flask and evaporated into dryness to over a water bath and used standard scientific method to obtained flavonoids. 200 cowpea seeds thoroughly mixed with 2 mg flavonoids and replicated thrice for one treatment. As similar manner other treatments and untreated control were designed and introduce with 5 pairs of newly emerged cowpea weevil, *C. maculatus* in 100 mL capacity plastic bottle with arranged in Complete Randomized Design (CRD) and started to monitor from 1st day after treatment (DAT). Adult mortality and number of eggs laid on seeds of each treatment were recorded daily until 6th DAT and retained for further 30 days to assess new progeny production of the weevil *C. maculatus*. Flavonoids from *J. adhatoda* and *P. nigrum* shown excellent constituent to kill all the adult *C. maculatus* within 6 days followed by *O. tenuiflorum* (80%) and it was significantly ($p \leq 0.05$) as par with *E. globules* (72.6%) and *A. indica* (74%). Similarly, the flavonoids from these above mentioned leaves dry powders except *P. nigrum* significantly active against fecundity of an adult which shown *J. adhatoda* (6.3 egg/female), *C. aurantiifolia* (7 eggs/female) and *O. tenuiflorum* (7 eggs/female), however *J. adhatoda* totally affect the development of F1 new progeny production. According to the observations the differences were not statistically significant about the fecundity between the flavonoids from *P. nigrum*, *A. indica* and *C. annuum*. *L. camera*, *E. crassipes* and *C. citratus* did not show any significant effect on adult mortality, fecundity, new progenies as well as obtained much damage seeds next to control and obtained unsatisfactory results as untreated control while, *M. oleifera*, *A. reticulate*, *V. trifolia* and *C. annuum* obtained moderately against adulticidal activities of *C. maculatus* on cowpea seeds during the storage until 30 days. However, *J. adhatoda* proven its efficacy on cowpea seeds to control *C. maculatus* by highly effective to suppressing new progeny production and led without any damage in the seeds during the storage.

Keywords: Flavonoid, Adult, Mortality, *Callosobruchus maculatus*, *Justicia adhatoda*

(ID 043)

The Effect of Rhizospheric Fungal Species of Tomato (*Solanum lycopersicum* L.), on In-Vitro Growth of the Tomato Early Blight Pathogen

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Abstract

Tomato (*Solanum lycopersicum* L.) is a globally consumed crop, susceptible to various biotic and abiotic stresses. Among biotic stresses, plant diseases, particularly Early Blight caused by *Alternaria* spp. leads to heavy losses in the field and post-harvest stages. The conventional use of synthetic agrochemicals to control these diseases poses environmental risks, underscoring the need for sustainable alternatives. Hence, this study aimed to assess the potential of rhizospheric fungi in controlling *Alternaria* spp. Infected tomato leaves, stem parts, and fruits were collected from commercial cultivations in four agro-ecological regions in Sri Lanka (two from mid-country in the wet zone, and two from the intermediate zone). All samples were washed using running tap water, and 1 cm² sections, including the edges of lesions, were cut, surface sterilized, placed on potato dextrose agar (PDA), and incubated at room temperature until colonies appeared. Fungal colonies that emerged from lesions, were sub-cultured onto fresh PDA, and pure cultures were obtained using the hyphal-tip purification method. *Alternaria* isolates were identified morphologically and confirmed the pathogenicity by Koch's postulate method. Species-level identification involved genomic DNA extraction and sequencing ITS regions. The soil dilution plate technique was used to isolate rhizospheric fungi from two agroecological regions. Composite samples (10 g) of soil attached to the roots of 5 uprooted healthy plants, from each field were used. Soil suspensions were inoculated onto PDA using the spread-plate method and incubated at room temperature for 5 days. A total of 27 isolates were obtained and morphologically identified up to the genus level after preparing pure cultures. The dual-culture plate technique was used to assay percentage inhibition, and according to Tukey's pairwise comparison, *Trichoderma* sp. and *Purpureocillium lilacinum* exhibited significantly high ($p \leq 0.05$) inhibition of *Alternaria* colony growth, ($68.25 \pm 1.18\%$ and $64.35 \pm 3.31\%$ respectively). Microscopic observations of inhibition zones between *Alternaria* and antagonistic rhizospheric fungal colonies, including *Trichoderma* sp. and *P. lilacinum* showed the presence of mycoparasitism-related structures, such as haustoria, coils, loops, and knobs. Qualitative assay for fungal chitinase enzyme production demonstrated high activities in *P. lilacinum*, *Trichoderma* sp. and *Acremonium* sp., whereas in a quantitative assay for fungal glucanase enzyme, testing the ability of fungal culture filtrates to release 1 µg of glucose per minute, from Beta-glucanase solution, *P. lilacinum*, *Trichoderma* sp., and *Paecilomyces* sp. showed significantly high ($p \leq 0.05$) activities (105.14 ± 3.62 , 100.11 ± 4.09 and 99.83 ± 6.44 µg glucose/L respectively). In conclusion, this study highlights the potential of rhizospheric fungi like *P. lilacinum* and *Trichoderma* sp. as effective biocontrol agents against *Alternaria* spp. and these findings lay the groundwork for future applications in enhancing tomato crop resilience against pathogens and promoting sustainable and eco-friendly agricultural practices.

Keywords: Rhizospheric fungi, Mycoparasitism, ITS region, Chitinase enzyme, Glucanase enzyme

(ID 093)

Antifungal Activity of Selected Indigenous Medicinal Plants in Sri Lanka Against Candida Infections

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Abstract

Candida infections have been recorded as an emerging health concern among immune-compromised patients, infants and pregnant women in Asia, Africa and Europe. Skin diseases, genital infections, candidiasis and candidemia caused by overgrowth of symbiotic *Candida* species in the human body are treated by antifungal drugs. The common drugs viz., fluconazole, flucytosine, amphotericin B, nystatin, etc. are responsible for more side effects in the human body while *Candida* species are indicating a resistance towards them. Therefore, the continuous discovery of antifungal compounds against *Candida* infections is an essential process. Thus, the current study focused on the determination of the antifungal activity of water extracts of selected indigenous medicinal plants in Sri Lanka towards *Candida* infections. Three common indigenous medicinal plants; *Cyperus rotundus* (roots, tubers, leaves and flowers), *Acalipha indica* (roots, stem, leaves and flowers) and *Aloe barbadensis* Miller (gel and leaves) were collected and their water extracts (10 g/25 mL) were screened for the antifungal activity against two common *Candida* species; *Candida glabrata* and *Candida parapsilosis* using disk diffusion method. Briefly, the pathogenic bacterial lawns were prepared by spreading equalized solutions of *C. glabrata* and *C. parapsilosis* on Muller Hinton Agar supplemented with 2% glucose. Sterile paper disks soaked with 30 µL of water extracts of each plant part were placed on pathogen lawns. Sterile distilled water was used as the negative control. The plates were incubated at 37° C overnight and observed for clear zone formation. According to the results, the water extract of *C. rotundus* tubers indicated an inhibitory action by giving clear inhibition zones against both tested *Candida* species. All other water extracts of medicinal plants indicated negative inhibitory actions against tested *Candida* species. The results revealed that *C. rotundus* tubers consist of antifungal activity against *C. glabrata* and *C. parapsilosis*. Hence, *C. rotundus* tubers can be used as an effective treatment for infections caused by the tested *Candida* species.

Keywords: Antifungal activity, *Candida* infections, Indigenous medicinal plants, *Cyperusrotundus*, Water extracts

(ID 101)

Comparative Analysis of Physiochemical Properties and In Vitro Antioxidant Potency Among Morphotypes of *Centella asiatica* Grown in Sri Lanka

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Abstract

Centella asiatica commonly referred as Gotukola, is recognized for its extensive application in traditional medicine owing to its remarkable health benefits. This study investigated the differences in pH, ash content, moisture content, and *in vitro* antioxidant potential among three prevalent vine-type morphotypes of *C. asiatica*: Wel Gotukola, Meerigima Gotukola, and Yodha Gotukola, indigenous to Sri Lanka. *C. asiatica* plants of the same age (100 days) at their first harvestable matured stage, were randomly collected from domestic gardens in Gampaha District, Sri Lanka. Three replicates of each morphotype were sampled. Moisture and ash content were analysed using the standard AOAC method, and pH was measured using the potentiometric method. DPPH (2,2-Diphenyl-1-picrylhydrazyl) radical scavenging capacity assay was used to determine the antioxidant activity. To thoroughly compare antioxidant potential among morphotypes, the ANOVA test was utilized followed by post-hoc Tukey HSD tests. Following results were obtained for the average moisture content of Wel Gotukola (83.41%±1.16%), Yodha Gotukola (74.33%±2.23%), and Meerigama Gotukola (79.46%±1.89%), alongside average ash content of Wel Gotukola (11.60%±1.02%), Yodha Gotukola (13.12%±2.57%), and Meerigama Gotukola (12.17%±2.01%). Additionally, an average pH of Wel Gotukola (6.00±0.21), Yodha Gotukola (5.75±0.25), and Meerigama Gotukola (5.98±0.14) was observed. The antioxidant activity of *C. asiatica* extracts exhibited concentration dependent increases in radical scavenging capacity. Notably, the DPPH radical scavenging potency, denoted by the minimum IC₅₀ value, exhibited significant variations across different Gotukola varieties (p<0.05): Wel Gotukola (6.4 ± 0.54 µg/mL), Yodha Gotukola (8.56±0.35 µg/mL), and Meerigama Gotukola (7.0±0.75 µg/mL). Post-hoc Tukey tests showed antioxidant activity was significantly higher in Wel Gotukola compared to that of Meerigama and Yodha Gotukola morphotypes (p<0.05). Furthermore, Wel Gotukola demonstrated the highest average pH, moisture content, and the lowest mineral content. Conversely, Yodha Gotukola exhibited the lowest pH, moisture content, and the highest ash content. These findings underscore the potential of chemical parameters in elucidating the distinctive attributes of the three Gotukola varieties. Specifically, the significantly higher antioxidant potential observed in Wel Gotukola suggests its potential as an optimal candidate for herbal product development. This study imparts valuable insights into optimizing the therapeutic efficacy of formulations based on the specific *C. asiatica* employed in such endeavours.

Keywords: Antioxidant activity, *Centella asiatica*, Morphotypes, Proximate analysis

(ID 156)

Microplastic Contamination in Seafood: Knowledge and Awareness of Fishermen and Consumers in Negombo Lagoon Area

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Abstract

Microplastics (MP) are tiny plastic particles (<5 mm) which are widespread in freshwater, marine, and terrestrial ecosystems. MP become significant environmental threat and there is a possibility to end up MP in seafoods. The present study assessed the level of awareness regarding contamination of seafood with MP among consumers and fishermen in Negombo lagoon area. Data were collected from 60 participants (30 fishermen and 30 consumers) via administered questionnaire with closed-ended and open-ended questions which extract the information on awareness about MP. Findings revealed that awareness on MP were relatively low in Fishermen (36.67%) but higher in consumers (63.33%). Further 40% of fishermen and 60% of consumers had knowledge on impact of MPs on human health. However, some fishermen (56.67%) and consumers (43.33%) had no knowledge about the sources of MP. Majority of respondents had given X-press pearl (47.06%) and hotel wastage (29.41%) as the main sources of MP. Moreover, 45% of fishermen had observed plastics attached in gills and gut of fish. Respondents were generally aware that there is a risk of bioaccumulating MP after consuming seafood and apprehension regarding potential hazard to human health. Durability was the main reason for the selection of plastics used by respondents while recyclability played a lesser role. Only 36% of fishermen and 64% of consumers were found to be aware of the methods for reducing MP pollution. Both consumers and fishermen have acknowledged the importance of awareness programs on plastic pollution and its harmful effects, as well as the importance of reducing and recycling plastics in mitigating the issue. Majority of consumers (75%) and a smaller number of fishermen (25%) have actively engaged in environmental initiatives, such as beach clean-ups. All participants display a strong willingness to adopt biodegradable alternatives, emphasizing their commitment to eco-friendly practices. Educational campaigns and media awareness, coupled with stringent policy enforcement and eco-friendly plastic adoption, can mitigate plastic and microplastic pollution, addressing the ongoing issue effectively.

Keywords: Microplastic, Awareness, Fishermen, Consumers, Seafood

(ID 318)

Analysing Plastic Pollution: A Case Study of Coastal Pollution from Inland Urban Waterways in Galle City, Sri Lanka

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Abstract

The coastal stretch of Galle city is currently facing an acute pollution with the aggregation of various types of waste on beaches due to malpractices of the community living around the coastal as well as inland areas of the country. Rivers or canals play a key role in the transport of wastes from source to sea and are estimated to emit around 1 metric ton of plastics into the ocean annually. Mainly five sea outfalls are existing along the Galle coastal zone and those transfer various waste towards the beaches. The present case study aims to identify the coastal pollution caused by inland waterways in Galle municipal council area and to detect the main plastic pollutants flow into coastal zone through inland waterways from month of April to June 2023. The waste trap constructed at the main inland waterway located at Galle municipal council area, the Moda Ela trapped different types of waste and the CCTV camera fixed directing to the above-mentioned canal, captures images, uploaded to a cloud system and feed the data to an Artificial Intelligence model to detect the litter type and their counts which flows along the canal daily and get recorded in the smart plastic litter monitoring web-based system using feature extraction techniques in AI. This smart system has mainly identified the count of plastic fragments, plastic bottles, Styrofoam, and trash bags separately, as the main pollutants of this canal and has interpreted graphically and numerically in the smart system which can be freely accessed. Weights of waste were taken manually. Finally, recorded counts of waste in the smart system emphasis that most abundant causative agent affected on pollution of Moda Ela was plastic bottles (58%) while effect of Styrofoam and trash bags were 34% and 8% respectively. Further, average weight of plastic bottles was recorded highest during the study period (130 kg) when compared to other waste categories. According to the results, plastic bottles have become the main source of pollution comes through inland canals which contribute to coastal pollution. Visual observations further convince that the highest pollution source was Moda Ela while less contribution was from Mahamodara canal. The present study highlights plastics as the main pollutants in inland waterways which effect on coastal pollution. Therefore, it is necessary to identify the polluters and need to implement proper rules and regulations while suggesting any alternatives for plastics.

Keywords: Coastal pollution, Inland waterways, Waste trap, Galle Municipal Council area, Artificial intelligence technology

(ID 283)

Analytical Methods for Extraction of Microplastics from Compost in Sri Lanka**Perera, P.P.P.^{1*}, Liyanage, A.S.², Somasiri, H.P.P.S.³, Mahatantila, K.³, De Zoysa, H.P.E.³**¹*Faculty of Graduate Studies, University of Colombo, Colombo 03, Sri Lanka*²*Department of Chemistry, University of Colombo, Colombo 03, Sri Lanka*³*Industrial Technology Institute, Sri Lanka***pushpikapalpolage@gmail.com***Abstract**

Microplastics (MP) are the plastics with 1 µm-5 mm dimensions. Meanwhile, compost has been identified as a major source of MP in the soil, although compost is a great plant nutrient source, and it provides tremendous benefits for crops. This is primarily ascribed to most of the compost being produced through Municipal Solid Waste Management projects. However, due to the detrimental impacts on soil's biological, physical, and chemical health, together with the high accumulation probability of MP caused by repeated application of compost, regulations should be implemented on the limitation of MP in compost. Even though there are a few different methods available in the literature for MP extraction and quantification in organic matter (OM)-rich matrices, like compost, sludge, and sediments, a properly validated, routine analytical procedure is missing in Sri Lanka Standards (SLS). Therefore, in this project, the effectiveness of four different MP extraction methods in the literature were compared and validated for compost, to implement an MP analysis method suitable for compost specifications in the SLS. The methodologies included MP extraction by density separation using NaCl or ZnCl₂ solutions followed by digestion of OM using 30% KOH:NaOCl solution or Fenton's reagent. The common MP analysis method for the four protocols was staining with the hydrophobic, fluorescent stain Nile Red, and visual observation. Digestion efficiency of OM and spike recovery of Polystyrene (PS), Polyvinyl Chloride (PVC), Polyethylene terephthalate (PET), High-Density Polyethylene (HDPE), and Polypropylene (PP) microplastics in 1-2 mm dimension by the four MP extraction methods were compared for the validation. T-tests (confidence level=95%) were carried out to determine the significant difference between the OM digestion efficiency in each of the four methods. Each of the combinations compared was significantly different from the other except for ZnCl₂/Fenton and NaCl/30% KOH:NaOCl comparison. Meanwhile, the OM removal by ZnCl₂/Fenton and NaCl/30% KOH:NaOCl excluding the density separation step also was not significantly different. The spike recovery analysis showed ZnCl₂/Fenton combination as the best out of the tested combinations with above 95% recovery percentages for PS, PVC, PP and 100 for HDPE and PET by particle count. However, precipitate formations in the ZnCl₂/Fenton combination might cause false negative or positive results for spike recovery when applied to the real samples with smaller MP. The extraction reagents, NaCl was not an ideal solution and ZnCl₂ was a good solution for the MP types used. Moreover, in this project, double digestion of OM with NaCl/30% KOH:NaOCl before and after the density separation with ZnCl₂ is suggested as a novel and more effective OM digestion protocol before Nile Red staining, and further validations are suggested prior to its final implementation.

Keywords: Microplastics, Compost, Extraction, Organic matter

(ID 293)

Zoning, Land Use Management and Nature-Based Solutions in Urban Planning, Where Sri Lanka is Standing

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Abstract

Urbanization rapidly changes the land use pattern in Sri Lanka. Cities are important economic centers and provide opportunities for quality of life. Zoning creates prospering urban planning environments, improves construction permit efficiency, enables agency coordination, and provides widespread participation in urban planning. A comprehensive zoning plan with environmentally conscious zoning contributes to the conservation of natural resources, enhances the ability of climate change adaptation and mitigation, fosters a greener urban environment, and ensures urban sustainability. Nature-based Solutions (NbS) are incorporated by nature; use, or mimic, natural processes to contribute to improvement in given landscapes, small or large scale. Attention to NBS has significantly increased in the recent past and is trying to mainstream NbS into a wide range of policies, and urban planning. This study aimed to explore how zoning and NbS can be incorporated in an urban setting to increase urban resilience in water-born cities. The administrative capital of Sri Lanka, Sri Jayawardhanapura-Kotte was selected due to unique inland urban wetland characteristics and vulnerability to wetland ecosystem due to rapid development in the area. Sri Jayawardhanapura-Kotte is rich with its unique landscape and is a part of Ramsar-Colombo wetlands. The Sri Jayawardhanapura-Kotte Capital City Development Plan (the Plan) 2020 and other relevant national policies were assessed in terms of zoning and application of NbS as a strategy of a sustainable and resilient city. Environmental changes and disaster risk areas were assessed (spatial and temporal changes) utilizing earth observation and GIS techniques, and secondary data were obtained from official records and reports. Sri Jayawardhanapura-Kotte covers 78% of the Greater Colombo flood retention area, and 55% of the area is suitable for flood retention. However, 40% of Colombo wetlands have been lost during the last 30 years due to urbanization. Data shows that most of the wetlands are being filled for infrastructure development, including housing, and it is critically important to conserve remaining wetlands in the area with strict regulations including zoning. The Plan has no signs of incorporating or recognizing NbS in the objectives, strategies, and actions for restoration wetlands, proper zoning system for flood mitigation. Analysed policies lack recognition or incorporation of zoning for environmental conservation and disaster risk reduction. The importance of urban areas for future cannot be underestimate and proper urban planning is a necessity in Sri Lanka for mitigate present anthropogenic climate change impacts ranging but not limited to urban flooding to public health.

Keywords: Urban planning, Zoning, Nature-based Solutions, Resilience, water-born cities

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Rumassala	Mirissa
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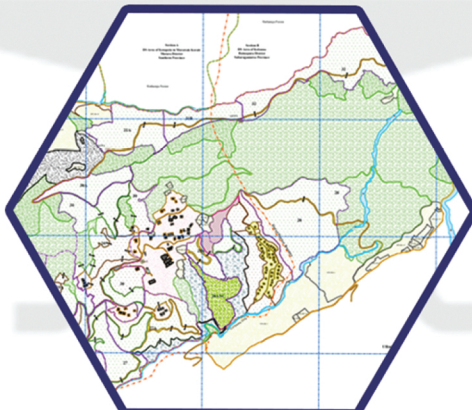
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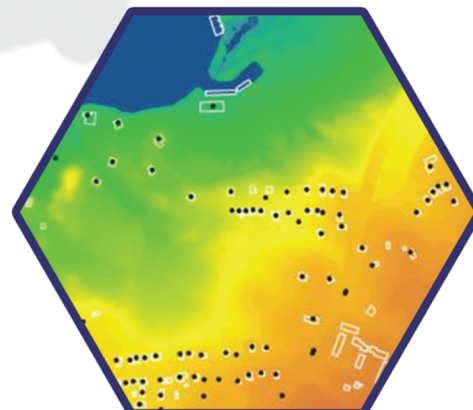
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