TWENTY SEVENTH
INTERNATIONAL
FORESTRY AND
ENVIRONMENT

Symposium
2023

27th and 28th of January 2023
University of Sri Jayewardenepura, Sri Lanka

DFES

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

27th International Forestry and Environment Symposium 2023

27th International

Forestry and Environment Symposium

2023

Economic Resilience and Environmental Sustainability: A Synergy for the Future

Economic Resilience and Environmental Sustainability:

A Synergy for the Future

Proceedings of the International Forestry and Environment Symposium Volume 27 (2023)

27th and 28th of January 2023

University of Sri Jayewardenepura, Sri Lanka

Organised by

The Department of Forestry and Environmental Science

University of Sri Jayewardenepura

PREFACE

The International Forestry and Environment Symposium, organised by the Department of Forestry and Environmental Science, University of Sri Jayewardenepura is recognised as the oldest and most renowned forestry and environment symposium in South Asia, where the researchers, academia, professionals, policy makers, and the industries, annually publish, discuss and learn about the latest developments in forestry and environment sectors.

Since the inaugural event held under the theme of "Forestry for Development", at Coral Gardens Hotel, Hikkaduwa in 1995, throughout the years, the Symposium has received wide recognition among academics and professionals in the forestry and environmental sectors, both Sri Lanka and overseas. Currently, the Symposium is an ideal platform that facilitates connections with well-established research networks, while making outstanding research work visible. Apart from furnishing a platform for sharing latest research outcomes related to forestry and environment sector, the International Forestry and Environment Symposium holds up in making a regional and national impact by sharing knowledge and ideas that covers a wide range of sub disciplines related to the fields of forestry and environmental sciences.

This year, the 27th International Forestry and Environment Symposium is held under the theme of "Economic resilience and environmental sustainability: A synergy for the future" presenting research findings under 12 key areas namely, 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 contain 179 abstracts of scientific studies from both local and international researchers.

The symposium Organising Committee would like to express their sincere gratitude to the stakeholders of this pre-eminent venture for their support in making the event a reality. Further, we extend our gratitude towards all authors, reviewers, participants, and session chair persons, academic and non-academic staff members of the Department of Forestry and Environmental Science and the students for their persevering support in making this event a success.

Symposium Organising Committee
Department of Forestry and Environmental Science
27th January 2023

Message from the Chief Guest
Dr. Nandalal Weerasinghe
Governor, Central Bank of Sri Lanka

To witness the holding of the 27th International Forestry and Environment Symposium 2023, which is organized by the Department of Forestry and Environmental Science of the University of Sri Jayewardenepura under the theme of "Economic Resilience and Environmental Sustainability: A Synergy for the Future", is, for me, a greatly satisfying experience in view of its diversity in the current context.

In most instances, the real value of forests and the environment is not sufficiently identified in economic decision making. The non-market values of these sectors are not recognised in particular, such as the environmental services and livelihood benefits having effects on economic and land-use policies, planning and management practices.

Also, sustainability of forest management has been given a low priority in economic planning. In general, the net result is that, in the face of these disincentives, forests and the environment are more likely to be managed unsustainably, converted, degraded and lost undermining the very goals of socio-economic development itself, i.e., income and employment generation, food security, rural development, poverty alleviation and national economic growth. Hence, sustainable forest and environment management is an integral part in socio-economic development and poverty alleviation of a country.

In this endevour, the Department of Forestry and Environmental Science of the University of Sri Jayewardenepura plays a key role in training and developing professionals who are capable of meeting the dynamisms in the forest and environment management and its contribution towards the economic development of the country. I strongly believe that the Department is able to complete its mission through the commitment of students who have been serving in the different environmental management agencies all over the world.

This Annual Symposium, which is yet another milestone of the Department is recognised as the oldest and most celebrated Forestry and Environment Symposium in South Asia, and the researchers, academia, professionals, policymakers as well as the industry receive the best opportunity learn and deliver the most effective for the development and the management of the forestry and environment. The theme selected for this year's Symposium is very timely as it is expected to deliberate mainly on the sustainability of forestry and environment in view of economic resilience.

My best wishes for every success of the 27th International Forestry and Environment Symposium 2023 and I hope it would portent the beginning of a series of dialogues that will truly be helpful in sustaining forest and economic management in Sri Lanka and its contribution to restoring prospects of economic growth and prosperity of the country.

Dr. P. Nandalal Weerasinghe
Governor
Central Bank of Sri Lanka
27th January 2023

Message from Prof. Upul Subasinghe
Acting Vice Chancellor,
Dean, Faculty of Applied Sciences,
University of Sri Jayewardenepura

I take great pleasure in writing this message for the proceedings of the 27th International Forestry and Environment Symposium 2023 organised by the Department of Forestry and Environmental Science, Faculty of Applied Sciences of the University of Sri Jayewardenepura. As the Acting Vice-Chancellor, Dean of the Faculty of Applied Sciences and as the Former Head of the Department of Forestry and Environmental Science, it gives me great joy to see this conference being organised this year too. I am indeed delighted to see the profound influence this conference has had on the academic and industrial sectors over the last few years.

The University of Sri Jayewardenepura since its inception has been on the quest for discovering and disseminating new knowledge while enhancing the capabilities of its student population. This conference is being organised this year with the timely theme, "Economic Resilience and Environmental Sustainability: A Synergy for the Future". Sustainability has become a topic of interest in the field of forestry and environmental science, and hence research is being carried out on a plethora of related topics. This research symposium supports the endeavour of bridging the gap between economic growth and sustainability and provides a platform for emerging scientists to interact with senior academics and policy makers. It is my hope that the policy makers will consider the key findings included in the proceedings such as green society in the policy making procedures so that all stakeholders may benefit from this knowledge.

I would like to convey my sincere gratitude to the organising committee for their immense dedication to organise this Symposium. On a final note, I would like to wish the participants the best of luck and I am sure that this Symposium will be a great success.

Prof. Upul Subabsinghe
Acting Vice Chancellor
Dean, Faculty of Applied Sciences
University of Sri Jayewardenepura
27th January 2023

Content

Biodiversity Conservation and Management

vii

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, Wood and Non Wood Indstry

Environmental Engineering and Green Technology

Geology, Soil and Water Resource Management

Citizen Science Forum

Poster Session

The Impact of Climate on Food Security

Sharan V.

Representative, Sri Lanka and the Maldives
Food and Agriculture Organization of the United Nations

Climate change affects all aspects of food security: availability, accessibility, utilization, and food systems stability. This in turn will have an impact on human health, livelihoods, food production and distribution channels, as well as changing purchasing power and market flows with negative effects on national and global economies. The consensus is that due to global warming, there will be a northward shift in thermal regimes that will open up large tracts of potentially fertile land in the higher latitudes, which are presently experiencing short growing seasons for extensive crop cultivation. The downside is that it could reduce rainfall and shorten growing seasons in the tropics and subtropics to less than the minimum 120 days required by most cereals. Parts of Africa and Asia will face losses of arable land, increased water stress and falling cereal yields leading to increased poverty and malnutrition. Yet one uncertainty in climate modelling is the possible interactions between gradual and abrupt changes, as it is also associated with changes in climate variability (e.g. more erratic rainfall), and changes in the frequency and magnitude of extreme weather events (more droughts or floods). These abrupt changes are important for food security and will have a significant global impact given the acute sensitivity of agriculture to perturbations in the weather.

The National Adaptation Plan process as well as the National Determined Contributions set up under the UNFCCC provides the opportunity to integrate food security as a key objective and pave the way to obtain regional and international support. As the entire food system is a source of greenhouse gas emissions, incentives are required to persuade crop and livestock producers, agro-industries and ecosystem managers to adopt good practices for mitigating climate change. Promoting Climate-smart agriculture aimed at identifying and implementing changes in practices, policies and institutions are required to address both adaptation and mitigation measures. Healthy, diversified forest ecosystems are more resilient to climate change and therefore restoring degraded forests is a major strategy for increasing resilience

As the Food and Agriculture Organization of the United Nations (FAO), the ultimate goal of FAO's climate change work is to inform and promote dialogue on the impacts of climate change and existing options for reducing vulnerability, and to provide site-specific solutions. FAO will play a leading role in transforming Sri Lanka's agrifood systems to make them more efficient, inclusive, sustainable, and resilient.

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

1

(17)

Endophytic Bacteria and Fungi as the Bio Controlling Agents against the Pathogens of Common Diseases in Sri Lankan Rubber Plantations

Fernando T.H.P.S.[*], Aberathne A.H.M.N.R., Mallikaarachchi D.A.N.

Department of Plant Pathology and Microbiology, Rubber Research Institute, Agalawatta, Sri Lanka
*sarojinifernando787@gmail.com

Abstract

Natural rubber (*Hevea brasiliensis*) plantation industry plays a major role in the economy of Sri Lanka. However, latex production of rubber plantations can be reduced due to many biotic and abiotic reasons such as seasonal changes, nutrient deficiencies and diseases. Among them, diseases play a significant role. *H. brasiliensis* can be affected by a wide range of leaf, stem and root diseases which are mainly caused by fungal pathogens. Among them, Corynespora Leaf Fall Disease caused by *Corynespora cassiicola*, Phytophthora Leaf Fall disease caused by *Phytophthora* spp., Colletotrichum Leaf Disease caused by *Colletotrichum* spp., White Root Disease caused by *Rigidoporus microporus*, Brown Root Disease caused by *Phellinus noxius* cause significant reduction of rubber yields reducing the income of the growers. Management of these economically important diseases is mainly done using the resistant rubber clones. Chemical controlling is also considered as the most popular method for disease control. Other than using the recommended level of chemical fungicides, usage of bio controlling agents are important for the integrated pest management strategies to make the process eco-friendly. This attempt was taken to select the effective antagonists to control the pathogens of major rubber diseases. Pathogens were selected from the culture collection of Plant Pathology and Microbiology Department, Rubber Research Institute of Sri Lanka. One bacteria and two fungi labeled as AKB1, AKF1 and AKF2 respectively were isolated from healthy leaves in severely affected rubber plantations. Pure cultures of each isolate were obtained. Inhibition of the growth of test pathogens against each bio controlling agent was tested on Potato Dextrose Agar using the direct opposition method. Percentage inhibition was calculated. More than 60% inhibition was shown by AKF1 against *Phytophthora* spp, *P. noxius* and *R. microporus*. And also, AKF2 showed 64.21% inhibition against *R. microporus*. Study of bio controlling agents are critical for the formulation of bio pesticides which will lead to reduce the usage of chemical fungicides and thereby reducing the economical and environmental impacts. The highly effective antagonists; AKF1 and AKF2 were selected and multiplied in artificial media and will be tested under field conditions for the effective management of the diseases.

Keywords: Endophytic bacteria, Endophytic fungi, Natural rubber, Common pathogens

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

2

(26)

Carbon Mineralization in Tropical Montane Forests Soils in Sri Lanka

Jayamali M.M.S.T.[1*], Herath H.M.S.K.[1], Samarakoon S.M.T.N.[2], Chandrajith R.L.R.[2], De Costa W.A.J.M.[3]

[1]*Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka*
[2]*Department of Geology, University of Peradeniya, Peradeniya, Sri Lanka*
[3]*Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka*
*sachinithisara100@gmail.com

Abstract

The change of soil carbon (C) mineralization of tropical montane forests (TMFs) across elevation remains unclear. The objective of the present study was to determine the variation of soil C mineralization along an elevation gradient in TMFs in Sri Lanka. Soil samples were collected from four permanent sampling plots (PSPs): 1042 (Sinharaja-Enasalwatte-1/ENS_1), 1065 (Sinharaja-Enasalwatte-2/ENS_2), 2080 (Pidurutalagala/PTG) and 2132 m asl (Horton Plains/HNP). Each sampling plot was 1 ha in size and 17 near-surface representative soil samples were collected up to 0.25 m depth. Four replicates from each PSP were used for the study. Evolution of CO_2 was measured in a 60-day soil laboratory incubation study by trapping in 1 N NaOH and titrating a 20 mL aliquot with a standardized 1 N HCl. An average temperature of ~25° C was maintained throughout experiment. Basic soil physico-chemical properties (pH, electrical conductivity (EC), redox potential (Eh), cation exchange capacity (CEC), organic carbon (OC) content, volumetric water content (VWC), bulk density and porosity) were determined. All data were subjected to analysis of variance (one way ANOVA) at 95% confident level and mean separation was conducted following Tukey's Test. Results showed a significant ($P<0.05$) effect of elevation on the CO_2 emission rate, cumulative CO_2 emission and, above mentioned soil properties. The highest and the lowest average CO_2 emission rates; 67.6±9.7 and 28.8±2.2 mg C kg^{-1} soil day^{-1}, respectively, were determined in PTG and ENS_1. PTG showed the highest cumulative CO_2 emission (4,071 mg C kg^{-1} soil), followed by HNP, ENS_2 and ENS_1: 3,799, 2,091 and 1,733 mg C kg^{-1} soil, respectively. In mean comparison between cumulative CO_2 emission and elevation, upper montane (above 2080 m) forests (PTG, HNP) and lower montane (1042–1668 m) forests (ENS_1, ENS_2) were distinctly separated into two different groups. We found a significant ($P<0.05$) positive correlation between cumulative CO_2 emission and pH, EC, soil porosity, CEC and soil OC content. The cumulative CO_2 emission had a significant ($P<0.05$) negative correlation with bulk density. In conclusion, the soil physicochemical properties of selected PSPs also showed variation across the elevational gradient. The present findings suggested that the attitudinal variation of CO_2 evolution is partially supported by the variation of physicochemical properties of selected TMFs. But further studies are required to confirm the relationship between CO_2 evolution and soil physicochemical properties of the TMFs studied.

Keywords: Incubation, Elevation, CO_2 emission, Horton Plains, Sinharaja, Enasalwatte, Piduruthalagala

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

3

(66)

Importance of Leaf Micro Morphological Trait Combinations of Trees to Capture Atmospheric PM10.5 and PM2.5: A Study on 11 Selected Tropical Roadside Tree Species in Colombo, Sri Lanka

Abeysinghe S.T.D.R.[*], Bandara W.A.R.T.W

Department of Zoology and Environmental Management, University of Kelaniya, Kelaniya, Sri Lanka
*teharasapna@gmailcom

Abstract

Roadside trees can increase the surface roughness of the ground and reduce wind speeds and provide considerable amount of time for pollutants like Particulate Matter (PM) to be blocked and filtered. This study was designed with the objective of understanding the most effective tree species to accumulate outdoor atmospheric PM10.5 and PM2.5. As a specific objective of the study, which is to understand this phenomenon in a tropical urban setting, 11 street tree species which are frequently distributed in roadsides of Colombo Municipal Council, Sri Lanka were selected; *Tectona grandis* (Teak), *Cassia fistula* (Ehala), *Terminalia catappa* (Kottamba), *Polyalthia longifolia* (False Ashoka), *Plumeria obtusa* (Araliya), *Madhuca longifolia* (Mee), *Ficus benjamina var.benjamina* (Walu Nuga), *Mangifera indica* (Mango), *Pongamia pinnata* (Karanda), *Ficus religiosa* (Bo), and *Acacia pycnantha* (Acacia). The study was conducted in two sites as Beddagana wetland forest; the least polluted site and busy roadsides of Sri Jayawardenepura Kotte, Kolonnawa and Colombo Municipal Council; the highly polluted site. PM10.5 and PM2.5 trapped on both surface and wax layer of leaves were measured using a gravimetric method. Leaf micro morphological traits were identified and their abundance were analyzed using Scanning Electron Microscope (SEM) images of the leaves. Standard MANOVA was followed to identify the relationship among each morphological trait and the PM amount. High PM values were recorded in polluted site. According to the study results it can be concluded that leaf size and leaf shape were the major determinants of capturing PM from the atmosphere. Compared to the other traits considered, only leaf size showed negative correlation with the capturing of both PM10.5 and PM2.5. Although trichomes, hairs, epi-cuticular waxes and texture of leaves showed positive relationship it can be concluded that they are not crucial properties in immobilizing PM in leaves.

Keywords: PM10.5, PM2.5, Leaf micro morphological traits, SEM images

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

4

(77)

Screening of Fungicides on the Management of Circular Leaf Spot Disease of Rubber

Silva M.K.R.*, Fernando T.H.P.S., Aberathne A.H.M.N.R.

Department of Plant Pathology and Microbiology, Rubber Research Institute, Agalawatta, Sri Lanka
*mkeshanisilva@gmail.com

Abstract

Since the first report in Sri Lanka in 2019, the Circular Leaf Spot Disease of rubber; caused by two fungi, *Colletotrichum* species and *Pestalotiopsis* species reached the epidemic level within several months. With the objective of determining the efficacy of fungicide/ fungicide combinations for the management of the disease, nine fungicide combinations were tested under polybag conditions as 40 polybag plants in each treatment. The fungicides were selected based on the results of the preliminary *in vitro* experiment. The systemic fungicides carbendazim and hexaconazole and the contact fungicide, mancozeb were tested in different combinations and in different concentrations. In order to evaluate the preventive action of the fungicides, the application of the respective fungicide was initiated prior to the appearance of disease lesions i.e. just after the dispatch of polybag plants from the nursery. Then the respective fungicide treatment was applied in seven-day intervals using a hand sprayer as to achieve an even foliar coverage of the plants under the treatment. The polybags plants were kept under a rubber field severely attacked with the disease, as to ensure even exposure to environmental conditions and with the objective of exposure to a natural inoculation. After a period of two months of establishment, the lesion percentage (LP) of each treatment was calculated by counting the number of leaflets with disease lesions and the total number of leaflets in the plants of the respective treatment. Analysis of variance for the LP values of the different treatments was carried out using SAS and subsequently, mean separation was carried out with Duncan's Multiple Range Test. The five treatments with (1) 3 g/l carbendazim and 3 g/l mancozeb alternatively, (2) 5 g/l carbendazim, (3) 4 g/l carbendazim, (4) 4 g/l carbendazim and 4 g/l hexaconazole alternatively and (5) 3 g/l carbendazim and 3 g/l hexaconazole alternatively gave significantly lower LP than the other treatments (P>0.001). The treatment with 3g/l carbendazim and 3 g/l mancozeb alternatively gave the lowest LP of the value of 8.426 and however, a non-significant variation existed between those five treatments (P>0.001). The two treatments 3 g/l carbendazim and 4 g/l hexaconazole resulted in moderate LP values of 40.939 and 40.203 respectively, whereas hexaconazole at the concentrations of 3 g/l and 5 g/l gave non-significant LP values compared to the control (P>0.001).

Keywords: Circular Leaf Spot Disease, Screening of fungicides, Polybag nursery

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

5

(84)

Does Community Forest (CF) Program able to Reduce Rural Poverty in the Central Dry Zone (CDZ) in the Transition of Rural Livelihood in Myanmar?

Thiri H.M.M.[1*], Ichikawa M.[2]

[1]The United Graduate School of Agricultural Sciences, Ehime University, Japan
[2]Faculty of Regional Collaboration, Kochi University, Japan
*thirihmwe.thiri@gmail.com

Abstract

The Community Forest (CF) Program was established in Myanmar in 1995 to reduce deforestation and address rural poverty. The Central Dry Zone (CDZ) is occupied 43% of the total CF area in Myanmar, while the diversification of rural livelihood is a common phenomenon due to unfavorable climatic conditions. The research was conducted in Nint Kyat Khwe village, located in the Mandalay region, where farm activities are one of the major livelihoods. This research aimed to examine the livelihood strategies of CF members and non-CF members and to explore the implication of CF on people's livelihood strategies in the transition of rural livelihood portfolios. A total of 189 households were surveyed. Three focus group discussions and two key informant interviews were conducted from February to March 2022 to collect sources of income, credit availabilities, demographic data, and five livelihood assets of households. For statistical analysis, a t-test was used to compare livelihood strategies, sources of income, and five livelihood assets between CF members and non-CF members. Then multilinear regression was used to examine the relationship between the diversification of non-farm activities of households and the livelihood asset of households. The livelihood diversification of local people was analyzed through sources of household income. The result found seven sources of income: dry land agriculture, small-scale livestock, toddy palm sugar production, casual labor (farm and non-farm), small business, non-farm employment, and remittance. Then, occupational diversity was classed as farm (agriculture, livestock), off-farm (toddy palm sugar production, casual farm labor), and non-farm (remittance, small business, non-farm employment). By applying the t-test, 58% of non-CF members pursued non-farm activities, while 34% of CF members undertook it at $p<0.01$. Farms contribute 44% of CF members' total gross household income, while farm income is contributed to 37% of non-CF member households' total income at $p<0.05$. Then, non-farm activities pursued by CF member households (0.5 ± 0.8) are significantly lower than the non-CF member (1.0 ± 1.0) at $p<0.05$. The relationship between livelihood assets and non-farm livelihood diversification was analyzed by multilinear regression. Natural assets of households have a negative relationship with non-farm livelihood diversification, while social and human assets have a positive relationship with livelihood diversification. Although CF could not provide immediate benefits from the forest to local people's livelihood, it provided secure land tenure and cultivation land for its members, thereby increasing the natural asset of CF members. The increased education and social networking extend to enable higher income generating of non-agricultural opportunities for local people. In conclusion, CF members are less diversified than non-CF members due to limited livelihood assets. Diversifying into non-farm activities is a coping strategy for rural people with better education and social networks in CDZ. Thus, CF is essential for the livelihood of the agricultural land-less vulnerable family who cannot access higher-income generating non-farm activities.

Keywords: Livelihood diversification, Migration, Community forest, Livelihood assets

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

6

(86)

Wetland Degradation and Impacts on Ecosystem Services: A Case Study from Bellanwila-Attidiya Wetland and Boralesgamuwa Lake in Colombo District

Ranasinghe R.R.[1]*, Wickramasinghe D.D.[1], Maltby E.[2], Witharana A[1], Dharmarathne G.[3]

[1]*Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*
[2]*School of Environment Sciences, University of Liverpool, United Kingdom*
[3]*Department of Statistics, University of Colombo, Colombo 03, Sri Lanka*
*rasadarii96@gmail.com

Abstract

Wetlands are productive ecosystems and provide valuable Ecosystem services (ES) to society. They provide fresh water, flowers, fisheries, fuel, educational value, recreational value, tourism, and mental relaxation. Urban wetlands are increasingly threatened by human activities impacting their quality and quantity. Alterations in the structure and function of wetlands can affect their ability to provide ecosystem services. Against this background, the current study investigated the effects of Land Use and Land Cover (LULC) changes on ESs in the Bellanwila-Attidiya (BA) wetland and Boralesgamuwa Lake, two significant ecosystems of the Colombo wetland network. This study examined the LULC of BA wetland and Boralesgamuwa Lake and their surroundings over two decades, from 2000 to 2020, using remote sensing and the Geographical Information System (GIS). Questionnaire surveys with 100 local residents and six national experts with research experiences with regard to wetlands were performed to asses ESs, which were analyzed using Principal Component Analysis. The results revealed the drastic transformation of natural areas into other land uses in the wetlands. In BA wetland and surroundings, settlements have expanded by 3.73% at the expense of paddy fields and open areas that have reduced by 3.94% and 0.65% respectively. Similarly, the provision of ESs has been changed, which was identified through statistically analyzed communities' perceptions of ESs of wetlands. The results indicated that provisioning services (freshwater, fisheries, fiber, and medicine) and cultural services (aesthetic, recreational, and religious values) have significantly changed over time. Clear trends of changes in LULC could be observed within the Boralesgamuwa Lake and its surroundings as well, where the extent of water bodies and open areas has increased by 22.41% and 5.51%, respectively, at the expense of vegetation and paddy fields, which have decreased by 27.18% and 1.05%, respectively. Similarly, the delivery of ESs has been affected over the years in response to public perception. Statistical analysis of public responses indicated that the provisioning of food, fresh water, fiber, fisheries, and aesthetic and historical values have significantly changed in Boralesagmuwa Lake over time. This study, where public perception was a major concern, clarifies the relationship between land use and ESs and emphasizes the importance of getting community input for wetland conservation and management initiatives.

Keywords: Urban wetlands, Land use and land cover change, Ecosystem services, GIS, Public perception

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

7

(91)

Analyzing Practices of People on Drought Adaptation Strategies in the Dry Zone of Sri Lanka

Bandara K.M.S.M.*, Dias R.A., Dissanayake H.P.P.M.

Department of Environmental Management, Rajarata University, Mihintale, Sri Lanka
*shanikarjt36@gmail.com

Abstract

Drought is one of the severe natural hazards described as a period of below-average precipitation in a certain area, leading to long-term water shortages. This is a problem exacerbated by climate change, which leads to harm to agricultural subsistence and the livelihood of the people. As this disaster is a major issue in the 21st century it poses large-scale issues for humans from every perspective. In the Sri Lankan context, this situation has increased in the present period especially in the dry zone in a high manner. With this sort of background, this study was done to analyze the practices of people on drought adaptation strategies in the Dry Zone of Sri Lanka. This study was carried out in a literature survey based on previously published articles, journals, proceedings and other publications to find out the most common drought impact in the dry zone of Sri Lanka and the practices of people on drought adaptation strategies in the dry zone of Sri Lanka. According to the literature survey, in the dry zone of Sri Lanka, the most common impacts of the drought were recognized in three sections Environmental impacts, Economic impacts and Social impacts. The most common Environmental impacts were recognized as an increase in average temperature, dry flora, a decline in surface water and groundwater and less soil fertility. Less-income families are one of the most common economic impacts of drought followed by fewer savings and economic benefits. The most common social impacts can be seen as, conflicts related to water, changes in lifestyle, and less food security. Farmers are using different adaptation strategies to mitigate the impacts of drought over 1000 years as the Dry zone in Sri Lanka is a water deficiency area and paddy cultivation could be highly vulnerable to climate change. The most used drought adaptation strategies by people are harvest storage, paddy cultivation, bethma practising, paddy monoculture, agro well usage and preserving food and seeds. Referring to the perception people of drought adaptation strategies in the dry zone of Sri Lanka 57% of people have started to use the Chena cultivation method instead of the paddy cultivation method for the sake of the uncertainty and understanding the shortage of rainfall in the area especially in Yala season compared to Maha Season. Most people have reduced their dependence on rice as the growth of the paddy is affected by the drought. Farmers have started growing less susceptible crops to the drought as they are aware of the less cultivation due to the drought and have started installing various types of rainwater harvesting in each house. At present people in the dry zone prefers to use less water consumption agriculture, alternative crops and cropping of drought-resistant varieties.

Keywords: Drought, Practices, Strategies, Impacts, Dry zone

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

8

(100)

Variation of Oil Yield in Compared to Application of Different Types of Fertilizer to Mature Oil Palm in WL2a Agro Ecological Zone of Sri Lanka

Bulugahapitiya H.[1]*, Palihakkara I. R.[1], Balasuriya A.[2]

[1]*Department of Crop Science, University of Ruhuna, Matara, Sri Lanka*
[2]*"Abhaya", Kamburupitiya, Sri Lanka*

Abstract

The productivity of oil palm highly depends on the availability of macro and micro nutrients. Any failure in the supply of these nutrients badly affects, initially the vegetative growth and then the quantity and quality of final yield. An experiment was initiated at Talgaswella Estate of Elpitiya Plantations PLC., in the Low Country Wet Zone of Sri Lanka, to investigate the possibility of improving marginal oil palm plantations to a more productive and profitable status in 2019. A ten-year-old oil palm field was selected for the experiment. Study was designed in a randomized complete block design with eleven treatments in three replicates, including an absolute control. Each trial plot contained six palm trees totaling 198 numbers of trees. Treatments included different quantities of Empty Fruit Bunches (EFB), Palm Oil Mill Effluent (POME) and Poultry Litter (PL), with and without chemical fertilizer. Yield parameters and oil content were recorded and data were analyzed using Minitab statistical tool. For the period of two years of the trial, yield data is showing continued increment in 100% organic fertilizer treated plots (T_{11}) when compared with 100% chemical fertilizer treated plots (T_2). The treatment, T_{11} has generated significantly higher palm oil yield when compared to (T_2) and 50% chemical and 50% organic fertilized combination (T_5). This clearly indicates that the application of organic fertilizer to the oil palm cultivation can assure better oil yield. Therefore, it is recommended that periodical application of organic fertilizer, especially on marginal oil palm lands can increase the overall productivity of the crop and oil yield.

Keywords: Oil Palm, Poultry litter, Palm oil mill effluent, Empty fruit bunches

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

9

(111)

Distributional Ecology of Filmy Ferns and Grammitid Ferns of Sri Lanka: The Most Sensitive Ferns Species for Changing Climate

Kumarasinghe P.G.S.A.[1*], Janaranjana U.G.T.N.[1], Ranil R.H.G.[2], Gunawardena G.M.W.W.L.[3]

[1]*Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka*
[2]*Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka*
[3]*Department of Town and Country Planning, University of Moratuwa, Moratuwa, Sri Lanka*
*subhashiamallka@gmail.com

Abstract

The filmy ferns (family Hymenophyllaceae) and grammitid ferns (family Polypodiaceae) are generally considered the most sensitive ferns to changing climate. The family Hymenophyllaceae is characterized by its translucent fronds with mostly one or a few cell thicknesses. The grammitid ferns were earlier treated as a separate family, the Grmmitidaceae, and with the recent molecular work, they were nested within the family Polypodiaceae. Both families are mostly epiphytic or rupestral, but very rarely present in terrestrial habitats. Sri Lanka harbours 20 species of filmy ferns, including one endemic, and 22 species of grammitid ferns with eight endemics. Most species are confined to humid and shady environments in the rainforest ecosystems of Sri Lanka. Though both families are rich in information on their phylogeny, details are not available on their distributional ecology, conservation biology, population dynamics, environmental services, and reproductive biology on both regional and global scales. This study aimed to understand their distributional ecology in Sri Lanka by analyzing past records over the last one and a half centuries. The handbook to the Flora of Ceylon (Volume 15A and 15B) was used as a base document and collector's information, date of collection, locality of each specimen, and deposited herbaria were studied referring to 752 specimens deposited at 22 worldwide herbaria. The distribution maps were prepared using QGIS software. The results revealed that except for Ritigala Strict Nature Reserve, all other specimens have been collected from the intermediate and wet zones of Sri Lanka. According to distribution maps, these species have been recorded from 13 administrative districts, with the highest number of species recorded in Nuwara-Eliya (59.5%), Kandy (59.5%), and Rathnapura (50%) districts. The central province can be considered the most sensitive area for filmy ferns and grammitid ferns. *Crepidomanes kurzii* and *Prosaptia ceylanica* show restricted distribution patterns and are confined to two single known localities in Kandy and Matara districts, respectively. Furthermore, *P. ceylanica* is only known for its type locality in the Matara district. *Abrodictyum obscurum* is the only terrestrial species in both families and it is mostly confined to streamside banks of lowland rainforests. Out of the 42 species studied in both families, 9 and 2 species are treated as critically endangered and possibly extinct species, respectively. The study emphasizes that an island-wide survey is urgently needed to further validate the outcome of the present study. It also provides useful information for setting future conservation and management guidelines for this unique group of plants.

Keywords: Distributional ecology, Mapping, Pteridophytes, Filmy ferns, Grammitid ferns

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

10

(112)

A Situational Analysis of Critically Endangered (Possibly Extinct) Plant Species in Sri Lanka

Janaranjana U.G.T.N.[1]*, Kumarasinghe P.G.S.A.[1], Ranil R.H.G.[2], Gunawaedhena G.M.W.W.L.[3]

[1]*Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka*
[2]*Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka*
[3]*Department of Town and Country Planning, University of Moratuwa, Moratuwa Sri Lanka*
*thanushiu.g.13@gmail.com

Abstract

Sri Lankan flora and fauna are significant on both global and regional scales due to its rich diversity, high endemicity, and unique position in the Indian Ocean. The island flora has a greater risk of extinction than the mainland population. The Critically Endangered (Possibly Extinct) [CR (PE)] plant species are those that are likely to be extinct and yet those have little possibility for rediscovering. The National Red List (2020) reports 137 CR (PE) plant species including 55 endemics (48%) in 47 families. The aim of this study was to analyze the current status and future prospects of CR (PE) plant species using past records while assessing their distributional pattern. The National Red List-2020 was used as a base document. The Flora of Ceylon (Volumes: 1-15) was used to extract the information on the locality, date, collector, and herbarium of each species. The QGIS software was used to map out the geographical distribution pattern of candidate species. The probable areas for the occurrence of selected species were identified. Results revealed that out of 321 specimens deposited in 16 worldwide herbaria, the National Herbarium, Peradeniya (PDA), Kew Herbarium, London (K), and Natural History Museum, London (BM) are holding 221 (69%), 126 (39%) and 41 (12%) specimens of CR (PE) plant species, respectively. Out of the 47 families assessed, the highest number of CR (PE) species was recorded from the family Poaceae (15 spp.) including 7 endemics. Though species show scattered distribution pattern across the island, approximately 77 species including 31 endemic (58%) have been confined to the wet zone of Sri Lanka. It is further identified that the central highland and southwest of Sri Lanka as hotspots for CR (PE) plant species in Sri Lanka. The distribution map shows that species are scattered within 19 administrative districts of Sri Lanka. Of which, NuwaraEliya (20%) and Kandy (29%) districts are the priority and most sensitive areas for the occurrence of CR (PE) species. It is further revealed that 79 species including 28 endemics (59%) have been confined to a single locality. This analysis would lead to a clear understanding of the possible area for new localities of CR (PE) plant species in Sri Lanka, which could be useful for the rediscovery and conservation of these species.

Keywords: Biodiversity conservation, Geographically distribution, Climatic factors, Extinction, Endemicity

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

11

(155)

Public Perception on Ecosystem Services: Threats of Pilikuththuwa Cave Forest in Sri Lanka

Jayarathna H.D.S.C.[1]*, Wickramasinghe D.D.[1], Woroniecki S.[2]

[1]*Department of Zoology and Environment Science, University of Colombo, Colombo, Sri Lanka*
[2]*Department of Thematic Studies, Linkoping University, Sweden*
*shermilaresearch@gmail.com

Abstract

Ecosystem Services are delivered freely by ecosystems and support both the environment and humankind. This research explored the ecosystem services of the Pilikuththuwa Cave Forest in the Gampaha District, where human pressure is increasingly evident. To assess the perception of ecosystem services and threats from 2000 to 2020, a questionnaire survey was conducted with 75 households. The main findings revealed that respondents only perceived cultural (52%), provisioning (40%), and support services (8%) from the forest. Cultural service ranks the highest (10.07%), which includes recreation, aesthetic beauty, and education. Fresh air (13.12%), freshwater (12.86%), and medicinal plants (12.41%) were identified as the most prominent current provisioning services. Nutrient recycling (49.83%) and soil formation (50.17%) were the current supportive services perceived by the respondents. The study revealed that provisioning and supporting services have decreased while cultural services have increased over the two decades. Since the Pilikuthtuwa forest is an unprotected area, it is threatened highly by encroachment (12.81%), habitat changes in the vicinity (13.30%), climate change (13.09%), and reduction of forest cover (12.66%). The relevant policymakers, with the involvement of the stakeholder community, may use these results to develop strategies to conserve, manage, and restore the Pilikuththuwa forest.

Keywords: Ecosystem services, Forest, Public perception, Threats

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

12

(167)

Selection of Plus Trees, Growth Attributes and Biomass Estimation of *Melia dubia* Genetic Resources

Akhilraj T.M. [1*], Parthiban K.T. [2], Kambli S.S. [3]

[1]*Department of Silviculture and Agroforestry, College of Forestry, University of Agricultural Sciences, Dharwad, India*
[2]*Department of Agroforestry, Forest College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, India*
[3]*Karnataka Forest Department, Bengaluru, India*
*akhil.rajtm@gmail.com

Abstract

Forest plantations are generally raised through seed-based seedlings which resulted in wider variability, contributing to uncertain and unproductive yield. This necessitated establishment of strong research and development mechanism to identify and develop high yielding and short rotation varieties. The present study is about *Melia dubia* Cav., a member of Meliaceae family. It's a multipurpose agroforestry tree used for pulpwood, timber, fuel wood, fodder, plywood and afforestation purposes. *M. dubia* plantation was raised during January, 2010 under National Agriculture Innovation Project at Forest College and Research Institute, Mettupalayam, Tamil Nadu. Selection of superior genetic resources was carried out in the year 2016 by comparison tree method. The objective of selection programme is to obtain significant amounts of genetic gain as quickly and inexpensively as possible, while at the same time maintaining a broad genetic base to ensure future gains. A total of 46 candidate plus trees (CPT) were identified from the plantation based on morphometric traits viz., tree height, basal diameter, girth at breast height (GBH), texture of bark, bole straightness and free from pest and disease through check tree method. Score was given for each character and the trees which showed greater performance than the mean were selected. Further screening has been done and thirty plus trees have been finally screened for biomass estimation through destructive analysis. The plus trees exhibited good variability in terms of growth attributes. The basal girth of plus tree ranged from 48 cm (MTPMD 10) to 122 cm (MTPMD 1). The GBH of the plus tree ranged between 44 cm (MTPMD 10, MTPMD 36) and 85 cm (MTPMD 1). Similarly, the height of plus tree ranged between 12 m (MTPMD 7 and MTPMD 8) and 17.5 m (MTPMD 9). Total biomass ranges from 97 kg (MTPMD 30) to 545 kg (MTPMD 1). Stem weight, branch weight and leaf weight also vary between the genetic resources. This selection and subsequent progeny trial of selected plus trees are a base for genetic improvement. This study is essential for successful breeding program and will help in development of varieties with superior quality and high biomass to meet the present and future industrial demands.

Keywords: Plus tree selection, *Melia dubia*, Genetic improvement, Comparison tree method, Biomass estimation

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

13

(170)

Gene-wide Diversity of Two Personality-Related Genes (DRD4 and SERT) in Urban and Rural Populations of House Swallows across Sri Lanka to South Pacific Indicates a Possible Demographic Expansion or Local Selection in Rural Populations

Jayasinghe G.D.[1], Myers B.M.[2], De Silva C.[1], Thakshila T.[1], Scordato E.S.C.[2], Seneviratne S.S.[1*]

[1]*Avian Sciences and Conservation, Department of Zoology and Environment Sciences, University of Colombo, Colombo, Sri Lanka*
[2]*Department of Biological Sciences, California State Polytechnic University, Pomona, CA, USA*
*sam@sci.cmb.ac.lk

Abstract

Urbanization-related environmental and landscape changes often negatively impact biodiversity, primarily due to habitat loss and fragmentation, forcing wildlife to migrate to new habitats. Nevertheless, urban exploiters and urban adapters seem to thrive in urban environments. Behavioral plasticity might play a role in their successful urban adaptations. However, the mechanisms of how these behavioral variations are produced and maintained at the genetic level are not well understood. Neurotransmitter-related genes DRD4 and SERT have been associated with several behaviors that might play a role in urban adaptations. House swallow superspecies complex that includes Hill swallows (*H. domicola*), Pacific swallows (*H. tahitica*), and Welcome swallows (*H. neoxena*), is an example of urban adapters that have increasingly been observed to be nesting on artificial structures. In this study, the genetic diversity of DRD4 (9.06 kb) and SERT (21.1 kb) genes were assessed in 12 House swallow populations in a wide geographic range from Sri Lanka to Oceanic Southeast Asia, Australia, and Fiji Islands. The proportion of heterozygote sites for each population was significantly higher ($P<0.01$) in urban populations for both genes. Multi-locus heterozygosity (MLH) did not show similar patterns in the SERT gene, with no significant difference. However, a significant difference could be observed in DRD4 when the Sri Lankan population was excluded from the analysis. The Hill swallow population in Sri Lanka showed extremely low heterozygosity in the DRD4 region compared to the rest of the populations, which was not evident in the SERT region. The Sri Lankan population also had the highest number of private alleles and the highest proportion of minor alleles in both genes. More rural, Queensland, and West Australia populations (for DRD4), and Queensland, West Australia New South Wales, and Tasmania populations (for SERT) showed significantly negative Tajima's D values indicating expansion after a bottleneck or a selective sweep. The Sri Lankan population indicated a population contraction or a balancing selection scenario with a significantly positive Tajima's D value in SERT. Higher genetic diversity in urban populations and negative Tajima's D values in rural populations might suggest a demographic expansion in the lower levels of urbanization gradient with the introduction to anthropogenic resources. However, different patterns of diversity and neutrality estimates in the two genes suggest that they may be impacted by more local evolutionary processes in the genome, like adaptation through a selective sweep or balancing selection, rather than by broader demographic changes in the populations.

Keywords: Animal behavior, Fitness indicators, Local adaptation, Personality genes, Urbanization

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

14

(176)

Effects on Soil Nutrients from Intercropping of Immature Oil Palm (*Elaeis guineensis*) with Banana, Ginger and Turmeric in the Galle District, Sri Lanka

Dissanayake S.M.*, Palihakkara I.R.

Department of Crop Science, University of Ruhuna, Matara, Sri Lanka
*dissanayake857@gmail.com

Abstract

Oil palm (*Elaeis guineensis*) is identified as the world's leading edible oil producing plant and is well established as a perennial plantation crop in tropical countries. Oil palm has spread over 10,000 hectares in the wet zone of the Island. This crop is one of the most important economic and forth major plantation crops in Sri Lanka. Oil Palm is vertically growing perennial crop attains a height of about 20 to 30 meters with economic life of 35 years. It is planted on wider space and under good management it takes three years to utilize entire inter space. Since it is vertically growing perennial crop, there is ample scope for raising intercrops in oil palm plantations during the initial 3-4 years. In immature plantations, land productivity can be sustainably increased with some selected intercrops. Oil Palm is very much sensitive for chemical fertilizer and therefore it is essential periodic application of recommended dose. During intercrop, fertilizer need to be given to those intercrops also as per the recommendation of Department of Agriculture, Sri Lanka. A field experiment is being conducted at Thalgaswella estate (6° 24' 60" N, 80° 27' 44" E. 48 m above sea level, WL2a) in Galle district to investigate the suitability of different intercrops during the immature phase of oil palm. Banana, Ginger and Turmeric were selected as intercrops. The experiment was designed with Randomized Complete Block Design (RCBD) with four treatments, including three replicates and a control. Statistical package used is SAS software. Soil chemical parameters were measured annually for pH, Organic Carbon (OC), Phosphorus (P) and Potassium (K) by using page, A.L., 1982 method. There was a positive variance in soil K in the intercrop plots against the monocrop plots in the first year of this experiment. Intercropped Turmeric, Ginger and Banana has shown soil K 92 ppm, 85 ppm and 82 ppm respectively. Soil P has shown positive trend in intercrop plots against monocrop plots. Intercropped Turmeric, Ginger and Banana have shown soil P as 39 ppm, 35 ppm, 35 ppm respectively. Initial P values of Banana, Ginger and Turmeric intercropped plots were 28 ppm, 28 ppm and 35 ppm respectively. Initial K values of Banana, Ginger and Turmeric intercropped plots were 82 ppm, 83 ppm and 93 ppm respectively Soil pH and O.C are not showing any significant variances between pre-treatment and after one-year period of trial.

Keywords: Inter-cropping, Oil Palm, Policies, Mono-crop, Land productivity

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

15

(189)

Present Status of Fisheries in Puttalam Lagoon, Sri Lanka

Liyanage G.L.S.S.N.[*], Wijesinghe R.D.N., Herath S.S.

Department of Fisheries and Aquaculture, University of Ruhuna, Matara, Sri Lanka
*samitha.sandamal@gmail.com

Abstract

The lagoon fisheries under small-scale fishery play a significant role in annual fish production in Sri Lanka. Puttalam lagoon is one of the major lagoons that contribute to fish production and provides livelihoods to the people in North-western Sri Lanka. However, the status of Puttalam lagoon fisheries is not well known due to a lack of detailed studies. Hence, the present study was conducted to evaluate the status of fisheries, the socio-economic status of fishers, and the management strategies adopted for the fishing activities in Puttalam Lagoon. In this study, two major fish landing sites at Sothupitiya and Norochcholei and three fisher communities (n=77) in Anawasala, Sothupitiya, and Mampuri were comprehensively studied from May to June 2022. Both mechanized and non-mechanized crafts were used in lagoon fisheries with seven different types of fishing gear. Gillnets were the main and permissible fishing gear in the Puttalam lagoon. The catch composition of gillnet, mesh-wise CPUE (Catch Per Unit Effort), and species-wise CPUE were analyzed in this study. Altogether, 33 finfish species belonging to 26 families and five shellfish species belonging to two families were identified. The average total fish harvest of the lagoon was 21.6 ± 3.5 kg boat^{-1} day^{-1} and *Lates calcarifer*, *Mugil cephalus*, and *Gerres* sp were predominated over the other commercial fish species in the fish landings. The species-wise highest mean catch was recorded for *Lates calcarifer* (14.8 kg boat^{-1} day^{-1}). The highest CPUE ($P<0.05$, ANOVA) was recorded for 4.5" meshed gill nets (19.2 kg boat^{-1}day^{-1}), and the highest number of species was recorded in 3.5" meshed nets (11.4 ± 1.3). According to the socio-economic analysis, more than 50% of fishermen earned over Rs. 50,000 per month through lagoon fishery. The daily income of fishers in Puttalam lagoon varied throughout the year and was the lowest in June due to the indirect impact of the country's prevailing economic crisis. The management of fisheries in the lagoon is in accordance with co-management. Hence, both government authorities and fishers are involved in decision-making processes aiming at the sustainable development of the fisheries in Puttalam lagoon. Based on the study, it can be concluded that lagoon fishery is the primary source of livelihood for the people nearby and is directly related to the socio-economic development of the stakeholder communities.

Keywords: Puttalam lagoon, Catch per unit effort, Fishing gears, Gillnet, Socio-economic analysis

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

16

(200)

Spatial Distribution and Morphological Identification of Edible Oysters of *Crassostrea* spp. Species, Naturally Inhabiting the Negombo Estuary, Sri Lanka

Rodrigo U., Weerakoon D.K*., Marasinghe M.M.K.I.

Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*devaka@sci.cmb.ac.lk

Abstract

Crassostrea spp. is an ecologically and socio-economically important genus in Sri Lanka. It is a dominant export in the country and provides various ecological functions such as providing habitat for commensal macrofauna and provision of food and shelter for its associated organisms. Therefore precise understanding and sustainable utilization of this coastal marine resource are vital for sustaining local livelihoods and ecosystem conservation of its habitat. This is the initiation of the first detailed study conducted from April to June 2022, to understand the *Crassostrea* population in the ecologically and socio-economically important Negombo estuary with special emphasis on the naturally occurring *Crassostrea* oyster species and their distribution. A 100 m x 100 m virtual grid map was superimposed on the estuary using ArcGIS mapping software and 106 grids were randomly selected out of which 54 grids were from the southern half. From each selected grid, one sampling site was selected at the grid center and oysters were counted using a 1 m x 1 m quadrat placed on the estuary bed at the selected sampling site. Sediment textures were determined using volume percentages of silt, sand and clay obtained by centrifuged sediment suspensions and applying them on a soil triangle. turbidity, salinity, DO, depth, pH and temperature were recorded. *Crassostrea madrasensis* and *Crassostrea belcheri* were identified via shell morphologies. Based on the southern half sampling points, three sites were oyster positive. Dead oyster sites were frequent along the edges. Live or dead oyster sites contained a higher sand percentage. Sediments from oyster-positive sites were sandy loam or loamy sand. Sediment texture from oyster-absent sites showed diversity, in which the most frequent was, silt loam and the least frequent was sand and loam. Statistical analysis between sediment characteristics and physicochemical parameters in the southern half of the estuary showed that sediment texture was mostly silt loam as the depth increases towards the mid, and oysters prefer edges compared to the middle. Salinities of 1, 3.6 and 3.7 ppt and DO values of 12.13 and 12.49 mg/L fall in the tolerable range. High mortalities were observed in the sites with DO values as low as 0.5 mg/L. Turbidity, salinity, sediment texture, depth and freshwater input are considered important environmental factors that affect the distribution and abundance of oysters in the southern half of the Negombo estuary. This study shows how oysters in the Negombo estuary tend to confine at the edges and therefore recommends optimization of study by the second sampling stage, incorporated with estuary categorization as edge and the middle, and then extrapolating oyster counts for the edge category to obtain correct estimates of the oyster population in the estuary.

*Keyword*s*: Crassostrea* distribution, Habitat preference, Indian backwater oyster, White Scar Oyster

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

17

(204)

Comparative Analysis of Maturity Indices, Nutritional Values, Phytochemicals and Antioxidant Activities of Fruits of *Ampelocissus indica* (L.) Planch Grown in Sri Lanka

Nandasiri W.J., Fernando I.R., Jayaweera C.D.[*]

Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*dangolle@sjp.ac.lk

Abstract

Ampelocissus indica (L.) Planch, commonly known as 'red-stemmed wild grapes' is an under-utilized plant species, widely distributed in the evergreen and semi-evergreen regions of the globe. The phytochemical composition of *A. indica* (L.) Planch grown in Sri Lanka is yet to be studied in order to find out its potential applications. Therefore, this study was focused on the comparative analysis of maturity indices, nutritional values, phytochemical constituents and antioxidant properties of fruits of *A. indica* (L.) Planch grown in different geographical coordinates in the same climate zone. Fruits of *A. indica* (L.) Planch at their highest physiological maturity level were collected from Kanneliya natural conservation center (L_1) and Sinharaja rain forest (L_2) in the Southern province of Sri Lanka and two vines were selected per each location. Samples were authenticated. The maturity indices; moisture content, pH, titratable acidity, total soluble solids and texture profile of fresh fruits of *A. indica* (L.) Planch were determined using standard methods. Analysis of the nutritional parameters; carbohydrate, protein, fat, ash, and fiber contents of the oven-dried fruits were carried out using the standard gravimetric methods while the freeze-dried fruits were analyzed for bioactive compounds; phenolics, flavonoids, and antioxidant properties using the standard spectrophotometric methods. Each analysis was carried out in triplicates and mean values were taken. The evaluated maturity indices show equality of maturity for the two locations at the 95% confidence level. In summary, this study indicated that the evaluated nutritional parameters, phenolic content and antioxidant activities of *A. indica* (L.) Planch fruits determined using 2, 2-diphenylpicrylhydrazyl, 2, 2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic and ferric reducing power assays demonstrated no statistically significant differences due to location. However, flavonoid content showed a significant difference ($p<0.05$) based on location.

Keywords: *Ampelocissus indica* (L.) Planch, Maturity Indices, Nutritional values, Phenolic compounds, Flavonoids, Antioxidant activity

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

18

(224)

Assessment of the Impacts of Atmospheric Pollution on Floristic Diversity and the Use of Lichens as Indicator Species for Assessing Atmospheric Pollution: in Sri Lanka: A Case Study of Three Tropical Forests in Central Highlands of Sri Lanka

Ranasinghe D.M.S.H.K.[1], Tennakoon M.T.[1], Chatterjee S.[2], Nissanka N.A.A.S.P.[3]

[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Department of Natural Resources, Terri School of Advanced Studies, India*
[3]*Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka*
hemanthi.ranasinghe@gmail.com

Abstract

The impacts of atmospheric pollution reach distant locations and are not restricted to the vicinity of the polluting sources. Pollutants of fine particulate matter impact the carbon, nutrient, and water cycling, primary production, crop and timber production in forest ecosystems. In Sri Lanka, fewer research studies have been carried out in assessing the impact of atmospheric pollution on forest ecosystems and also the use of lichens as a bioindicator in this context. Three forest reserves belonging to sub montane tropical forest category was selected for the study. The selection of the location was influenced by the fact that continuous monitoring of air pollutants had been done by the Central Environmental Authority in Kandy City and its environs. The three forest reserves located in the neighborhood of the Kandy City was taken for the study; Udawatte Kelle Forest Reserve, Gannoruwa Forest Reserve and Hanthana Forest Reserve. Transects having the width of 5m and plot length of 100m were laid in these forest reserves from the most disturbed areas to less disturbed areas. In each transect, the diameter at breast height (DBH) and height were recorded in all the plants having more than 5 cm DBH. The plants in the undergrowth were identified at generic and species levels. Samples of leaves, litter, soil were taken to the laboratory for analysis of nutrients; organic carbon, electric conductivity, pH, available potassium, nitrogen, Cation Exchange Capacity. Corticolous lichens (Lichens growing on tree trunks) above 1.5 m from the ground level were recorded in trees having >5 cm DBH in the plot. All lichens species were recorded and identified to the generic level, while some of the species were identified only to the family level at the field. Furthermore, numbers of thalli were counted excluding non-propagative thalli. The lichen samples taken to the laboratory were identified using light microscope, classified according to indicator species of air pollution based on the available literature. The results showed that despite the fact that the atmospheric levels of pollutants (PM2.5, PM10, CO, NO_2 SO_2 O_3) were within the maximum permissible levels in the Kandy City and the neighborhood, Hanthane Forest Reserve showed lower levels for all the pollutants compared with the other two as it was located further away from the City. In the disturbed areas both the species diversity, lichen diversity was reduced showing some correlation with the level of disturbance. With regards to occurrence of lichens, Crustose lichens were the most abundant especially in the more disturbed areas and the occurrence of same was the least in Hanthane Forest Reserve which was the least disturbed among the three. Foliose lichens did not occur in Udawatte Kelle which was a high disturbed area. The bark pH in all the trees sampled showed values ranging from 5.4 to 6.0 and a significant relationship between bark pH and the lichen diversity could not be observed. Disturbed ecosystems shows poor nutrient cycling as their functions become stressed compared with the more naturalized ones.

Keywords: Air pollution, Lichens, Forests, Biodiversity, Nutrient cycling

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

19

(10)

The Perceived Palatability of Forage Plants of Wild Asian Elephants in Sri Lanka

Tharangi U.D.[1*], Halwatura R.U.[1], Amarasekera H.S.[2], Somaratne S.[3]

[1]*Department of Civil Engineering, University of Moratuwa, Moratuwa, Sri Lanka*
[2]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka*
[3]*Department of Botany, Open University, Nawala, Sri Lanka*
*tharangi.uyanahewa90@gmail.com

Abstract

The dilemmatic human-elephant conflict and the loss of forage lands due to the ever-increasing population density of Sri Lanka indicate the need to increase sustainable forage availability. Asian elephants feed on different plant species depends on the plant palatability. The feeding behavior of wild elephants provide the basis for enhancement of forage availability through elephant-specific conceptual conservation strategies in habitat enrichment to keep elephants inside the fragmented landscapes. The literature on the elephant forage plants in Sri Lankan forests and lands is limited and there are gaps in the knowledge on the plant palatably in relation to the elephant forage preferences. Thus, the present study explores the perceived palatability of elephants' forage in different provinces in the country. A list of palatable plant species was compiled based on the literature, field surveys, and the results of interviews conducted with wildlife experts. A questionnaire was developed from the list of palatable plant species and validated through wildlife experts and a pilot sample. The survey method of the research was used to collect information from a sample of respondents with field experience and expertise in the subject. The responders were chosen at random, and a piloted and validated questionnaire was administered through the Google form. Perceived palatability score was calculated from the responses considering their human perception towards forage plants. The data were analyzed for frequency distribution and mean comparison was performed using one-way analysis of variance procedures. Twenty-two common elephant forage plants were recognized from eight provinces on the island, included 03 herbaceous, 14 grasses, and 05 sedges. These plants speculatively thrive well in most of the elephant ranging areas. As far as provinces in the dry zones are concerned, it can be assumed that the probability occurrence of the selected plants is similar. The perceived palatability scores vary across the provinces, and plant types. The distribution of elephant forage plants in the island indicates an ecological provenance, inferring the influence of the general climatic conditions of the island. Of the listed 22 forage plants, *Pennisetum purpureum*, *Sacciopelsis interrupta*, *Panicum maximum*, and *Echinochloa glabrescens* were dominant over the rest, having relatively higher perceived palatability scores. Further, studies are required to have a complete image of the spatiotemporal variation of the four forage plants identified. The study showed the significance of the availability of forage plants and their palatability levels to secure and sustain the grazing forages for wild elephants in Sri Lanka.

Keywords: Perceived forage palatability, Human-elephant Conflict (HEC), Asian elephants (*Elephas maximus*), Grazing forages, Wildlife conservation, Sri Lanka

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

20

(31)

A Study on Nutritional Properties of Some Selected Underutilized Vegetables in Harispattuwa Divisional Secretariat of Kandy District Sri Lanka

Kapilaratne K.M.R.V., Wimalasekara R.*

Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*rinukshi@sci.sjp.ac.lk

Abstract

Even though Sri Lanka is blessed with a wide variety of nutritionally invaluable vegetables, most of them remain underutilized mainly due to lack of awareness on their nutritional richness. In Sri Lanka, the cultivation of underutilized vegetables (UUVs) is mainly restricted to rural areas, as the knowledge repositories about them are solely hosted by the local communities. The failure of UUVs to compete with the commercial crops is one of the major reasons for them to become underutilized. The present study addresses the importance of their nutritional content and disseminating the findings to enhance the consumption of UUVs among the general public. The objective of this study was to identify UUVs and to explore nutritional properties of some selected UUVs in Harispattuwa Divisional Secretariat, Kandy District. A survey was conducted representing randomly selected fifty families of different income levels as sample population, in Harispattuwa Divisional Secretariat, *via* a questionnaire to collect information mainly about knowledge and consumption frequency of UUVs and awareness on nutritional properties. Five vegetables; 'Maila' [*Bauhinia racemosa* (L.)], 'Kalu ala kola' [*Colocasia esculenta* (L.)], 'Karan koku' [*Acrostichum aureum* (L.)], 'Kara' [*Canthium coromandelicum* (Burm.f.)] and 'Malla' [*Olax zeylanica* (L.)] were reported as the rarely consumed vegetables indicated by 2-6% of lower responses. Total protein, carbohydrate and crude fiber contents were determined using Bradford assay, Phenol-sulphuric acid and Weende methods respectively. Mineral analysis was done using atomic absorption spectroscopy. The protein and carbohydrate contents were significantly high in 'Kalu ala kola' (8%) and 'Karan koku' (19%) compared to the commonly consuming vegetables like pumpkin (1%), leeks (2%) and green beans (2%) according to the literature. Higher crude fiber and vitamin C contents were recorded for 'Malla' (69%) and 'Kalu ala kola' (66 mg/100 g) relative to those nutrient contents in some common vegetables like carrot (3%) and drumstick (3%). 'Maila' (488 mg/100 g), 'Kalu ala kola' (295 mg/100 g) and 'Karan koku' (192 mg/100 g) are rich sources of Ca, Fe, K respectively. The present study concludes that these UUVs are valuable sources of food with essential nutrients and encouraging the people to grow them is suggested as important future perspectives to popularize UUVs consumption.

Keywords: Nutritional properties, Harispattuwa divisional secretariat, Underutilised vegetables

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

21

(46)

Characterization of the Vocal Repertoire of Sri Lankan Jackal (*Canis aureus nariya*)

Jayaweera U., Seneviratne S.S.[*]

Laboratory for Molecular Ecology and Evolution, Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*sam@sci.cmb.ac.lk

Abstract

Vocalization is an intriguing ecological phenomenon shown across the animal kingdom. In mammals, the structure and context of vocalization are highly variable. The Sri Lankan Jackal (*Canis aureus nariya)* is the only wild canid species and the third largest carnivore in the island, however, little is known about its vocalization. The objective of this study is to characterize the vocal repertoire of the Sri Lankan Jackal. Provoked and spontaneous jackal vocalizations were studied from August 2021 to May 2022 as part of a broad ecological study of the species. A playback acoustic method was used to provoke the Jackal's vocal response. Pre-recorded howling calls were broadcasted using a speaker in several known locations where jackals are known to occur including Athurugiriya (Western Province), Periyakamkulam (Northern Province), Sellankandal wewa (Northwestern Province) and Udawalawe National Park (Sabaragamuwa Province). Unprovoked vocalizations were studied in Mannar (Northern Province), Sigiriya (Central Province) and, Gampaha (Western Province). Complete group howls and other vocalizations were recorded at the Udawalawe National Park using an Omni-directional Microphone fitted to a parabolic reflector and a Marantz solid-state recorder. Spectrometric analyses were done using Raven Pro (v. 1.6.3) bioacoustics software. Different syllable types and vocal types were identified using the differences in duration of notes (sec), frequency (Hz), frequency modulation (Hz), and the number of emphasized harmonics. Our results suggested that the jackal vocal repertoire consisted of phrases of syllable series forming a continuum and a variety of recognizable sounds. The jackal vocalization comprised of a total of 23 syllable types forming 05 vocal types, that include the bark (n=1), whimper (n=6), whine (n=12), short-lone howl (n=4), and group yip-howl (n=3). The group-yip howl is its group vocalization as well as its major vocal type in the repertoire–forming the iconic jackal howl. Our results further indicate that the functions of their vocal repertoire may be related to re-union, territorial defense as well as reinforcing group bonds.

Keywords: Canidae, Frequency modulation, Vocal behavior, Vocal ecology, Nariya

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

22

(50)

Predator-prey and Commensal Association of Rufous Woodpecker (*Micropternus brachyurus jerdonii*) and *Crematogaster* Ants in Sri Lanka

Gunasekara V.R., Weerakkody S., Seneviratne S.S.[*]

Avian Sciences and Conservation, Department of Zoology and Environment Sciences,
University of Colombo, Colombo 03, Sri Lanka
*sam@sci.cmb.ac.lk

Abstract

Nesting within the arthropod nests is rare but can be found in several lineages of birds. In Asia, only the Rufous Woodpecker (*Micropternus brachyurus*) (RUWP) shows this peculiar nesting behavior where it breeds inside the nest of the *Crematogaster* ant. This study focused on the symbiotic relationship between RUWP in Sri Lanka (*M. b. jerdonii*) and *Crematogaster* ants. We looked at the RUWP feeding habits and feather odor, and the comparative density distribution of RUWP and *Crematogaster* across Sri Lanka to understand the underline mechanics of this association between the bird and the ant. This association is studied in the context of ants' diversity and colony size. All the observed ants associated with RUWP belong to the *Crematogaster* (*Crematogaster) rogenhoferi* species group. We exposed RUWP feathers (treatment), feathers of other birds (negative control), ant insect repellents, and attractants (positive controls), to wild-caught *Crematogaster* ants in an experiment chamber to test the affinity of RUWP feathers on ants. There was a significant positive attraction (One-way Anova:FDF5=24.85, p-value<2e-16) of *Crematogaster* ants towards RUWP feathers. RUWP feces contained 100% *Crematogaster* ants (n=5 individuals). Variable line transects with a fixed 20 m distance for either side were taken in known locations of RUWP to determine RUWP and ant nest density. The density information was put together in heatmaps using the equation (H opt=(2/3n)(1/4)×σ) to calculate the kernels using the mean center and standard distance in QGIS software. This shows a restricted density of RUWP with respect to ant nest colonies. Linear regression analysis revealed a significant positive correlation (Adjusted R-squared=0.2573, p-value:0.00933) between RUWP and ant nest density. These results indicate commensalism between the RUWP and *Crematogaster* ants, within which a predator-prey relationship also exists.

Keywords: Commensalism, Feather odor, Kernel density analysis, Predator-prey relationship

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

23

(51)

Exploring the Spatial Variation of Morpho-Anatomical Traits of True Mangrove and Mangrove Associates in the Southern Province of Sri Lanka in Accordance with Climatic Adaptation

Ranathunga W.R., Caldera H.I.U.*

Department of Plant Sciences, University of Colombo, Colombo 03, Sri Lanka
*iroja@pts.cmb.ac.lk

Abstract

As salt-tolerant species, mangrove vegetation has evolved special characteristics to survive in its harsh environment. Since leaves are the most productive organs and are exposed to the external environment, they are highly sensitive to environmental changes. Although many studies on Sri Lankan mangrove flora have been focused on mangrove physiology, conservation etc., only a few studies have focused on leaf morpho-anatomical characteristics in relation to different climatic conditions. The present study is aimed to determine the spatial variation of morphological and anatomical characters of leaves of true mangrove and mangrove-associate species in the Southern Province of Sri Lanka. Seven mangrove sites in the Southern Province covering the three principal climatic zones were selected. Mature leaves were collected at each site along with soil salinity measurements. Leaf morphological traits such as specific leaf area (SLA) and leaf anatomical traits including leaf thickness with cuticle (LT), palisade thickness (PT), spongy mesophyll thickness (ST), palisade to spongy ratio (PSR) and water storage tissue thickness (WST) were measured. ANOVA test and Cluster Analysis were carried out using RStudio software to determine whether there is a significant morpho-anatomical trait variation in relation to different climatic zones. The study observed varied leaf trait values for different true mangrove and mangrove associate species that emphasized the varying degrees of ability to cope with different environmental conditions. For instance, a lower leaf area and SLA were observed in true mangrove species compared to mangrove associates. *Lumnitzera racemosa* Willd. had significantly higher LT (481.56 μm±53.74b) and WST (221.14 μm±47.9a) which facilitates osmoregulation. In addition, high PSR was observed in *Acrostichum aureum* (L). which would enhance the photosynthetic efficiency. Furthermore, a variation in laminar traits was observed in relation to different climatic zones. Some species including *Bruguiera sexangula* (Lour) Poir, *Rhizophora* spp., *Hibiscus tiliaceus* (L). and *Clerodendrum inerme* (L) Gaertn. showed significantly higher SLA in the wet zone. The presence of salt glands on the adaxial surfaces of the leaves of *Acanthus ilicifolius* (L)., a mangrove associate species, revealed similar adaptations as in true mangrove species. A spatial variation in clustering was observed with members of the same family clustering together, indicating a genetic influence. *A. ilicifolius* (L)., a mangrove associate species, exhibited similar adaptive responses as true mangroves whereas *Excoecaria agallocha* (L). showed adaptations to inhabit different climatic zones. In conclusion, both true and mangrove associate species are likely to adapt to environmental changes under climate change scenarios. This study would aid in the identification of climate-resilient species for mangrove restoration programs.

Keywords: Mangrove, Morpho-anatomical traits, Adaptation, Mangrove associates, Spatial variation, Climate change

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

24

(53)

Predicting Current and Future Potential Distribution of Endemic Plant Genera in Sri Lanka Through Ecological Niche Modelling

Viduranga W.A.A.D.M.*, Kathriarchchi H.S.

Department of Plant Sciences, University of Colombo, Colombo 03, Sri Lanka
*malithatukorala@gmail.com

Abstract

Rapid spatial and seasonal climatic variations have a significant impact on Sri Lanka's remarkable biodiversity and patterns of endemic species distribution. In terms of distribution, range size, habitat preferences, and ecological plasticity, endemic plant generics represent a uniform, threatened group within Sri Lankan flora. The present study was mainly conducted to identify the current and future potential distribution of total of 57 plant species included in 17 endemic plant genera in Sri Lanka by ecological niche modelling and to predict the extent of suitable habitat change of these species in 2070. In addition to that, the present study was aimed to calculate the niche overlap and the extent of niche overlap change in 2070. The current and future potential distribution of seventeen genera was mapped using MaxEnt v3.4.1 and ArcGIS v10.7.1 software. Layers of bioclimatic variables and species occurrence data were used as the input data for MaxEnt v3.4.1. Bioclimatic data were extracted from the WorldClim v2.1 database and the species occurrence data were gathered mainly from the specimens in the National Herbarium, Peradeniya, national and international databases. Each species' future potential distribution was projected under two Shared Socioeconomic Pathways (SSPs); namely, SSP2-4.5 and SSP5-8.5. Isothermality (bio 3), temperature seasonality (bio 4), precipitation of the coldest quarter (bio 19) and elevation were selected for the present study to remove the multicollinearity within bioclimatic variables (Pearson cross-correlation coefficient value<±0.8). Prepared models were then threshold to a 95% suitability score and the percent of suitable habitat change in 2070 was calculated using RStudio v1.3.1093. The current and future potential distribution models were overlapped separately, and the total overlapping area was calculated. The present study detected contractions of suitable habitats of fourteen of the seventeen endemic plant genera in 2070 under both SSP2-4.5 and SSP5-8.5 climate projections. *Phoenicanthus* sp*., Hortonia* sp*.* and *Podadenia* sp showed expansion of habitat in 2070 under two future climate projections. The major determinant of the distribution of the endemic genera; *Adrorhizon* sp*, Davidesa* sp*, Loxococcus* sp, and *Diyaminauclea* sp is elevation. Distribution of monotypic endemic genus; *Chlorocarpais* sp mostly determined by the coldest quarter's precipitation parameter (bio 19). The remainder endemic generics have a significant correlation with temperature seasonality (bio4).Moreover; a reduction of the total overlapping niche area of all endemic plant genera was detected. The findings of the study are expected to apply in the conservation of endemic plant generics by suitable habitat prediction and mapping.

Keywords: Niche, Endemic genera, Modelling, Predictions

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

25

(63)

Habitat Use by Asian Elephants (*Elephas maximus*) in a Human-Dominated Landscape in Lunugamwehera, Sri Lanka

Fernando C.[1]*, Weerakoon D.K.[1], Pilapitiya S.[2], Wijesinghe M.R.[1], Fernando P.[3]

[1]*Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*
[2]*World Bank Environment and Natural Resources Global*
[3]*Centre for Conservation and Research, Sri Lanka*
**chandimasf@gmail.com*

Abstract

In Sri Lanka, the home ranges of many elephants extend outside protected areas. Hence understanding patterns of habitat use in human-dominated landscapes is crucial for their conservation. Tracking data from GPS collars provide valuable insight into elephant movement, habitat use, and behavioural adaptations. In this study, two female elephants from two different family groups, which frequented areas outside Lunugamvehera National Park (Southern Sri Lanka), were fitted with GPS collars and monitored for 14 months. The GPS collars provided six position fixes per day (i.e.,four hourly). A total of 3,160 points from these two individuals were visited to record habitat types, crop types, and prevailing mitigatory measures. The results indicate that in both groups the diurnal patterns of habitat use were markedly different to the nocturnal habitat use. During the day (0600 to 1800 hrs.) the elephants predominantly used forest habitats and mature scrubs whereas at night (1900–0500 hrs.) the elephants used human-dominated habitats and returned to the forests early morning. The elephants did not frequent the actively cultivated areas (corn, sugarcane, millet, banana, and paddy), but primarily used abandoned crop fields and scrub habitats. This was most likely due to the presence of deterring mechanisms such as electric fences, crop guarding, and hanging fences in actively cultivated fields also due to direct threats such as shooting by farmers. This study indicates that female elephant groups do not risk raiding more nourishing and perhaps more palatable crops when there is the availability of forage elsewhere and where deterrents are in place. Harvested and off-season crop fields, especially sugarcane and paddies, were used opportunistically because they were not guarded. These findings may support the idea that habitat selection of female elephant groups which typically comprise adult females and young of both sexes are driven by a trade-off between food availability and anthropogenic risks. Another important observation was that, although located in close proximity to the Lunugamvehera National Park, none of the recordings over the 14 months were within the protected area, suggesting that the habitat ranges of these two groups are entirely outside the protected area network. The findings of the present study show the importance of maintaining a mosaic of habitats including forest and scrub patches within human-dominated landscapes and the need for using deterrent mechanisms for protecting cultivations, both of which would be crucial to sustained coexistence between people and elephants outside protected areas.

Keywords: Female elephants, Habitat use, Risk-benefits, Human-elephant conflict, GPS tracking

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

26

(65)

Biopiracy to Bioprospecting: Assessing the Benefits and Challenges of Ratifying Nagoya Protocol

Wijethunga A.R.L.[1*], Dissanayake D.M.S.B.[2], Pilapitiya A.R.[3]

[1]*United Nations Development Programme, Colombo, Sri Lanka*
[2]*Institute of Development Studies, Colombo, Sri Lanka*
[3]*University of Colombo, Colombo 03, Sri Lanka*
*ramitha.wijethunga@undp.org

Abstract

The distinctive biodiversity of Sri Lanka provides many provisioning, regulating, supporting, and cultural services to the local community and beyond. Further, unsustainable utilization in the biodiversity hotspots will lead to further deterioration of the resources. External parties have obtained patents and intellectual property rights for some Sri Lankan fauna and flora, including some traditionally valued Sri Lankan medicinal plants without the government's consent. This has been identified as a reason that prevents local communities from accessing the benefits of biodiversity. Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits-2014 has been identified internationally as a framework that can be used to address biopiracy-related issues. However, Sri Lanka is not yet a party to the Nagoya Protocol. No comprehensive studies have been carried out to assess the benefits and challenges available for Sri Lanka in ratifying the protocol. The objective of the study was to examine the reasons for not ratifying the Protocol by the Government of Sri Lanka, while most of the countries have ratified and are enjoying the benefits. A desk review was carried out to assess the benefits achievable and policy and institutional gaps in ratifying the Protocol. Structured key informant interviews were held with the officials of the relevant authorities, academics, professionals and environmentalists covering 10 from each category, and 10 community focus group discussions to examine the benefits and challenges in ratifying the Protocol. Sri Lanka does not have any policy or legal barriers to ratifying the Protocol. Reviewed literature on the experiences of other countries revealed that there are clear socio-economic and environmental benefits to the communities and economies by ratifying the Protocol. While experts agreed that biopiracy is currently happening and traditional knowledge systems are being degraded, the key decision makers are of the view that ratifying the protocol may lead to irreversible damage to Sri Lankan biodiversity. Inadequacy of effective quarantine services and limited knowledge of officials were identified as key challenges in combating biopiracy. On the other hand, community groups also have made requests to assert their traditional rights to access biodiversity. In this context, this study proposes to initiate a comprehensive, inclusive and fact-based dialogue over the potential benefits and challenges in ratifying the Protocol that provides greater legal certainty and transparency for both providers and users of genetic resources by establishing more predictable conditions for access to genetic resources and helping to ensure benefit-sharing.

Keywords: Nagoya protocol, Sri Lankan position, Traditional rights and benefits, Bioprospecting, Biopiracy

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

27

(73)

Swordtail (*Xiphophorous helleri*) Growth Promoting Activity and Proximity Analysis of Pineapple (*Ananas comosus*) Peel Oil Supplemented Feed

Thanushanthahi L.[1], Manage P.M.[1, 2], 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 growing ornamental fish industry is constantly exploring novel feed additives to serve as phytogenics. Phytogenics are plant-derived compounds that are incorporated as feed additives. The phytogenics improve culture production among cultured fish and shrimps. Owing to low-cost and high availability, phytogenics offer a sustainable tool to address environmental, social, and economic issues concurrent with the expansion and increasing demand for aquaculture, including ornamental fish culture. The present study was conducted to evaluate the effects of the dietary inclusion of Pineapple (*Ananas comosus*) peel oil on the growth performance of Swordtail (*Xiphophorous helleri*). The Pineapple peel oil extraction was done using the Soxhlet apparatus. The extracted oil was then incorporated into the swordtail feed while using olive oil in the control feed. The prepared fish feed was given for Swordtail with an initial average body weight of 0.12 ± 0.07 g and average length±SD of 1.15 ± 0.2 cm. Two triplicate groups were fed with control and experimental diet, for 10 weeks. Results showed significantly enhanced growth performance in terms of average weight gain: 0.48 ± 0.01 g, weight gain rate: $282.0\pm35\%$, relative growth rate: 2.82 ± 0.35, Specific growth rate: $1.92\pm0.12\%$ day^{-1}, feed conversion rate: $2.19\pm0.04\%$ and condition factor: $0.42\pm0.02\%$. The biochemical composition, including crude protein, crude lipid, ash, moisture, and carbohydrate, was analyzed for both prepared feeds. Among the biochemical properties of prepared feed, moisture content was analyzed using the moisture analyzer; protein content was determined using Kjeldhal method; crude fat content was determined using Soxhlet extraction method; ash content was analyzed using muffle furnace and the carbohydrate content was determined by subtracting crude protein percentage, crude lipid percentage and ash percentage from 100%. The proximate analysis results showed that the carbohydrate content ($60.05\pm0.05\%$) in the control feed was significantly high ($p\leq0.05$), whereas moisture ($11.35\pm0.11\%$) and ash ($13.77\pm0.03\%$) contents were significantly high ($p\leq0.05$) in experimental feed. Conclusively, the present study recommends using Pineapple peel oil as a feed additive to improve the growth performance of swordtail which eventually leads to get more profit.

Keywords: Plant-based feed additive, Swordtail, Pineapple peel oil, Growth performance

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

28

(79)

New Insights of the Endemic Plant Genera in Sri Lanka and Their Conservation Status

Viduranga W.A.A.D.M.[*], Kathriarchchi H.S.

Department of Plant Sciences, University of Colombo, Colombo 03, Sri Lanka
*malithatukorala@gmail.com

Abstract

Endemism refers to species that are confined to a particular geographical region. A total of 16 plant genera are regarded as endemic to Sri Lanka. The correct identity and the status of these endemic plant genera are still in a debate and thus precise identification with the light of literature, taxonomy and molecular studies is mandatory. Due to erroneous identification, documentation, and nomenclatural issues, rarity and restricted distribution of these taxa and unexplored habitats made this evaluation more problematic. Hence, this present study was conducted to produce an updated list of endemic plant genera in Sri Lanka and identify and analyze the *in-situ* conservation status of these species. The taxonomic history of all 17 endemic genera was summarized to get a general understanding of their basiyonyms, protologues, nomenclatural issues and taxonomic gaps. Locality data were obtained from an intensive herbarium taxonomic study done at the National Herbarium, Peradeniya, Department of Forest Conservation, and national and international databases. The *in-situ* conservation status was evaluated using the literature, and analysis was conducted by overlaying protected area map with recorded locations of endemic plant genera. According to the conservation status, the categories of endangered, vulnerable, and critically endangered, which are considered the most threaten, covering approximately 95.00% of all species found in endemic genera. *Doona, Cyphostigma*, and *Podadenia* are three genera that have the potential to be added to the current list of endemic plant generics. With thorough literature reviews, the genera *Kokoona* and *Farmeria* can be eliminated from the endemic generics. Based on comprehensive botanical survey, *Chlorocarpa, Phoenicanthus, Loxococcus, Schumacheria, Championia, Stemonoporus, Dicellostyles, Hortonia, Adrorhizon, Davidsea, Diyaminauclea, Leucocodon, Nargedia, Podadenia, Scyphostachys, Doona* and *Cyphostigma* considered as the 17 endemic plant genera in Sri Lanka. There were 57 endemic species in total, with *Stemonoporus* and *Doona* being the two largest endemic plant genera in terms of number of species. The majority of species have been reported outside of Sri Lanka's protected areas (70%), according to their recorded distribution data and some need legal conservation validity.

Keywords: Sri Lanka, Endemic, Plant genera, *In situ* conservation

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

29

(88)

eDNA Metabarcoding: Gaps of Publicly Available Reference Databases of Freshwater Vertebrates in Sri Lanka

Ranaweera J.B.S.[1*], Fernando T.S.P.[2], Weerakoon D.K.[1]

[1]*Department of Zoology and Environmental Science, University of Colombo, Colombo 03, Sri Lanka*
[2]*Department of Zoology, Open University, Nawala, Sri Lanka*
[*]*judyranaweera@gmail.com*

Abstract

Environmental DNA (eDNA) has become a rapidly emerging technology during the last decade. Although eDNA applications are used worldwide, none of the eDNA metabarcoding studies have been conducted solely in Sri Lanka yet. Detection rate of species through DNA metabarcoding technique varies with the availability of gene sequences in reference databases. Therefore, the main objective of this study was to assess the data gaps of local species in two selected reference databases (the NCBI database and the BOLD database). Local freshwater vertebrates were considered for this analysis by dividing them into three major categories as freshwater fish (97 species), freshwater amphibians (40 species) and freshwater reptiles (7 species). The availability of COI gene sequence and CytB gene sequence of each species were recorded. In the NCBI database, reference gene sequences were available only for 17.53% (17 species) of freshwater fish, 7.50% (3 species) of freshwater amphibians and 14.29% (1 species) of freshwater reptiles. In the BOLD database, reference gene sequences were available for 52.58% (51 species) of freshwater fish, 17.50% (7 species) of freshwater amphibians and 42.86% (3 species) of freshwater reptiles. Endemic species were analyzed separately. This revealed the availability of reference gene sequences for 4.92% (3 species) of endemic freshwater fish in the NCBI database. However, none of the reference gene sequence was found for endemic freshwater amphibians and reptiles. In the BOLD database, reference gene sequences were available for 36.07% (22 species) of endemic freshwater fish and 33.33% (1 species) of endemic freshwater reptiles but none for endemic freshwater amphibians. According to the results, large gaps of publicly available reference CO1 gene sequences were observed in both NCBI and BOLD databases. Not only the availability of reference gene sequences, but also the submitted countries of those sequences were also analyzed as a part of this study. Asia has contributed the most according to the country-vice analysis. Among them, many are in the South Asian region. Therefore, this study highlights the need of expanding reference databases for greater local representation as well as the importance of forging collaborations with the developed countries in the same region in order to increase international cooperation and funding to carry on further studies on neglected taxa and under-represented taxa in Sri Lanka.

Keywords: eDNA (environmental DNA), Metabarcoding, Reference databases, Reference gene sequences

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

30

(89)

Seed Security for Food Security: A Situation Analysis from the Rural Home Gardens

Bandara A.M.S.M.R.S.G.*, Hansika S.T., De Silva D.A.M., Mitsuyuki T.

Department of Agribusiness Management, Sabaragamuwa University, Belihuloya, Sri Lanka
*ruwinibandara@agri.sab.ac.lk

Abstract

Seeds being a primary agricultural input, its availability, access, and affordability is directly linked to the agricultural production. Traditional home gardens, backyards, Kandyan forest gardens, and micro-agricultural systems rich in biodiversity and species, mix with the knowledge and skills of the community to manage sustainable food production systems. Therefore, the study targeted to identify the types of seed production and preservation systems available among the farming community, and to identify the impact of seed ownership on household resilience to food insecurity. Data were gathered using an initial transaction walk, and a series of focus group discussions with rural households of Imbulpe and Boralanda GN divisions of Rathnapura and Badulla districts, respectively. The study areas were selected given the diversity of the crops in the area. Sample profile included 30 farmers who were purposively selected from each GN division. Results were analyzed using descriptive statistics and it revealed the existence of two seed production and preservation systems: formal and informal. Formal seed systems included both private and public stakeholders in seed and planting material business. Farmers used these formal seed systems for commercial level cultivation of both up-country and low-country vegetables. Informal seed systems were characterized with the own production, selection, storage, and maintenance of seed banks, barter system, and community seed gifting/sharing, and purchasing locally produced seeds from the locality. Informal seed systems were identified mainly for cereals (traditional rice varieties), pulses, fruits, vegetables, and spices at home gardening level. This resulted in seed and planting material ownership retaining among the local farmers. Seed ownership is an intangible asset which empowers social and human capital status of the households. Locally bred varieties proved to be resilient to climate change and maintain the crop diversity in home gardens. Informally sourced seeds recorded comparatively low yield than the hybrid/improved seed varieties that are sourced from formal seed systems. In conclusion own seed supplies ensured food availability, minimized seasonal yield variations, and enhanced meal diversity.

Keywords: Food security, Household resilience, Seed system

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

31

(92)

A Preliminary Survey of the Avifaunal Diversity in Pampaimadu Premise of the University of Vavuniya, Vavuniya, Sri Lanka

Keerthanaram T.[1, 2*], Wijerathna H.M.P.A.[1], Sanjeewani H.K.N.[1]

[1]*Department of Bioscience, University of Vavuniya, Vavuniya, Sri Lanka*
[2]*Postgraduate Institute of Science (PGIS), University of Peradeniya, Peradeniya, Sri Lanka*
*more.keerthanaram@gmail.com

Abstract

Vavuniya is a lowland dry zone district of the Northern Province of Sri Lanka, which is still unexplored with a natural forest cover of 1,238 km^2. Even though there are many kinds of literature concerning the water birds of the Vavuniya, the diversity of tropical avifaunal species is still a gap which was the light of this study. The study area is situated 10 km from the center of Vavuniya along the A30 highway, with the dry-mixed evergreen forest as vegetation. The district is located within the dry zone which experiences a mean temperature of 28° C and annual rainfall of 1,400 mm. It also consists of 02 adjoined tanks along the boundary. The study points were used for the avifaunal survey during mid of March to end of July 2022. Habitat diversity within the study area was discussed using a prepared checklist and the community indices like the Shannon-Weiner index (H'), Simpson's diversity index (D), Simpson's evenness (E), and Species richness (R) across various habitats ecosystem: Woodland-Paddy land (H_1); Woodland-Water catchment area (H_2); Forest (H_3); Grassland with inundated land ecosystem (H_4); and Manage Garden with Occasional trees (H_5) of the study area. The checklist resulted in a total observation of 93 avifaunal species including 87 resident and 06 migrant species belonging to 47 families (including 09 endemics, and 05 nationally threatened species). Rock Pigeon (*Columba livia)* belongs to Family Columbidae with the highest frequency (68%, n=123) and is evenly distributed across different habitats but the family Ardeidae is found extensively dominating in H_5 (39%). H_1 is with the highest H' (3.5) and D (0.96); while H_3 has the highest R (2.52) and E (0.62). The seasonally inundated habitats H_2 and H_4 bring water birds to the study area. It also increases the availability of avifaunal insectivores. Many anthropogenic disturbances, such as habitat alterations, intentional wildfire, and road mortality are the key threats encountered by the avifaunal species in the study area. In addition to that, the activity of stray dogs within the premises was observed to be a potential threat during the breeding season. Appropriate conservation strategies including landscape management, conservation of available forest land, and proper awareness of neighboring local communities are necessary to maintain the current ecological status.

Keywords: Avifauna, Checklist, Habitat variation, Species diversity, Vavuniya

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

32

(105)

Preliminary Study on Floral Distribution, Abundance and Diversity of Mangroves in Vankalai, North-west Coast of Sri Lanka

Madhushani K.G.S[1, 2*]

[1]*Department of Bioscience, University of Vavuniya, Vavuniya, Sri Lanka*
[2]*Post Graduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka*
*sanjeewanimadhushani@gmail.com

Abstract

Sri Lanka harbors a remarkable amount of mangrove habitats. Northern Province shares about 16% of the total mangrove extent of the country. Vankalai consists of several ecosystems which range from arid-zone thorn scrubland, arid-zone pastures and maritime grasslands, sand dunes, mangroves, salt marshes, lagoons, tidal flats, sea-grass beds and shallow marine areas. Due to the integrated nature of shallow wetland and terrestrial coastal habitats, this sanctuary is highly productive, supporting high ecosystem and species diversity. The research was aimed to identify the distribution, abundance and diversity of mangroves in Vankalai of the Northern Province, Sri Lanka. Ten 25m wide belt transects with 10m intervals were randomly arranged in the small patch of mangrove vegetation perpendicular to the 350m of shoreline across the water-land gradient. Each transect was divided into five 5mx5m subplots for convenience of sampling. True mangrove species in each transect were identified and counted. The quantitative data has been used to compute the Shannon diversity index (H), Simpson Index (D) and Shannon Evenness (E), which were used to compare the diversity of the study sites. Ten different mangrove species including *Avicennia marina* (n=115)*, Avicennia officinalis* (n=73)*, Rhizophora apiculate* (n=33)*, Rhizophora mucronata* (n=102)*, Sonneratia alba* (n=3)*, Pemphis acidula* (n=4)*, Excoecaria agallocha* (n=40)*, Lumnitzera racemose* (n=91)*, Bruguiera cylindrical* (n=97)*, Ceriops tagal* (n=31) were identified and they were belonging to five families; Avicenniaceae (n=2), Rhizophoraceae (n=5), Lythraceae (n=1), Euphorbiaceae (n=1) and Combretaceae (n=1). Further, based on the IUCN status, two mangrove species (*Sonneratia alba* and *Bruguiera cylindrical*) were identified as endangered species. The highest Shannon diversity index (H=2.21) and the lowest Simpson index value (D=0.14) were observed in the transects of point 1 due to minimal disturbances. The least Shannon diversity index and evenness were recorded in the point 5 as 1.65 and 0.85 respectively at the point 5 since fishing and tourism activities take place in the proximity of this place. The Shannon diversity index varied at the points of 1 (H=2.21)>2 (H=2.10)>3 (H=1.89)>4 (H=1.84)>5 (H=1.65) whereas Simpson index value were varied at the points of 1 (D=0.14)<2 (D=0.17)<3,4 (D=0.18)<5 (D=0.19) respectively. Pollution and human interaction would have degraded the environmental quality of the mangrove habitats. Based on the observations it was found that the extent of disturbances was minimum at the points of 1 and 2 whereas anthropogenic influence was increased at the points of 3<4<5 respectively. Further, use of mangrove poles and sticks to build fish baits and fishing rods by the anglers could possibly destroy these small patches of mangroves. Hence, actions should be taken for conservation of existing patch and replenishment of new mangroves.

***Keywords*:** Mangroves, Diversity, Shannon Diversity Index (H), Simpson Index (D) and Shannon Evenness (E)

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

33

(113)

Habitat Utilization and Behavioral Patterns of the Endemic Sri Lankan Green Pit Viper (*Craspedocephalus trigonocephalus*) in the Wet Zone of Sri Lanka

Dhananjani D.M.T., Mahaulpatha W.A.D.*

Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
**mahaulpatha@sjp.ac.lk*

Abstract

Behavioral patterns and habitat utilization of the endemic Green Pit Viper (GPV) *Craspedocephalus trigonocephalus* were studied in the wet zone of Sri Lanka. The region, which is covered by the wet zone, has no significant dry periods and a moderately high mean annual rainfall of over 2,500 mm. Data collection occurred between April 2021 and March 2022 with a total of 260 hours of standardized sampling effort distributed throughout the collection period. The method used was an active search which consists of a visual search of up to six meters from the central line along each side of the quadrate. Quadrats were placed in habitats, taking each GPV sighting as the center of a quadrate. At each GPV-occupied quadrat, ambient temperature, body surface temperature, prey availability, perch position and perch light level were recorded. The day was divided into six-time periods as; early morning, morning, mid-day, evening, late evening, and night. Activity level was determined considering the number of GPV that could be visually observed. A total of 49 GPV were examined during the study. Focal animal sampling was conducted, and an ethogram was developed. A strong positive relationship was observed between ambient temperature (Ta) and body surface temperature (Ts) of GPVs (Pearson correlation r=0.936). The highest number of individuals preferred filtered sun light (57.14%). *C. trigonocephalus* mostly preferred distal position on the branches followed by middle and apical. There was a significant difference in the percentage of individuals with different behaviors [ANOVA, F=3.64, $p<0.05$]. Behavioral pattern of GPV varied in the temporal scale during the day. During the morning time slot, *C. trigonocephalus* spent most of the time ambushing (16.12%) and basking (6.42%) respectively. During the mid-day they spent most of their time basking (10.57%), followed by resting (7.15%). The evening, late evening, night, and early morning slots were spent mostly on ambushing. The highest average time of 239 min was spent on ambushing behavior. Feeding behavior (9.8 min) had relatively short time on average. Results of this study indicate that *C. trigonocephalus* is well adapted for the utilization of its preferred habitat in the wet zone, and that, it displayed behavioral patterns that vary within temporal scales, which results in more efficient and effective utilization of resources. Therefore, this study provides important insights for conservation and management of *C. trigonocephalus* by critically evaluating the requirements of this species.

Keywords: *Craspedocephalus trigonocephalus*, Behavior, Endemic pit viper, Wet zone

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

34

(117)

Avifaunal Diversity in Kirala Kele, Matara, Sri Lanka

Gunawardena O.G.Y.D.[1], Priyadarshana P.H.M.G.C.[2]*, Rathnayake W.A.S.P.P.[1], Janith H.A.C.[3], Gunawardena M.P.[1]

[1]*Faculty of Science, Horizon Campus, Malabe, Sri Lanka*
[2]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[3]*Department of Chemistry, University of Kelaniya, Kelaniya, Sri Lanka*
*priyadarshanachathura1@gmail.com

Abstract

Avifauna is an important taxon in various ecosystems both in ecological and economical contexts. Their diversity status can indicate habitat conditions while birdwatching can bring economic benefits to local communities, diversifying their livelihoods while contributing to the conservation of biodiversity. Kirala Kele is a wetland ecosystem in the Matara District which is an important habitat for biodiversity including birds. Therefore, a survey was conducted to assess the diversity of avifauna in Kirala Kele. The survey was conducted by visual observations in selected 200m four transects which focused on the micro-habitats, and anthropogenic activities. Data collection was carried out from April 2022 to September 2022 once a month from 6.00 am to 8.00 am and 4.00 pm to 6.00 pm. During the survey, 72 species of birds were recorded, belonging to 38 different families. Lesser Whistling Duck (*Dendrocygna javanica*), Spotted Dove (*Spilopelia chinensis*) and Red-vented Bulbul (*Pycnonotus cafer*) are indented as the most abundant species in the study area. Lesser Sri Lanka Flameback (*Dinopium psarodes*), Sri Lanka Hanging Parrot (*Loriculus beryllinus*), Crimson-fronted Barbet (*Megalaima rubricapillus*) and Sri Lanka Swallow (*Cecropis hyperythra*) have been recorded as endemic species. Shannon wiener index (H') and Simpson index (D) in transect 1 were 3.18 and 0.94 (marshland), in transect 2 was 3.38 and 0.96 (paddy fields), in transect 3 were 3.30 and 0.95 (canal and cultivation area), and in the transect, 4 were 1.92 and 0.66 (open water and marshland), respectively. The overall Shannon wiener index (H') in the study area was 3.21 and Simpson Index (D) was 0.91 which indicates that the sanctuary has a rich diversity of birds. The results further depict that the diversity and abundance of species depend on the availability of water, the extent of human disturbances, and the presence of vegetation cover. Since the study concluded that Kirala Kale contains a high diversity of birds, and it has great potential to be developed into an attraction of birdwatches. Therefore, the study will focus further on the diversity of birds in the migratory season, and we recommend the capacity building of local communities to promote the area as an important location for birding and educational tourism.

Keywords: Avifauna, Conservation, Diversity, Educational-tourism, Kirala Kele

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

35

(118)

Diversity of Odonata in Kirala Kele Sanctuary, Matara District, Sri Lanka

Rathnayake W.A.S.P.P.[1], Janith H.A.C[3], Priyadarshana P.H.M.G.C.[2]*, Gunawardena O.G.Y.D.[1], Gunawardena M.P.[1]

[1]*Faculty of Science, Horizon Campus, Malabe, Sri Lanka*
[2]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[3]*Department of Chemistry, University of Kelaniya, Kelaniya, Sri Lanka*
*priyadarshanachathura1@gmail.com

Abstract

Kirala Kele sanctuary is a wetland ecosystem that is one of the most valuable conservation areas in the Matara. Odonates represent an important role as an indicator species of wetlands and therefore, a study was conducted to explore and investigate the diversity of Odonata species that inhabit Kirala Kele and identify its use as an indicator of environmental management in the area. The study was conducted in selected four different transects (200 m each) which focused on the micro-habitats, and anthropogenic activities. Individuals belonging to different species of dragonflies and damselflies were counted by visual observations and photographs were taken to identify using standard guidebooks. Data collection was carried out from April 2022 to September 2022 once a month from 8.00 am to 10.00 am and 3.00 pm to 5.00 pm. The results showed that there were 27 species of Odonata from 3 different families. Pied Parasol (*Neurothemis tullia tullia*) and Variegated Flutterer (*Rhyothemis variegata variegate*) are identified as the most abundant species in the study area. One species namely, Sri Lanka Orange-faced Sprite (*Pseudagrion rubriceps ceylonicum*) has been recorded as endemic. Species diversity measured within study sites using Shannon wiener index (H') and Simpson index (D) indicated that transect A (marshland) H'-2.08, D-0.82, transect B (paddy fields) H'-2.08, D-0.82, transect C (canal and cultivation area) H'-1.25, D-0.48 and transect D (open water and marshland) H'-1.65, D-0.69, respectively. Based on the study, the overall Shannon wiener index in the study area was 1.95 while Simpson Index (D) was 0.75, which concludes the sanctuary has a considerable diversity of Odonata. The number of dragonfly species and abundance is remarkably higher in transects along the canal, in presence of emergent aquatic reeds and surrounded by paddy fields. Along the transects which are mostly affected by anthropogenic activities such as vegetation clearing and pollution or less anthropogenic activities, but low water levels had a small diversity. The results reveal that the diversity of species depends on several factors like the presence or absence of aquatic habitats, level of human disturbances, presence of emergent aquatic reeds, and degree of pollution. Thus, understanding the diversity and distribution of Odonata in the sanctuary can provide important insight into effective ways to manage the environment, which is often overlooked in biodiversity conservation strategies.

Keywords: Conservation, Diversity, Kirala Kele, Odonata

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

36

(119)

Dynamics of Odonata in an Agroecosystem: Effects of Paddy Cultivation Phases on the Diversity of Dragonflies and Damselflies

Ranaweera S.R.D.[1], Shafa S.M.R.[1], Priyadarshana P.H.M.G.C.[2]*, Gunawardena M.P.[1]

[1]*Faculty of Science, Horizon Campus, Malabe, Sri Lanka*
[2]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
*priyadarshanachathura1@gmail.com

Abstract

Wetlands represent a major part of biodiversity and provide habitat to many species which cannot succeed in other ecosystems. Man-made wetlands like Paddy fields represent a greater percentage of wetland ecosystems in Sri Lanka. However, there are only a few studies that observed the Odonata diversity in man-made wetland ecosystems in Sri Lanka. Therefore, this study was conducted to observe the effect of cultivation phases of a paddy-field ecosystem on the diversity of Odonata. The paddy culture period chosen for the study was started in June 2022 and ended in September 2022 and the study covered the Seeding, Tillering, Booting, Flowering, and Harvesting phases. Fixed-radius point count method was used for the data collection purpose and ten circular plots of 5m radius were laid maintaining a 50 m distance between two plots in the study area which had a total area of 785m^2. At all five successive stages of the cultivation cycle, the number of Odonata species and their abundance were recorded once a week in each plot. Data was recorded each day from 8.00 am to 10.00 am and from 3.00 pm to 5.00 pm. Odonata diversity was calculated separately at each of the stages of the paddy cultivation cycle using Simpson's index (D) and Shannon- wiener index (H'). According to results, 592 individuals were recorded belonging to 14 species of Odonata in 02 families. Among the total recorded species, 64% of species belonged to the family Libellulidae. Sri Lankan Orange-faced Sprite (*Pseudagrion rubriceps ceylonicum*) was the only endemic Odonata species that were recorded during the study. The overall H' and D diversity indexes were 1.71 and 0.75, respectively. Values of H' and D diversity indexes for these five stages (Seeding, Tillering, Booting, Flowering, and Harvesting) were 1.36 & 0.65, 1.59 & 0.72, 1.72 & 0.76, 1.81 & 0.79 and 1.59 & 0.78, respectively. The study revealed that among the index values of each cultivation phase, the flowering stage had the highest diversity, while the seeding phase showed the lowest diversity. Therefore, it is evident that the transformation of land use/habitat in different stages plays a major role in the diversity of Odonata. and this study can be used to depict the impacts on biodiversity due to the degradation of wetlands.

Keywords: Odonata, Paddy cultivation phases, Biodiversity, Man-made wetland

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

37

(120)

Dung Beetle Functional Diversity and Ecosystem Services (Resource Relocation) in Different Land Use Types in the Upper Walawe Basin Area

Perera P.R.M.[1]*, Kudavidanage E.P.[2], Udayakumara E.P.N.[2], Wijesekara H.[2], Lekamge D.[2]

[1]Faculty of Graduate Studies, Sabaragamuwa University, Belihuloya, Sri Lanka
[2]Department of Natural Resources, Sabaragamuwa University, Belihuloya, Sri Lanka
*rumeshikaperera00@gmail.com

Abstract

Conversion of forest habitat to different land uses will change the environmental quality of the altered land. Since the relationship between anthropogenic disturbance and animal diversity and ecosystem services emerged, much scientific research has been conducted on this aspect. The present study focuses on comparing dung beetles, a known biological indicator, on examining five diverse environs (large forests, forest patches, Pinus plantations (*Pinus caribaea*), home gardens, and tea plantations) Coprophagous beetles of the subfamily Scarabaeinae (Coleoptera: Scarabaeidae). This study examined whether dung beetles' diversity, species richness, functional groups, and ecosystem services (dung removal) vary with the habitat types. We also assumed that the intensity of anthropogenic activities varies in these habitats. The experiment was conducted for 48 hours each in five habitat types with three selected replicates per each habitat type. The Shannon-Weiner Diversity Index shows that the highest dung beetle diversity is recorded in large forest areas (2.1719). The highest species abundance (186) and richness (22) were recorded in the large forest. The lowest species abundance was recorded in tea plantations (109). The lowest species richness was recorded in pinus plantations (10). Moreover, functional group diversity is high in habitats with fewer human activities. The dominant species in large forests is *Onthophagus favrei* (dominancy index-2.9%). In forest patches and pinus plantations, *Onthophagus amphinasus* (19%) and *Paracopris signatus* (36.30%) appeared consecutively. In home gardens and tea plantations, the most dominant species is *Onthophagus unifasiatus* (26.50% and 28.40%). Habitats with anthropogenic activities have less species richness and a high dominancy index. Furthermore, dung beetle resource relocation efficiency was skewed toward forest areas. The highest dung removal percentage was recorded in forest areas (large forest-9.58% and forest patches-7.33%). The dung removal in the anthropogenic activities related to land uses was decreased as a home garden (7.17%), Pinus plantation (6.58%), and tea plantation (5.42%). Moreover, large dung beetles (body mass$\geq$0.5 g) were only recorded in large forests and forest patches. Low diversity in tea plantations could be attributed to pesticide and fertilizer usage, as beetles are highly sensitive to these chemicals. Pinus plantations showed low rates of dung removal because resource availability in those habitats is less due to the fewer mammals. These findings indicate that replacing forests and forest areas with simplified human residential areas and agricultural systems can result in shifts towards less specialized dung beetle communities with altered proportions to other animal groups.

Keywords: Scarabaeinae, Dung removal, Species richness, Species abundance, Dominance index

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

38

(124)

Spatial Distribution of Fishing Cat *(Prionailurus viverrinus)* in Selected Wetlands of Colombo Ramsar Wetland City using Camera Traps

Bandara A.M.P.W., Sigera P.S.T., Mahaulpatha W.A.D.*

Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*mahaulpatha@sjp.ac.lk

Abstract

The first wetland capital city in the world, Colombo Ramsar Wetland City (CRWC), provides a diverse array of habitat types intermixed with one another to the faunal and floral communities. In this research, the spatial distribution of Fishing Cat *(Prionailurus viverrinus)* was studied in Baddagana Wetland Park (BWP), Diyasaru Wetland Park (DWP) and Heen Ela Marsh (HEM) located within the CRWC, from June 2021 to January 2022. Annona (*Annona glabra*) woodland, mixed woodland, herb dominated high vegetation and herb dominated low vegetation habitat types were selected and camera trap stations were established providing equal trapping effort for each habitat type. Camera trap locations were selected to ensure a sufficient coverage of each wetland. Trap locations were changed every 30 days, and cameras were set to function during both day and night for 24 hours a day. A total number of 2,831 camera trap records belonging to 6 species were identified as meso-mammals. Spatial distribution was determined by the habitat preference of *P. viverrinus* and Relative Abundance Index (RAI) was used for the analysis of preference in each habitat type. It was evident that *P. viverrinus* mostly preferred Annona woodlands in both BWP (RAI, 14.4) and DWP (RAI, 12.7). However, the most preferred habitat type in HEM (RAI, 9.1) was mixed woodlands. Herb dominated high vegetation was the least preferred habitat type of *P. viverrinus* in BWP (RAI, 6.7) while herb dominated low vegetation was the least preferred habitat type in both DWP (RAI, 4.7) and HEM (RAI, 3.6). Mixed woodlands were almost equally preferred by *P. viverrinus* in all study sites and the preference of herb dominated low vegetation and herb dominated high vegetation was relatively low in all the study sites compared to other habitat types. This study suggests that the preference of *P. viverrinus* varied among different habitat types and one of the major reasons for Annona woodlands being the most preferred habitat type is that they are directly accessible to water. This increases their prey availability within the Annona woodlands, compared to the other habitat types. Thus, it is greatly important to conserve the wetland habitat types associated with water, in order to protect and conserve the *P. viverrinus* in Colombo wetlands.

Keywords: Colombo Ramsar Wetland City, Meso-mammals, Camera trapping, Biodiversity, Carnivores

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

39

(128)

Habitat Preference of Lesser Whistling Ducks (*Dendrocygna javanica*) in Selected Wetlands within Colombo Ramsar Wetland City

Mahaulpatha W.A.D.*, Sigera P.S.T., Bandara A.M.P.W.

Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*mahaulpatha@sjp.ac.lk

Abstract

Lesser Whistling Ducks (LWD) (*Dendrocygna javanica*) mostly occur in flocks and inhabit lakes, ponds and marshes within freshwater wetlands. They feed mainly on plants taken from water (seed, shoots, tuber and leaves), vertebrates (fishes) and invertebrates (mollusks and worms). In this study, habitat preference of LWD in five selected wetlands in Colombo Ramsar Wetland City (CRWC); Beddagana Wetland Park (BWP), Diyasaru Park (DP), Heen Ela Marsh (HEM), Thalangama Marsh (TM) and Kimbulawala Wetland (KW) was studied from May 2021 to April 2022 as wetlands in urban areas act as the last resort for many resident and migratory bird species and play a major role in the assemblage and conservation of water birds. Habitats present in the selected wetlands were categorized as open water body, floating vegetation, trees, grassland, paddy field, shrubs, bare land. Percentage cover of each habitat type at each sampling site were estimated using quadrat method. LWD were surveyed using line transects of 100m in length, laid in each selected study site to cover representative habitats and observations were made up to 30m towards either side of each transect. Sampling was done in three time slots of the day, morning, mid-day and evening. Floating vegetation, open water body and grassland were the preferred habitat types of *D. javanica* in BWP, DP, HEM and TM. LWD were not recorded in KW. Floating vegetation (54.97%) was the most preferred habitat by LWD in each study site followed by open water body (24.70%) and grassland (15.82%) habitat types. *Eicchornia crassipes* (Common water hyacinth) and *Salvinia molesta* (Giant salvinia) were their most preferred floating vegetation type. Higher abundance of LWD was recorded in TM (83.22%) followed by DP (9.17%), BWP (4.16%) and HEM (3.45%). TM which had higher abundance of LWD had higher floating vegetation coverage (28%) and was rich with *E. crassipes* and *S. molesta*. Present study revealed that, LWD mostly used *E. crassipes* and *S. molesta* as their main foraging and resting sites. Management of invasive alien species have been undertaken in Colombo wetlands and as *E. crassipes* and *S. molesta* are alien species they are currently being removed. Therefore, outright removal of *E. crassipes* and *S. molesta* may not be suitable and a monitored removal program that will conserve this habitat type should be implemented in order to conserve the habitats preferred by LWD in CRWC.

Keywords: Lesser whistling ducks, Wetlands, Habitat preference

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

40

(133)

Examination of Neediness of Other Effective Area-based Conservation Measures in Conservation of Threatened Migrant Birds and Breeding Residents in Sri Lanka

Samarasinghe S.S.T.

United Nations Development Programme, Colombo, Sri Lanka
sugandhi.samarasinghe@undp.org

Abstract

Sri Lanka offers habitats to 522 avifauna species at present, including 278 migrant species. Many migrant species are waterbirds and 75% of migrants depend on Sri Lankan wetlands. Sri Lanka is a party to the Convention on Biological Diversity and has legal obligations to conserve biodiversity. Except for the migratory avifauna, the bird species in schedule IV of the Flora and Fauna Protection Ordinance receive legal protection outside PAs. Sri Lanka is also a party to the Convention of Migratory Species (CMS) which holds states responsible for the protection of migrant species, however, according to the National Report–2019, No arrangements and agreements affecting migratory species changed recently, and no waterbirds are included in Appendix I. Against this backdrop, the objective of the study was to examine the appropriate and effective conservation approach. Gangewadiya area in the Lower Kala Oya Basin in Puttalam is one of the four richest waterbird regions in Sri Lanka having ideal habitat for migratory waterbirds, was selected as the study area to examine the neediness for other area-based conservation measures. The study was limited to the threatened, migratory avifauna species, and desk review, conceptual modeling, and Pressure-State-Response methods were chosen to identify and analyze threats and responses. The Biodiversity Baseline Survey Report, 2017; reported 39 Migratory Birds (M) and 142 Breeding Residents (BR) including 03 Critically Endangered (CR), 01 Endangered (EN), and 02 Vulnerable (VU) species in the study area. *Sterna nilotica Gmelin*, 1,789, *Sterna albifrons Pallas,* 1,764, and *Merops philippinus Linnaeus,* 1,766 are BR & M, CR species, not found in Appendix II of CMS. *Falco tinnunculus* is an Uncertain M, EN found in schedule IV of FFPO, while mentioned in Appendix II of CMS. *Charadrius dubius* and *Charadrius alexandrines* are BR & M, VU is identified as the Appendix II taxa for which Sri Lanka is a Range State that demands international cooperation for conservation. These threatened, migratory/breeding residents *range* not managed as PAs and are adversely impacted due to conversion of land uses, changes in salinity, hydrology, water pollution, and expansion of prawn and salt production. This poses threat to species already nationally threatened, and species called for international obligation for conservation; since disturbances in strategic points along the flyways, breeding, and wintering grounds can badly affect them. Therefore, Other Effective Area-based Conservation Measures are required to minimize the key threat to ranges of migratory birds and breeding residents of Sri Lanka.

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

41

(136)

Relationship between Tree Girth and Forest Dieback Severity in Horton Plains National Park, Sri Lanka

Fernando K.S.I.[1]*, Gunaratne A.M.T.A.[1] , Ranawana K.B.[2], Abeysundara S.P.[3]

[1]*Department of Botany, University of Peradeniya, Peradeniya, Sri Lanka*
[2]*Department of Zoology, University of Peradeniya, Peradeniya, Sri Lanka*
[3]*Department of Statistics and Computer Science, University of Peradeniya, Peradeniya, Sri Lanka*
*sanduni.fernando2018@gmail.com

Abstract

Forest dieback changes the physiognomy, structure and floristic composition of montane forests leading to deterioration of ecosystem services. Although research has been conducted to investigate the etiology of forest dieback at Horton Plains National Park (HPNP), a direct cause for this phenomenon is yet to be identified. We investigated the relationship of plant maturity with forest dieback in montane forest species at HPNP. Two sites were selected considering the dieback percentages: less than 25% crown dieback as the healthy site and more than 75% crown dieback as the severe forest dieback site. The percentage crown dieback and girth at breast height was recorded in all individuals>10 cm in both plots. The mean GBH varied significantly among different crown dieback categories in five tree species in the healthy site and four tree species in the severe forest dieback site. In the healthy site, the mean GBH of healthy *Cinnamomum ovalifolium* trees was lower than that of dead trees while in the severe dieback site, it was higher for the severe crown dieback category than the healthy and rare dieback categories. In the severe dieback site, the mean GBH of healthy *Symplocos obtusa* trees was lower than that of the medium crown dieback category, while the mean GBH of dead *Eurya chinensis* trees was higher than that of healthy and rare crown dieback categories, in the severe dieback site. Furthermore, low crown dieback percentages were recorded in *Syzygium rotundifolium, Vaccinium leschenaulti,* and *Litsea ovalifolia* with the low mean GBH. A lower mean GBH was recorded for dead individuals of *Symplocos cordifolia* than healthy individuals. More research must be conducted to understand the relationships between forest dieback and site-specific factors to ensure the success of conservation efforts in tropical montane forests at HPNP.

Keywords: Forest dieback, GBH, Plant maturity, Tropical montane forests

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

42

(143)

Garlic Extract as a Bath Treatment against *Gyroductylus* sp. in Guppy Fish (*Poecilia reticulata*)

Thusyakaanth S.*, Wijesinghe R.D.N., Bandara E.G.K.Y.C.

Department of Fisheries and Aquaculture, University of Ruhuna, Matara, Sri Lanka
*sthusy1996@gmail.com

Abstract

Parasitic infection is considered one of the major constraints in commercial fish farms owing to huge economic losses. Although there are plenty of commercial drugs available for treatments, those synthetic chemicals are more hazardous to the host and the environment than the parasite. Therefore, a special trend can be seen towards herbal medications. The present study is utmost significance as it focused on a well-known spice, Garlic (*Allium sativum*) as a bath treatment against gyrodactylosis caused by *Gyrodactylus* sp. The soxhlet extraction method was used to haul out the water-soluble compounds and the major components were identified using Thin-Layer Chromatography (TLC) techniques. During the phytochemical analysis, flavonoids, glycosides, quinones, and diterpenes were identified where the alkaloids, tannins, and phenols were absent in garlic extract. To find out the LC_{50}, values acute toxicity test was performed in 72 hours with triplicates and 802.2ppm value was resulted. 216 of infected adult guppies (2.9 ± 0.1cm, 0.32 ± 0.05 g) were used for a three-hour in vitro bath treatment with different concentrations of garlic extract including 50, 100, 150, 200, and 250 mg/L. Complete recovery from gyrodactylosis is observed by the means of microscopic observations at 3, 2.5, 2, and 1.5 h with 50, 100, 150, and 200mg/L of concentrations, respectively. According to the observations, it can be concluded that exposure to garlic extract caused the parasite to first detach from the host, then restrict its movements, and finally die. A significant negative correlation ($p<0.01$) can be observed between the garlic concentration and the eradication time. 250 ppm garlic extract bath for 0.5 hours was identified as the optimal and most effective treatment against gyrodactylosis. Therefore, garlic extract can be suggested as a herbal bath treatment against agent Gyrodactylosis infection in guppy fish.

Keywords: Bath treatment, LC_{50}, *Gyrodactylus* sp, *Poecilia reticulata*

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

43

(144)

Rhizospheric Fungal spp. of Tomato (*Solanum lycopersicum* L.) and Their Effect on Tomato Plant Growth and on *Alternaria solani,* the Causative Agent of Early Blight of Tomato

Fernando W.C.J.O.[1], Deshappriya N.[1]*, Fernando M.S.W.[2]

[1]Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Horticultural Crop Research and Development Institute, Department of Agriculture,
Peradeniya, Sri Lanka
*nelum@sci.sjp.ac.lk

Abstract

Tomato (*Solanum lycopersicum* L.) is a widely consumed crop throughout the world including Sri Lanka. Use of agrochemicals for enhanced yields and managing diseases associated with tomato results in deleterious impacts on soil microflora, fauna and leads to human health problems. A possible alternative is the use of rhizospheric microorganisms, as they are reported to improve productivity and protect various crops. Hence this study aimed to isolate rhizospheric fungal assemblages of tomato plants and evaluate their ability to solubilize phosphate while, controlling *Alternaria solani*, the causative agent of Early Blight of tomatoes. Rhizospheric fungi were isolated from commercial tomato cultivations in two agro-ecological zones (WM3b and IM2b), using soil dilution plate technique. Composite samples of soil attached to the root systems of five healthy plants, uprooted from each field were prepared and 10 g of each sample was used for the isolations. Twenty-seven fungal genera were isolated and *Trichoderma* and *Penicillium* were the frequently isolated genera. Phosphate solubilization ability of each fungal species was evaluated using Pikovskaya's agar and liquid medium, and four isolates (*Eupenicillium* sp., *Talaromyces purpureogenus*, *Paecilomyces* sp., and *Purpureocillium lilacinum*) with the highest phosphate solubilizing abilities were evaluated on tomato plant growth under greenhouse condition. The inocula of each fungal sp. were prepared by adding fifteen, 6mm diameter mycelial discs from each 5-day-old culture into polypropylene bags containing 90 g of sterile rice husk medium and incubated for 02 weeks at room temperature. Each pot contained a 4.6 kg layer of non-sieved sterilized potting medium (Sand: topsoil: Compost at 2:1:1 ratio) and a 2.5 kg layer of sieved medium on top, which was mixed with 15 g of inoculum. Three-week old, healthy tomato seedlings (variety-Bathiya) were planted (with 3 replicates) and allowed to grow with regular watering. Control pots contained potting medium with uninoculated sterile rice husk. Growth parameters such as Root and shoot lengths, fresh and dry weights of roots, shoots, and leaves were evaluated at 02-week intervals for 02 months and the results were analysed using ANOVA with Tukey's pairwise comparison. Plants treated with *T. purpureogenus* and *P. lilacinum* showed significant increases ($p \leq 0.05$) in all growth parameters in every evaluation. Dual culture plate assay on the Potato Dextrose Agar was used to test the effect of rhizospheric fungal spp. on the radial colony growth of *A. solani,* and *Eupenicillium* sp. showed the highest percentage inhibition (85.09±5.68%). Microscopic observations of inhibition zones between two colonies showed the presence of coils, loops, knobs, and haustoria, formed by inhibitory rhizospheric fungal species. Assays for Chitinase and Glucanase enzyme production showed that *Mortierella* sp.-1, *P. lilacinum, Trichoderma* sp.-1*,* and *Acremonium* sp*.* were the highest chitinase producers, whereas *P. lilacinum* was the highest glucanase producer. These results indicate the ability of some rhizospheric fungal species of tomato to increase the growth of tomato plants significantly by phosphate solubilization and ability to inhibit the growth of foliar pathogen *A. solani* under *in vitro* conditions.

Keywords: Rhizospheric fungi, Phosphate solubilization, Dual culture plate, Plant growth parameters

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

44

(163)

The Colouration in *Dicrurus caerulescens* (White-bellied Drongo) Follows the Precipitation and Temperature of the Environment

Weerakkody S.[1], Goodale E.[2, 3], Gunasekara V.R.[1], O'Brien I.[4], Bond A.[5], Seneviratne S.S.[1]*

[1]*Avian Sciences and Conservation, Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*
[2]*Guangxi Key Laboratory of Forest Ecology and Conservation, College of Forestry, Guangxi University, Guangxi, PR China*
[3]*Department of Health and Environmental Sciences, Xi'an Jiaotong-Liverpool University, Suzhou, China*
[4]*Field Museum of Natural History, 1400 S Lake Shore Dr, Chicago, United States*
[5]*The Natural History Museum, Akeman Street, Tring, Hertfordshire, United Kingdom*
**sam@sci.cmb.ac.lk*

Abstract

The variation in climatic conditions over space and time is considered a major driving force in speciation. Gloger's rule is one such rule that broadly explains the variation in the colouration of endotherms (birds and mammals) with the effects of climatic parameters. This predicts that endothermic animals tend to have darker colouration in warm and rainy climates. Here we have tried to explain the variation in the belly white colour in *Dicrurus caerulescens* (White-bellied Drongo), an overall black coloured bird with a variable white belly. The dark bellied birds are considered the subspecies *D. c. leucopygialis* found in the wetzone of Sri Lanka, and the pale bellied birds are considered *D. c. caerulescens* (found in the northern India) and *D. c. insularis* (in dryzone of Sri Lanka). A total number of 112 individuals of adult White-bellied Drongo, including field (n=23) and museum samples (n=36) from Sri Lanka (Total 59), and museum samples from India (n=45) and Nepal (n=8) which were deposited at the National Museum of Sri Lanka, Field Museum of Natural History, USA and the Natural History Museum, UK were taken into consideration. The length of the white belly was measured using a dial calliper adopting a standardized method to minimize inconsistencies. To understand how the extent of white belly varied with respect to precipitation and temperature, we adopted generalized least squares (GLS) methods accounting for spatial autocorrelation between data points. The climatic variables were extracted from the world climatic data through QGIS software. The GLS methods were carried out using the "nlme" package in the R Software for different orders of Autoregressive-moving average (ARMA) for the squared value of white belly length. To find the best fitting model, we used the Akaike information criterion (AIC) using the package "AICcmodavg" in the R. From this, we found a negative significant effect of the interaction between the temperature and precipitation for the white belly length over the studied area in ARMA (1, 1) correlation (-3.72e-01±0.022, t= -2.23, $p < 0.05$). The white belly is smaller; hence the birds are darker where there is higher temperature and precipitation. The reverse (pale belly) is true when lower temperatures and/or humidity. Therefore, this follows the Gloger's rule of becoming darker in colouration with the high rainfall and temperature in *D. caerulescens*.

Keywords: Dicrurus caerulescens, Colouration, Gloger's rule, Temperature, Precipitation

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

45

(219)

Recognition of Invasive Characteristics of *Areca triandra* Roxb. ex Buch.-Ham. (Arecaceae), an Introduced Palm Species in Sri Lanka

Wickramasinghe K.H.P.D.L.[1*], Chandrathilake G.G.T.[1], De Zoysa N.D.[2], Rajathewa R.A.M.P.M.[3]

[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Consultant Botanist, Massachusetts, USA*
[3]*Environmental Consultants, Education and Rehabilitation Organization (ECERO), Gampaha, Sri Lanka*
*diliniwickramasinghe95@gmail.com

Abstract

Areca triandra Roxb. Ex Buch-Ham native to the Southeast Asian region has been introduced to many tropical areas including Sri Lanka. Although the common occurrence of *A. triandra* is noticeable in the southwest region of Sri Lanka, there was no prior study and literature available to investigate the aggressiveness and invasive potential of this species. Therefore, the objective of this research was to identify the level of invasiveness and risk level of *A. triandra* in natural areas by (a) assessing the distribution range, (b) identifying the biological strategies for rapid colonization through a population assessment and reproductive biology assessment. An extensive literature survey was conducted to determine the distribution range of *A. triandra* in Sri Lanka. A population assessment was conducted in Meethirigala Forest Reserve (MFR) and Yagirala Forest Reserve (YFR). Mature *A. triandra* percentage, crown cover percentage, and reproductive biology assessment were conducted by establishing six 20 m×20 m plots, and *A. triandra* seedling percentage was evaluated by using twenty-four 1 m×1 m plots by covering different topographic conditions such as mid-slope and valley. To evaluate the invasiveness and risk level, a protocol for the prioritization of invasive species in Sri Lanka developed by the United Nations Development Organization (UNDP) was used. Results show that the common occurrence of *A. triandra* was noticeable in the southwest region of Sri Lanka. The abundance of mature individuals of *A. triandra* account for 57% with an average crown cover of 46% and seedlings account for 69% of the ground layer. The species thrives in locations subjected to natural and anthropogenic disturbances and the high crown cover and dominance of seedlings negatively affect the understory by suppressing native vegetation. This palm is clump-forming with 66% of plants with multiple stems. Sexual reproduction produced a large number of fruits; 150-200 fruits per infructescence and an average of 370 fruits per clump. Direct observation showed that the bright red fleshy pericarp of the fruit attracts frugivores, such as the Asian Koel and Green Imperial Pigeon. Protocol criteria evaluation has resulted in *A. triandra* being under "Alert" status with the risk level of "Moderate" for the invasiveness under natural conditions. Invasive potential with dense populations, clustering stems, high canopy cover, high fruit production, and effective seed dispersal confirms that *A. triandra* is displacing and threatening the native ecosystems. Immediate actions should be taken to control *A. triandra* populations for preventing further spread in natural ecosystems.

Keywords: *Areca triandra*, Arecaceae family, Invasive species, Frugivores, Infructescence

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

46

Biodiversity Conservation and Management

(231)

Conservation of Coastal Agriculture and Forestry–towards a Sustainable Blue Economy

Ranasinghe D.M.S.H.K.

Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka
hemanthi.ranasinghe@gmail.com

Abstract

Blue economy is an economic system or sector that seeks to conserve marine and freshwater environments while using them in a sustainable way to develop economic growth and produce resources such as energy and food. In terms of the global economy, around 90 per cent of all internationally traded goods are shipped by sea, and the market value of marine and coastal resources and industries is estimated at US$3 trillion per year or about 5 per cent of global gross domestic product. Sustainable use of ocean, seas and marine resources, as set out in SDG14, lies at the center of a sustainable blue economy. Sri Lanka's coastline is 1,340 kilometres and approximately 33 percent of Sri Lanka's population lives in coastal areas that support diverse livelihoods, from fishing to tourism to manufacturing and modern urban services. The coastal areas often provide excellent soil and climatic conditions for agriculture, which has been practiced for thousands of years and plays an important role in the economy of coastal areas. Apart from the traditional rice based farming systems it also comprise of coastal fishing and coastal aquaculture, seaweed cultivation, coconut based cropping systems, commercial cash cropping systems and homestead farming systems. With regards to forests, mangroves, coastal forests, savannah woodlands, dry forests are present in these areas. Further, coral reefs, sea grass beds, salt marshes also play an important role in sustaining the balance as together they provide habitats for biodiversity, food, shade, medicine, products for the industry, protection of the coastline and carbon sequestration. However, these ecosystems are threatened due to numerous factors; climate change (as it induces flooding, shoreline erosion, salinity intrusion, temperature rise), due to conflicting activities such as operational in these coastal areas such as infrastructure including shoreline structures (harbors, breakwaters, tourist hotels), other tourism activities, industry etc. On the face of this, these ecosystems are often in the frontline to get depleted. The habitats are also getting modified due to the increase of toxicity from both inland and marine pollution, invasion of species. Therefore more concerted effort need to be exerted for the conservation and sustainable use of the oceans, seas and marine resources if the country wants to reap the benefits of the blue economy sustainably. As oceans are shared by many countries, actions need to be taken at country, region and even global levels in the areas of regulation, technology transfer, enhancing awareness and education. A mechanism for regular monitoring is a must and this responsibility need to be shared by all the stakeholders. It is imperative to zone the coastal areas so that complementary activities will be lumped together. It is also required to strengthen the already available international agreements between the member countries such as South Asian Seas Programme, Programmes with the International Maritime Organisations, IORA (Indian Ocean Rim Association), BIMSTECH in arriving at regional policies and action plans and implementation of same with proper monitoring. The quantification of the resource is a vital step. It is also important to operationalize the Coastal Zone Management Plans in existence and declare Special Area Management Sites to ensure conservation and sustainable use of these resources.

Keywords: Coastal agriculture, Forestry, Blue economy, Sustainable development goals, Management plans

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

47

(232)

The Diet and Prey Preference of the Indian Pangolin (*Manis crassicaudata*) in a Human-Intervened Montane Landscape

Janashantha N.P.A.S.[1]*, Perera P.K.P.[1], Karawita H.R.[1], Algewattha H.R.[2]

[1]Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Department of Biological Sciences, Louisiana State University, USA
*apekshasandeepanie67@gmail.com

Abstract

Indian pangolin (*Manis crassicaudata*) is a solitary, elusive, and predominantly nocturnal mammal highly adapted to an insectivorous diet. It has become endangered due to hunting for bush meat and scales, illegal trafficking and poaching. Rescue and captive breeding programs for Indian pangolins have limited success due to the lack of understanding of the species' dietary preferences and foraging ecology. The stomach contents and prey preference of Indian pangolin have been less studied owing to the difficulty of acquiring suitable specimens. Such scientific information is unavailable, especially in Sri Lanka. In this study, we analyzed the stomach content of three (03) Indian pangolin specimens collected from human-intervened montane landscapes in the Kandy District, thus allowing a deeper understanding of the Indian pangolin's foraging ecology in a specific habitat. Stomach content analysis revealed that a greater proportion of the pangolin diet consists of grit which was 96.13% of the average dry mass (DM%). Plant matter (pieces of twigs, leaf particles, stems and barks) was least present, which was 0.26% of the average dry mass percentage. The plant matter is likely to be ingested while praying on arboreal insect nests, insects living under barks, and decaying logs. Insect matter consisted of ants, termites, their body parts, and wings which were 1.84% of the average dry mass and insect eggs accounted for 2.83%. A total of 13 ant species belonging to 05 subfamilies and 02 termite species of the same subfamily were identified in the stomach contents. Insect species representing terranean, subterranean, semi-arboreal and arboreal habitats were found in the stomach content. Approximately 13.97% of the insect matter belonged to the species in the terranean foraging layer, while sub-terranean, semi-arboreal and arboreal species accounted for 19.53%, 64.58% and 1.59% respectively. Accordingly, it appears that Indian pangolin in the studied montane landscape predominantly feed on semi-arboreal insects. The study further provides detailed insights into the prey preference and foraging ecology of the Indian pangolin in the montane landscape.

Keywords: Indian pangolin, Stomach content, Foraging ecology, Prey preference

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

48

(9)

Management of Free-floating Aquatic Weeds by Making Compost and Testing its Efficacy against Root-knot Nematode on Tomato

Samaraweera, I.D.D.J., Pakeerathan, K.*, Aruchchunan, N., Mikunthan, G.

Department of Agricultural Biology, University of Jaffna, Jaffna, Sri Lanka
*pakeerathank@univ.jfn.ac.lk

Abstract

Aquatic weeds are one of the prime pollution causing agents in fresh water bodies of Sri Lanka. In Sri Lanka, free-floating aquatic weeds such as *Salvinia molesta*, *Eichhornia crassipes*, *Azolla* spp and *Pistia stratiotes* are proliferating quickly and invading rapidly to new water bodies where threatening biodiversity by impeding light penetration and altering BOD and COD of the waterbody. This research was aimed to manage the aquatic weeds by composting and testing its efficacy on root-knot nematodes. Aquatic weeds were collected, mixed with fresh cow dung in 1:1 ratio and allowed for decomposition for 21 days. The recommended dose of prepared different compost was applied to tomato along with garden compost as control. The experiment was conducted in Complete Randomized Design (CRD) with four replicates. The data on nutritional qualities of the compost, plant growth parameters, and gall index were recorded. The data were subjected to ANOVA using SAS 9.1 and Tukey's HSD multiple comparison test was used to determine the best treatment combination at $P<0.05$. Total Nitrogen (N) content of composts were ranging from 1.42% to 5.6%. The highest significant N value of 5.6% was recorded in the *Azolla* spp based compost whereas the lowest N value of 1.42% was recorded in control. The highest total Phosphorus (P) content of 3.47% was observed in *P. stratiotes* based plant sample, whereas the lowest P value of 1.32% was recorded in the *E. crassipes* based compost. The total Potassium (K) content of this plant sample ranging from 1.3% to 24.4%. The highest K value of 24.4% was recorded in *P. stratiotes* based compost. The lowest K content of 1.3% was observed in control. Significantly higher shoot height (37.57 cm, 36.53), root length (18.75 cm and 17.5 cm), lower gall index (3.5,1.0), lower goal length (1.5 mm and 1.2 mm) and lower goal diameter (0.95 mm and 0.8 mm) were recorded in the application of *S. molesta* and *Azolla* spp based compost, respectively ($P<0.05$). Considering superiority of N, P and K level, and nematode suppressing efficacy, *S. molesta* and *Azolla* spp. based composts are superior than other composts. Therefore, findings conclude that the compost made from aquatic weeds are good source of plant nutrition, and can be substitute to chemical nematicieds to manage the nematodes in organic agriculture. Extensive field studies are needed for recommendation

Keywords: Aquatic weeds, *Azolla* spp., Compost, Root-knot Nematode

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

49

(23)

Testing the Biodegradability and Biodegradation Rate of Bio-based Film Products in Composting Environment

Senadheera S.K.M.S.[1], Gamage N.S.[2], Jayaweera C.D.[1]*

[1]*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Environmental Management and Assessment Division, Central Environmental Authority, Battaramulla, Sri Lanka*
*dangolle@sjp.ac.lk

Abstract

Bio-based film products have a considerable interest as a replacement for petroleum synthetic polymers of plastics. They are manufactured with a blend of corn starch such as Poly Lactic Acid (PLA) and Poly Butylene Adipate-co-Terephthalate (PBAT) based raw materials that have been specifically engineered to facilitate the process of biodegradation and compost ability. Hence, biodegradable polymers have been regarded as a promising solution to tackle the pollution caused by the wide use of conventional polymers. As the main responsible institute for integrating environmental considerations into the country's development process, the Central Environment Authority of Sri Lanka has taken an action to ban food wrappers (lunch sheets) made from conventional polymers in Sri Lanka. Thus, this study was to determine the biodegradability of bioplastic materials lunch sheets, available on the Sri Lankan market that are labeled as 100% biodegradable but not certified as compostable. The other specific objectives are to identify the biodegradability rate of each brand of lunch sheets, categorize those lunch sheets according to their biodegradability and finally get an idea to determine the optimum conditions for the biodegradation of a bio-based lunch sheet. In this study, the test was carried out in a controlled composting environment located in Gampaha–Dompe Green Park. Three different brands of biodegradable bio-based film products were tested together with cellulose paper as the positive control and nonbiodegradable lunch sheet (LDPE) as the negative control. The project length was 15 weeks. Samples were placed into frames which are made of wooden slats as width=280 mm, length=340 mm and height=50 mm and a 1x1 mm polyethylene mesh was fixed onto the frames. The methodology adopted was based on the study conducted in the Czech Republic in 2016. The emphasis was put on discovering whether bio-based film products are biodegradable or not. The biodegradability of each bio-based film product was tested using Visual inspection; the decomposed samples were inspected visually comparing with initial samples, Weight loss measurement; the initial weight and the weight after decomposition were measured using an analytical balance, FTIR and TGA analysis. Furthermore, the quality of the compost was analyzed using quality parameters such as pH, electrical conductivity, moisture, organic carbon%, nitrogen%, phosphorous%, potassium%, C/N ratio and S. The visual inspection of Sample C revealed large cracks and porous structure than Sample A and Sample B. Positive control was completely digested and the negative control stayed as it is. According to the weight loss measurement analysis, the positive control totally degraded and degradation order was Sample C>Sample A>Sample B. The TGA only suggested a partial degradation of samples. FTIR analysis indicated that the positive control was totally biodegradable, Sample B and sample C partially biodegradable and Sample A and negative control were not biodegradable. Based on the results it can be concluded that bio-based film products have not decomposed completely but their color, texture changed. Sample B exhibited the highest degradation rate and exhibited a high degree of decomposition. The degradation rate can be summarized as Positive control>Sample B>Sample C>Sample A> Negative Control respectively. The main conclusion from this study is that the biodegradation of bioplastics materials strongly depends on both the environment in which they are placed and the chemical nature of the material.

Keywords: Biodegradation, Biobased film products, Composting environment

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

50

(27)

Public Opinion Survey on the Status of Waste Management in Sri Lanka

Ariyasingha U.D.H.P.

Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka
hasinipramodya97@gmail.com

Abstract

Solid waste and wastewater management is a critical issue in Sri Lanka. Self-administered 18 questions were used for primary data collection covering 1,158 responses within 25 districts randomly. Age groups of the respondents and their contribution (as a percentage) for the survey were; below 18yrs (3.01%), 18-30yrs (90.59%), 30-45yrs (3.17%) and above 45yrs (1.90%). Among the respondents; 75.09% were undergraduates, 8.89% were employed, 6.13% were school students and, 5.76 were in other institutes of higher education. The time period of the survey was from 20th July 2021 to 6th August 2021. Survey was carried out using online platform (google forms). Questioner was developed to acquire information related to; solid waste, water quality (using taste as a parameter), waste disposal, disposal methods, type of wastes collected, were obtained. This was not merely a household survey, but included waste management done by Municipal councils as well. The objectives of this survey were; to find the quality of water in each area of Sri Lanka, to get an idea about household wastes and the availability of methodical waste disposal facilities, and to obtain ideas from the respondents. According to the data obtained from the survey, 83.77% of the respondents claimed that the consumed water doesn't contain hardness. Also, 56.30% respondents reuse household wastewater while 54.58% respondents dispose of less than 1kg of waste daily. Open dumping areas don't exist for 78.93% of the respondents, 56.39% of the respondents were aware of land-filling but 8.98 % thought that landfill process was not a good solution for garbage disposal. The disposal of non-degradable wastes to the environment was 50.07%. Burnt and open dumping percentages of household wastes were 34.54% and 10.47% respectively. Waste collection by the municipal councils does not happen systematically according to 55.01% respondents. Garbage recycling centers do not exist for 69.34% respondents. The survey showed that knowledge of waste disposal methods and environmental impacts must be improved. Awareness programs have to be conducted to acknowledge the community. Solutions from the respondents included establishing more sanitary land-filling facilities in necessary areas. Encouraging recycling of waste among the communities by conducting awareness programs about recycling companies that buy separated wastes like plastics, papers, glasses etc. which would provide an additional income.

Keywords: Solid waste, Wastewater, Disposal, Land-filling, Garbage

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and
Environmental Science, University of Sri Jayewardenepura, Sri Lanka

51

(30)

Comparison of Filter Media for Wastewater Treatment by a Prototype Trickling Filter

Selvanayagam A.[1], Samarakoon D.[2], Samaraweera M.D.S.[1], Wijetunga S.[1]*

[1]*Department of Agricultural Engineering, University of Ruhuna, Matara, Sri Lanka*
[2]*Janathakshan Gte Ltd, Kirulapone, Colombo, Sri Lanka*
*swije@agri.ruh.ac.lk

Abstract

The microbial process of wastewater treatment, attached growth, has significantly improved during recent years. Different filter media are used for microbial attached growth in trickling filters (TF) in the world. One of the main functions of filter media is the high surface area for the attachment of microorganisms to grow. Major wastewater treatment plants use stones as a medium for increasing the surface area in TFs. The proper grade of stone could not always be found within a reasonable distance from the wastewater treatment plant sites, significantly increasing transportation costs. Low-cost substitute materials, instead of stones, can reduce the cost of TF while increasing their treatment efficiency. This study attempted to use crushed waste polythene as a low-cost substitute material for stones. The objectives of this study were to evaluate the performance of prototype TF with crushed waste polythene and; to compare the treatment efficiency of two prototype TFs (with stone and with crushed waste polythene). Two prototype TFs were prepared using plastic barrels (250L) with two types of filter materials. The flow rate of the filters was 922mL/min and trickling filters were evaluated for two months for treatment efficiency. Water samples were taken before and after the trickling filter to determine the treatment efficiency. During the process of trickling filters, COD removal appeared to increase and it may be due to the adaptation of microbes to the new environment. The COD removal was comparatively higher in trickling filters with crushed polythene (62%) than in stones (42.6%). Almost similar results of pH and EC were found in both trickling filters. Total solids in treated wastewater were also almost similar in the two trickling filters. Based on the results of this study, it can be concluded that crushed polythene is a good alternative for stones in trickling filters.

Keywords: Crushed polythene, Filter material, Stone, Trickling filter, Wastewater

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

52

(32)

Study of BOD: COD Ratio as an Indicator for Wastewater of Rubber Industry Sector

Jayasinghe J.A.W.W.[1*], Kiriella K.G.T.N.[1], Jayarathne L.[2], Priyadarshani C.[1], Shiromani M.K.S.[1], Rajapakshe R.M.A.O.A.[1]

[1]*Central Environmental Authority, Kegalle, Sri Lanka,*
[2]*National Institute of Fundamental Studies, Kandy, Sri Lanka*
*wethmawishwajee9@gmail.com

Abstract

When considering the rubber industry sector, the most significant challenge is the efficient wastewater treatment before discharging it into the natural environment. The rubber industry is considered to be highly chemical and water-intensive: and involves enormous quantitative s of waste production. The ratio between Biological Oxygen Demand (BOD5) and Chemical Oxygen Demand (COD) is a widely used parameter in characterising wastewater and then the same was used in this study as an indication to measure the efficiency of wastewater treatment plant operated in the rubber industry sector. Data for the study was extracted from samples collected from 10 wastewater treatment plants of rubber industries in the Sabaragamuwa Province; two samples from each representing before and after treatment. The samples were tested in two replicated for BOD5, COD, pH, and conductivity. These selected rubber factories contain lagoon/pond type wastewater treatment systems or activated sludge wastewater treatment systems. The results showed that the treated wastewater samples were within the range of 0.1–0.4 of BOD5: COD and were below the BOD5: COD permissible level as per CEA standards. (General standards for rubber in inland surface waters; Latex-BOD 60, COD 400; Lanka rubber/crepe rubber–BOD 50, COD 400) comparing the BOD, COD, pH, and conductivity influent and effluent of the treatment process proves the effectiveness of each treatment plant of the relevant industry. Tested samples show a high BOD5: COD ratio in influent and effluent of wastewater treatment system indicate that wastewater of the industry is easily biodegradable. However, more research comparing the characteristics of different rubber manufacturing processes is needed to develop this approach further.

Keywords: BOD, COD, BOD: COD ratio, Wastewater treatment plant

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

53

(69)

Life Cycle Assessment of Conventionally and Organically Grown Pineapple in Gampaha District

Gunawardena M.A.*, Lokupitiya E.Y.K

Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*amrithagunawardena@gmail.com

Abstract

Pineapple is one of the major commercial fruits grown in Gampaha and Kurunegala districts of Sri Lanka. Most cultivations are under conventional practices which generate significant environmental impacts while there are few organic cultivations (~1%). There is lack of published on the environmental impacts related to cultivation of pineapple in Sri Lanka. This study therefore aimed to quantify and compare environmental impacts of conventionally and organically grown pineapple in Gampaha District. Environmental impacts were compared using Life Cycle Assessment (LCA) tool which evaluates the potential environmental impacts throughout the life cycle of a product or a process. According to ISO 14040:2006 and ISO 14044:2006 guidelines, LCA methodology has four main phases such as goal and scope definition, life cycle inventory analysis (LCI), life cycle impact assessment (LCIA), and life cycle interpretation. The system boundary for the study was from cradle to farm gate. All the environmental impacts were estimated for a functional unit of one tonne of pineapple. Primary data for the LCA was gathered using a pre-tested structured questionnaire conducted among twenty conventional- and six organic farms. Input and output inventories were prepared during LCI phase. Under LCIA phase, impact categories such as global warming potential (GWP), eutrophication, human toxicity, terrestrial ecotoxicity, and freshwater ecotoxicity were considered. Results indicated that conventional cultivation system has significantly higher impacts compared to the organic cultivation system. Global warming potential of conventionally cultivated one tonne of pineapple was 182.23 kg CO_2 eq. It was 26.72 kg CO_2 eq for organic cultivation indicating 7 times lower impact. Eutrophication potential was 6.63 kg PO_4^{3-} eq for conventional cultivation while that for organic cultivation was 0.81 kg PO_4^{3-} eq (8 times lower). Pesticide use has resulted in 2,279.12 kg 1,4 DB eq of human toxicity, 18,331.71 kg 1,4 DB eq of freshwater ecotoxicity and 1,624,494.37 kg 1,4 DB eq terrestrial ecotoxicity for conventional cultivation while organic cultivations have resulted in no toxicity. The results highlight significant contribution of synthetic fertilizers and pesticides towards all five impact categories of the LCA. The results could provide implications for promoting organic cultivation in order to reduce the impacts on the environment in the long run.

Keywords: Life cycle assessment, Pineapple, Conventional cultivation, Organic cultivation, Environmental impacts

Proceedings of the 27ʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

54

(74)

Eichhornia crassipes Leaves as a Waste-derived Bio-Sorbent to Remove Organics and Nutrients from Rice Mill Wastewater

Farwin A.F.S.*, Pratheepkumar M., Devaisy S.

Department of Bioscience, University of Vavuniya, Vavuniya, Sri Lanka
*shaheekafarwin015@gmail.com

Abstract

The increased rate of population growth resulted in the increased number of rice mill industries to fulfill the demand for rice. The rice mill wastewater contains a high load of organics and nutrients. Therefore, the direct discharge of wastewater into the environment may degrade the quality of the environment as well as causes adverse effects on human health. Among various methods to treat waste effluent, bio-sorption is a cheap and environmentally sound approach. *Eichhornia crassipes* is a noxious weed that spreads rapidly. Most of the tanks in Vavuniya are polluted by *E. crassipes* and it needs a sustainable solution. This study uses the leaves of *E. crassipes* to produce waste-derived bio-sorbent to treat rice mill wastewater. The wastewater was collected from one of the rice mills in the Vavuniya town area. The adsorption isotherm and adsorption kinetics experiments were conducted to find out the removal efficiencies of COD, nitrate, and phosphate from wastewater. The effect of the dosage of bio-sorbent (1-6 g/L) and the contact time (30-180 min) with the wastewater was studied to determine the optimum dosage and optimum contact time. The bio-sorbent showed maximum removal efficiencies of COD (54.5%), nitrates (58.1%), and phosphates (29.5%) at the optimum dosage of 4 g/L at 120 min. Based on the t-test, *E. crassipes* leaves significantly reduce COD, nitrate, and phosphate (p-value<0.05). However, COD and nitrate showed higher removal rates than phosphate. Further, long-term column studies should be conducted to apply the above technique in wastewater treatment plants in treating the rice mill wastewater in the real world. This study emphasizes that *E. crassipes* leaves have the potential to remove contaminants from wastewater as well as this would also help to minimize the spread of the weed to safeguard the environment.

Keywords: *Eichhornia crassipes*, Bio-sorption, Vavuniya tank, Water quality

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

55

(82)

Bacteria-based Sodium Alginate Formulation to Control Toxic *Microcystis* Blooms

Randima G.W.A.P.[1], Masakorala K.[1], Yapa Y.M.A.L.W.[2], Widana Gamage S.M.K.[1]*

[1]*Department of Botany, University of Ruhuna, Matara, Sri Lanka*
[2]*Department of Chemistry, University of Ruhuna, Matara, Sri Lanka*
**shirani@bot.ruh.ac.lk*

Abstract

Cyanobacterial bloom formation in freshwaters is a major socio-economic and health concern across the globe. Presently used chemical and physical control strategies are inefficient in complete removal of blooms and chemical application often lead to secondary pollution in water. Hence, the current study aimed to develop a bacteria-based formulation to control toxic bloom-forming *Microcystis aeruginosa* in freshwaters. Two bacterial strains, *Exiguobacterium acetylicum* and *Pseudomonas* previously isolated from Sri Lankan freshwaters and characterized for *M. aeruginosa* cell lysis and their microcystin (MC) toxin degradation were used in the study. Initially, suitability of bacterial strains to develop into solid formulations was evaluated through biofilm formation, antibiotic sensitivity and strain compatibility. Both strains formed biofilms on the surface of microtiter plates indicating their ability to attach and colonize on solid surfaces. The multiple antibiotic resistance indices for both strains were below the threshold risk level (0.2) against the seven tested classes of antibiotics. This result indicates that there is a low risk in introducing these bacterial strains to the natural environment. Further, plate assay showed that the two strains were compatible to stay together showing no antagonistic effect on the growth of each other. Having fulfilled all three criteria tested, the two strains were immobilized into beads (~5 mm) prepared from sodium alginate at 1:1 ratio of 1×10^8 cells/mL bacterial inoculum. Different weights (1.0, 2.0, 3.0 g) of bacteria-immobilized beads were enclosed in sachets made with Cambrella synthetic fabric. They were introduced to *M. aeruginosa* grown in BG-11 medium (OD=0.2, 730 nm) and kept at 26 °C. During incubation, growth stimulation of *M. aeruginosa* was visually observed in 1.0 and 2.0 g beads-containing cultures, whereas, gradual discoloration of colonies was observed with 3.0 g of beads. Microscopic observations also proved complete disintegration of *M. aeruginosa* colonies and lysis of cells in discolored cultures. After 15 days, *M. aeruginosa* cell lysis was estimated as a measure of chlorophyll degradation. The highest (8.4%) cell lysis was observed in cultures containing 3.0 g of beads. This indicates that bacteria cell lysis activity depends on the load of bacteria-immobilized beads. Degradation of MC toxin was estimated by enzyme-linked immunosorbent assay. The highest (57.6%) MC degradation was observed in cultures with 3.0 g of beads after 15 days of incubation. The efficiency of bacteria release from beads was tested by placing sachets in sterilized water. At 15 days, bacterial count in water was x10^7 CFU/mL, with all loadings of immobilized-bacteria indicating highly efficient bacteria release from the formulation. In conclusion, this study highlights that bacteria-based sodium alginate formulations can be made as a source of inoculum to control *M. aeruginosa* growth and MC degradation.

Keywords: Bacteria-based formulations, Cell lysis, *Microcystis* blooms, Microcystin

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

56

(87)

Microplastic Bioaccumulation in Selected Finfish Species Harvested from Northwest Coastal Waters, Sri Lanka: A Potential Risk to Human Health?

Kandeyaya K.B.K.D.K.[1], Ranatunga R.R.M.K.P.[1,2]*

[1]*Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Centre for Marine Science and Technology, Department of Zoology,*
University of Sri Jayewardenepura, Nugegoda, Sri Lanka
**ranatunga@sci.sjp.ac.lk*

Abstract

The widespread bioavailability of microplastics (MP) in the marine environment has upraised intense interest over the last few decades. However, MP trophic transfer via appetizing portions of marine organisms remains less recognized. Therefore, the present study looked at bioaccumulation potential of MPs investigating four common edible finfish species; *Sardinella gibbosa, Stolephorus commersonnii, Hemiramphus archipelagicus,* and *Katsuwonus pelamis* representing different trophic levels from Northwest Coastal waters. In the experimental protocol, the wild-caught finfish samples were analyzed considering their edible (muscle) vs non-edible (gastrointestinal (GI) tract and gills) tissues. The structural characteristics of MP materials were screened by stereomicroscope whereas elemental composition using Fourier-Transform Infrared spectroscopy. Amongst all the studied samples, around 96% exhibited MP contamination in the size range of 0.06 mm-0.11 mm. Fibers, fragments, and films were the prominent MP types detected while Polyethylene, Polypropylene, Polystyrene, and Nylon-6,6 were the polymeric substances extensively recorded. *K. pelamis* and *S. commersonnii* displayed the highest (1.1 ± 0.54 MP/g) and lowest (0.1 ± 0.02 MP/g) mean MP levels in edible portions, respectively. The MP quantities extracted from gills, GI tract, and flesh of each sample were significantly different ($p<0.05$), thereby Pearson correlation test results implied the GI tract as the major possible exposure route of higher trophic finfishes while gills act as the key direction of filter feeders. Parametric One-way ANOVA test indicated that the trophic transfer interactions in the studied finfish food chains were significant ($p<0.05$) at 95% level of confidence. Trophic Magnification Factors (TMF=2.347, 3.449) and Biomagnification Factors (1<BMF) of examined food chains signified that MPs are conceivably biomagnified in edible parts of marine food webs even though the contamination in edible tissues was significantly lower than that of non-edible shares as per the Two sample T-test and Mann-Whitney tests. Therefore, the findings advocate that trophic transfer denotes an oblique, yet possible key pathway of MP ingestion for any individual who depends on seafood diets habitually. Since the MPs magnification could possibly ensure the trophic dilution. However, considering the physical and chemical toxicities and associated contaminants of MPs, there is a necessity for further studies assessing the human susceptibility to MP-related hazards via the routine consumption of seafood. Addressing this gap which implies with food safety and pollution control is a vital primacy due to the nutritional value of seafood consumption.

Keywords: Microplastic, Trophic transfer, Biomagnification, Seafood

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

57

(96)

Ammonia Capturing Capacity of Biochar and Kaolinite

Perera A.J.S.L., Atapattu N.S.B.M.*

Department of Animal Science, University of Ruhuna, Matara, Sri Lanka
*nsbm@ansci.ruh.ac.lk

Abstract

Emission of ammonia from poultry litter has numerous negative impacts on poultry, poultry house workers and the environment. When applied as a litter amendment, acidified biochar (ABC) and Kaolinite are reported to lower the emission of ammonia. Apart from reducing ammonia formation, both amendments have a capacity to capture ammonia before being released into the environment. However, capacity of those materials to capture ammonia has not been estimated. The objective of this study was to determine the ammonia capturing capacity of ABC, kaolinite and three different mixtures of them; 75% Kaolinite and 25% ABC, 50% kaolinite and 50% ABC and 25% kaolinite, 75% ABC. Each of the five amendment mixture was tested in five separate completely randomized design experiments. Poultry litter samples were incubated in ten sealed-conical flasks; each fitted with flexible tubes through which emitting ammonia was conveyed to another sealed-flask containing either a known weight of amendment (five replicate flasks) or Styrofoam; control (five replicate flasks). The weight of the amendment or Styrofoam was adjusted to have same volume of material in flasks. A flexible tube originating from the second flask was connected to another sealed-flask containing a boric acid solution so that ammonia that has not been captured by the amendment or Styrofoam in the second flask is captured. A set of tubes originating from each of the ten boric acid flasks were fitted to a vacuum pump.N content, pH, dry matter percentage of the litter before and after the incubation and the amount of N captured by the boric acid were determined. The difference between N released and that captured by the boric acid solution was considered to be captured by the material added to the second flask. Though assumed to have no capacity to capture ammonia, in all five experiments, Styrofoam reported significantly higher ammonia capturing capacity compared to respective amendments. Ammonia capturing capacity of Styrofoam was as high as 1.24g/100g/hr while that of ABC and Kaolinite were 0.40g/100g/hr and 0.14g/100g/hr, respectively. In all five experiments, the percentages of ammonia captured (of the total released during incubation) were not significantly different between tested amendments and the Styrofoam. Percentage capture of ammonia by ABC, Kaolinite and Styrofoam were 91%, 83% and 84%, respectively. The study concludes that acidified biochar, Kaolinite and Styrofoam have capacity to capture ammonia releasing from poultry litter. Further studies are needed to understand the nature of capturing.

Keywords: Ammonia, Biochar, Kaolinite, Litter, Poultry

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

58

(99)

Influence of Biochar on Plant Uptake of Personal Care Products: Caffeine and Triclosan

Keerthanan S.[1], Jayasinghe C.[2], Vithanage M.[1]*

*[1]Ecosphere Resilience Research Center, Faculty of Applied Sciences,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Department of Food Science and Technology, Wayamba University, Gonawila, Sri Lanka
* meththika@sjp.ac.lk*

Abstract

The use of personal care products (PCPs) extends a person's longevity. Nonetheless, because of its uncontrolled burden on the environment, it is regarded as an emerging contaminant. The goal of this research is to determine the influence of cinnamon wood biochar (CWBC) on plant uptake of caffeine (CFN) and triclosan (TRI) from the soil. Ipomeoa aquatica was cultivated for 4 weeks in soil with a 2.5% CWBC amendment and spiked with 100 mg/kg CFN and 200 mg/kg TRI. Ultra-High-performance liquid chromatography (UHPLC) was used to quantify the CFN and TRI in the plant. The surface morphology of CWBC was investigated by scanning electron microscopy (SEM) and Brunauer–Emmett–Teller (BET) surface area. The gasification of biomass which increased the CWBC's surface area to 589 m^2/g, due to the development of a porous structure. The CFN accumulated more in the shoot of the plant whereas TRI accumulated in the root. The addition of 2.5% CWBC significantly ($p<0.05$) decreased the root and shoot accumulation of CFN by 40.4% and 70.9%, whilst those for TRI by 38.9% and 19.9%, respectively. The relative bioconcentration factors (RBF) of CFN and TRI in shoot and root was calculated by the ratio of bioconcentration factor (BCF) using RBF= 〚BCF(CWBC amended soil)∕ 〚BCF_soil and the results suggested that the addition of 2.5% CWBC decrease the RBF below the one indicating the effectiveness of CWBC towards mitigating the plant uptake of PCPs. Overall, the present study suggested the application of biochar to soil significantly decreased the plant uptake of PCPs, thus, can reduce the potential risk caused by the unintentional consumption of contaminated vegetables.

Keywords: Personal Care Products, Soil amendment, Health risk, Plant uptake

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

59

(108)

Evaluation of the Textile Dye Decolorization Potential of Native Bacterium *Alcaligenes faecalis* and its Dye Decolorization Pathway

Ekanayake M.S.[1, 2], Wijesekara I.[3], Manage P.M.[2,4]*

[1]*Department of Aquaculture and Fisheries, Wayamba University, Gonawila, Sri Lanka*
[2]*Centre for Water Quality and Algae Research, Department of Zoology,*
University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[3]*Department of Food Science and Technology, University of Sri Jayewardenepura,*
Nugegoda, Sri Lanka
[4]*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*

Abstract

Textile industries, which use two-thirds of the world's synthetic dyes, are one of the most significant sources of water pollution, releasing vast quantities into the environment. The expense of traditional physico-chemical treatment methods is considerable and produces secondary pollutants. As a result, this study aimed to isolate, identify, and optimize textile dye decolorizing bacteria to treat textile dyes in an environmentally friendly manner. Water and soil samples were collected from textile wastewater effluent sites in Sri Lanka and enriched for 14 days with a 50 mgL^{-1} dye mixture of CI Direct Blue 201 (DB 201), Cibanone yellow, Maxilon Blue, Cibacron Blue, and Vat Green dyes. The textile dye decolorization potential of pure bacterial isolates with various morphological traits was evaluated using DB 201 as the model dye. The overnight grown bacterial inoculum was equalized (A590=0.35) and added to the filter-sterilized DB 201 dye (5% v/v) for 14 days of incubation. Decolorization was calculated by measuring the changes in absorption through a UV-Vis spectrophotometer. The dye decolorization pathway was evaluated using bio-sorption and enzyme activities (Tyrosinas, Laccase, Lignin peroxidase, Manganese peroxidase, and Azoreducatase). Using DEAE and Sephadex, the responsible enzymes were partially purified and verified through SDS PAGE. Out of 228 bacterial isolates, *Alcaligenes faecalis* (MK166784) was identified as the most potent strain, which showed complete decolorization of DB 201 dye within 72 h in the temperature range 28 to 40 ^{o}C, pH 7-8 and static conditions, while controls remained unchanged. An extracellular enzyme, Azoreductase, showed significant enhancement (8.183±0.800 $Umin^{-1}mg$ protein^{-1}) after dye decolorization, compared to the control maintained without the dye (1.32±0.401 $Umin^{-1}mg$ protein^{-1}). Partially purified Azoreductase (32% yield) was further confirmed via bands around 37-50 kDa in SDS PAGE. Less than 2% of dye removal was detected in the biosorption assay. Additionally, FTIR spectra and seed germination assays (using *Oryza sativa* and *Vigna radiata* showed that *A. faecalis* degraded and detoxified DB 201 successfully. Consequently, the present study focuses on the influence of *A. faecalis* on textile dye decolorization and future directions for developing *A. faecalis*-azoreductase enzyme-based textile dye treatment methods.

Keywords: *Alcaligenes faecalis*, Textile dye, Decolorization, Azoreductase

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

60

(110)

Enhanced Crystallinity of MIL-53 (Fe) and Improved Pb^{2+} Ion Removal by MIL-53(Fe) in the Presence of TiO_2

Perera H.A.I.R.*, Warnapura A.G.S.M.

Department of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka
*ishanieperera@sci.pdn.ac.lk

Abstract

Water pollution due to improper disposal of various contaminants is one of the most serious threats faced by living beings all around the world. Lead (Pb) is a heavy metal which is commonly added to the environment by the industries such as battery manufacturing, paints etc. According to the world health organization, the maximum bearable Pb concentration of the human body is 70 μg dL^{-1}. However, in a contaminated water sample, this value could range from 200 to 500 mg L^{-1}. Thus, the efficient removal of heavy metals from contaminated water is vital. Among various removal techniques available, adsorption plays a major role due to its high efficiency, low cost and ease of designing. MOFs are a class of crystalline porous adsorbent material that consists of a metal ion/cluster and an organic linker. Owing to their tailoring ability, high porosity, and high surface area they have been widely used in the removal of contaminants from wastewater. The main objectives of this study are to synthesize MIL-53 (Fe) MOF and MIL-53/TiO_2 composite and determine the Pb (II) removal efficiency under light and dark conditions. MIL-53 (Fe) MOF was synthesized using iron (III) and 1, 4-dicarboxylic acid under solvothermal conditions. The composite was synthesized similarly in the presence of TiO_2 nanoparticles. The successful synthesis of MIL-53 (Fe) MOF and MOF/TiO composite was confirmed by powder X-ray diffraction and Fourier-transform infrared spectroscopy. By the Debye−Scherrer equation, 79.06 nm and 65.46 nm of crystallite size were obtained by the MOF and the MOF/TiO_{22} composite. Atomic absorption spectroscopy was used to determine the metal ion concentration before and after adsorption. The optimum conditions for the Pb(II) removal are as; 50 mg L^{-1}, 25 mg L^{-1} initial Pb ion concentration, 10 mg, 12.5 mg of adsorbent dose (for 25 ml of 50 mg L^{-1} Pb (II)) and 90 min, 90 min contact time for both adsorbents at light and dark conditions respectively. The pH of the solution was kept at a neutral level to ensure the reusability of wastewater after the removal of pollutants. The adsorption isotherms of both adsorbents were well fitted with the Langmuir model indicating the monolayer adsorption. Thus, at pH 7, 396.35 mg g^{-1} and 786.16 mg g^{-1} of maximum Pb (II) adsorption capacity were obtained by the MOF and the MOF/TiO_2 composite respectively. Thus, a significant improvement in the Pb (II) ion removal was observed with the composite compared to the MOF.

Keywords: Adsorption, Heavy metal, Isotherm, MIL-53 (Fe)

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

61

(114)

Determining Formaldehyde Phytoremediation Efficacy of Selected Ornamental Plants

Premadasa M.D.P.P.[1]*, Caldera, H.I.U.[1], Kaumal, M.N.[2]

[1]*Department of Plant Sciences, University of Colombo, Colombo 03, Sri Lanka*
[2]*Department of Chemistry, University of Colombo, Colombo 03, Sri Lanka*
*piyumiiideli@gmail.com

Abstract

In the recent past, deterioration of indoor air quality has become a serious concern due to the increased energy efficiency and reduced air exchange rate inside urban buildings. Volatile organic compounds (VOCs) are a major category of indoor air pollutants that can lead to adverse health outcomes such as headaches, allergies and asthma in those exposed for prolonged periods. Formaldehyde, the VOC used in the present study is a common contaminant of indoor air which originates from particle board, plywood, paper products, certain adhesives, tobacco smoke and other sources. The use of plants for the mitigation of indoor air pollution is viewed as a cost effective and eco-friendly method with untapped potential. The main objective of the present study was to determine the formaldehyde removal efficacy of selected plant species while investigating the mechanisms used by these plants in the removal process. The selected plant species were *Zamioculcas zamiifolia*, *Hedera helix*, *Dracaena sanderiana* and *Ficus* sp. Plants of the same age were used with three replicates from each species. Phytoremediation potential was assessed by exposing the plants for 24 hours to gaseous formaldehyde ($2.0 \, \mu L \, L^{-1}$) in air tight chambers made of Plexiglass (an inert material for VOCs) with dimensions of 0.9 m height×0.58 m length×0.55 m width. Formaldehyde removal was measured using GC-MS and the result was expressed as removal percentages. Several leaf anatomical characters (cuticle thickness, epidermal thickness and mesophyll layer thickness), stomatal characters (stomatal density, stomatal index, guard cell length and potential conductance index) and physiological characters (stomatal conductance and photosynthetic rate) were measured to study the possible mechanisms involved in the formaldehyde removal process. The data were subjected to ANOVA and Pearson correlation test. According to the results obtained, *Ficus* sp. had the highest formaldehyde removal percentage (92.80%) while *Hedera helix* had the lowest (56.86%). The study further showed that stomatal density and stomatal conductance play a major role in formaldehyde removal by these plants while cuticle and epidermal thickness act as hindrances to this process. This conclusion was further confirmed by Pearson's correlation values in correlation analysis. The current study was carried out for 24 hours of exposure and it would be of interest to explore, the long term behavior of the plants through further studies. Overall, the results justify future studies on a cross-section of diverse plant species for formaldehyde removal efficiency to determine species with superior removal efficiencies for a better phytoremediation process.

Keywords: Phytoremediation, VOCs, Formaldehyde, GC-MS technology

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

62

(130)

Upgrading of Pyrolytic Char Generated from Waste Tyre Pyrolysis for Solid Tyre Industry

De Zoysa D.M.D.A., Hewage J.S., Sudusingha Y.C.Y., Ranaweera S.A.*

Department of Chemistry, University of Ruhuna, Matara, Sri Lanka
*samantharan@chem.ruh.ac.lk

Abstract

In Sri Lanka, accumulation of tons of low-quality pyrolytic char (PT-char) in pyrolysis plants is a significant issue in waste tyre management. Finding a solution to upgrade low-quality PT-char is urgent in Sri Lankan context as it initiates a method of finding a solution to the disposal issue of PT-char. As a result, the current study introduces an efficient and cost-effective routine for upgrading low grade PT-char into value-added products which is not being successful before. The upgrading method entails carefully regulating size reduction of the low-grade PT-char (particle size<50 μm) and following optimization of acid-base demineralization parameters. After the size reduction of PT–char, demineralization procedure was introduced using low char: acid/base ratios (1:2), diluted acids and bases (2 M HCl and 2 M NaOH), low temperatures (30 ^{0}C-60 ^{0}C), and short reaction times (30-60 minutes). Purity and surface characteristics of upgraded char were investigated using XRD, elemental analysis, SEM, and TGA. Based on a CHN analysis, 67% (w/w) of initial carbon content of crude C-PT char was increased up to 91% (w/w) by washing it twice with 2 M HCl and once with 2 M NaOH (2 M H2+2 M S) while reducing ash content from 17.65% (w/w) to 3.59% (w/w). Significance removal of metals such as Zn (1.14% w/w) , Fe (0.34% w/w), Mg (0.25% w/w) and Ca (2.71% w/w) from C-PT char were observed after treating with 2 M H2+2M S (Zn 0.36%w/w , Fe 0.06%w/w, Mg 0.01%w/w and Ca 0.01% w/w). Removal of Zn from C-PT char further confirmed by XRD and surface modification was confirmed by SEM images. Additionally, the rheological and physico-mechanical properties of the upgraded char incorporated solid tyre base compounds were evaluated and compared with commercial grades of carbon black; N 330, and N 660. It was observed that tensile strength, tear strength, hardness and compression properties of purified PT-char incorporated rubber compounds were not significantly different and exhibit resemble properties to the samples prepared using commercial carbon black grades. Overall, it can be confirmed that upgraded PT char has a significant potential to be used as an economical alternative for reinforcement filler in solid tyre industry and upgrading procedure is efficient and economically viable than the conventional methods.

Keywords: Pyrolytic char, Demineralization, Purification, Modification

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

63

(148)

Assessment of Phytotoxicity of Potable Water Treatment Plant Sludge-bound Compost Pellets on Seed Germination of Radish (*Raphanus sativus* L.)

De Silva R.S.D.[1], Amarasinghe S.R.[1]*, Ranawaka R.A.A.K.[2]

[1]*Department of Soil Science, University of Ruhuna, Matara, Sri Lanka*
[2]*Mid Country Research Station, Department of Export Agriculture, Atabage, Sri Lanka*
*rajika@soil.ruh.ac.lk

Abstract

Binding loose compost into pellets needs different binding materials. Maintenance of pellet stability highly depends on the binding materials used. Potable water treatment plant sludge (WTPS) has the potential to be used as a binding material due to the high content of clay, organic matter, and nutrients. However, compost and WTPS may contain heavy metals, toxic compounds, salts, and growth inhibitors. Therefore, the determination of the phytotoxicity of WTPS bound compost pellets is essential before amending them to the soil. The present study aimed to assess the phytotoxicity of different pelleted compost using seed germination bioassay of *Raphanus sativus* L. Four compost pellets were considered (T1: commercial compost pellet (100% compost), T2: commercial integrated pellet (90% compost+10% inorganic fertilizer), T3: WTPS-bound compost pellet (90% compost+10% WTPS), T4: WTPS-bound integrated pellet (80% compost+10% WTPS+10% inorganic fertilizer)) and pellet aqueous extracts (PAE) were prepared, respectively. Distilled water was used as the control. The dilution sequence of PAE as 50% and 100% were tested for seed germination in Petri dishes in a randomized design with three replicates. pH, EC, and selected heavy metals (Al, Zn, Cu and Cr) were determined in PAE. RSG% (Relative Seed Germination %), RRG% (Relative radicle Growth %), and GI% (Germination Index) were calculated for all the PAE after 72 hours. The PAE had a pH range from 6.8-7.2. The Cr was not detected in all 100% PEA. The highest levels of Al and Zn were detected in 100% PAE of T1. All the treatments in both 50% and 100% PAE showed GI% higher than 80% except the 100% PAE of commercial integrated pellet (T2) and WTPS-bound integrated pellet (T4). The PAE from the T2 and T4 showed low RSG% and RRG% and thereby the GI% is low due to high EC in PAE. The GI% of 100% PAE in T2 and T4 was 32.33% and 67.25%, respectively. The lowest values for RSG% and RRG% were recorded for T2 as 44.44% and 72.75%, respectively. Spearman's Rank Correlation coefficients were calculated for EC with RSG%, RRG%, and GI% and all variables showed negative correlations as (-0.44), (-0.97), and (-0.69), respectively. This indicates that high EC reduces radical growth and seed germination. PAE at 100% concentration levels of commercial integrated pellet showed high phytotoxicity, and WTPS-bound integrated pellet showed less phytotoxicity while other treatments did not show any sign of phytotoxicity. All the PAE at 50% concentration level were free from phytotoxicity. Hence, 10% WTPS in w/w basis can be used as a binding agent in pelletizing loose compost. Different WTPS concentrations should be tested in binding process for its optimum utilization.

Keywords: Bioassay, Compost, Phytotoxicity, Radish, Water treatment plant sludge

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

64

(153)

Comparative Study of Bisphenol-A and its Analogue Bisphenol-S on Growth and Condition Factor of Juvenile Zebrafish (*Danio rerio*)

Dulanthi M.L.Y., Rajapaksa R.P.G.K.*

Department of Zoology and Environmental Management, University of Kelaniya,
Kelaniya, Sri Lanka.
*gayani@kln.ac.lk

Abstract

Bisphenol-A is a synthetic estrogen highly used in the production of polycarbonate plastics and epoxy resins in plastic industry world-wide. Bisphenol-A presents as a ubiquitous environmental contaminant in all ecosystems. Bisphenol-A is an endocrine disruptor which affects the growth, development and physiology of living organisms. Therefore, bisphenol-S has been introduced as a safe alternative to bisphenol-A and it has become the widely used bisphenol-A substitute. Bisphenol-S has also been identified as an endocrine disruptor and emerging environmental contaminant. Therefore the safety of bisphenol-S substitution has become questionable. Thus, this study was carried out to comparatively assess the impacts of bisphenol-A and bisphenol-S exposure on growth and condition factor of zebrafish (*Danio rerio*). After 7-days acclimatization period, twenty juvenile zebrafish of 67 dpf (days post fertilization) of age were treated 35 days with 10 µg/L and 100 µg/L of bisphenol-A, bisphenol-S and with treatment control in triplicate tanks. Mean body length, weight, specific growth rate and condition factor of fish were evaluated. Mean body weight increment of zebrafish under 100 µg/L of bisphenol-S and bisphenol-A were significantly different from the treatment control ($p<0.05$, One way ANOVA, Tukeys pairwise Comparison). The mean body length increment and specific growth rate were not significant under both concentrations of bisphenol-S and bisphenol-A with treatment control ($p>0.05$). However, the condition factor of fish under both concentrations of bisphenols were significantly less than control ($p<0.05$). The condition factor of fish under comparable concentrations of bisphenol-S and bisphenol-A were not statistically significant. Therefore, it can be concluded that exposure to environmental concentrations of both types of bisphenols could affect the wellbeing of juvenile zebrafish. Based on the findings, bisphenol-S cannot be recommended as a safe substitution to bisphenol-A. Yet, more comprehensive studies are recommended to evaluate relative effect of bisphenol-S on freshwater ecosystem health.

Keywords: Body length, Body weight, Condition factor, Bisphenol-A, Bisphenol-S, Zebrafish, (*Danio rerio*)

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

65

(154)

Degradation Potential of Biodegradable Plastics under Laboratory Conditions

Sandeepani G.D.V.A., Ranatunga R.R.M.K.P.*

*Center for Marine Science and Technology, Department of Zoology,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka
ranatunga@sci.sjp.ac.lk

Abstract

Conventional plastics are one of the greatest environmental issues due to their excessive usage and slow degradation. Biodegradable plastics have been introduced as a promising solution to the issue. However, the degradation potential and the best exposure conditions for biodegradable plastics are not well understood in the local context. Therefore, the present study was conducted to evaluate the degradation potential of some commercially available single-use plastics labeled as "biodegradable". Two brands of lunch sheets (LS1 and LS2) made from Polylactic acid (PLA), Polybutylene adipate terephthalate (PBAT), and corn starch, and one waste bag made from Low-density polyethylene (LDPE) and Linear low-density polyethylene (LLDPE) were tested against cellulose filter paper (FP) as a positive control. Degradation was tested using mass loss analysis, biogas production, and FTIR spectrum analysis together with visual analysis. The test materials were subject to different exposures, i.e., placed under seawater, beach sand, freshwater, sand with overlying freshwater, and under direct sunlight for 210 days, and anaerobic exposure for 60 days. LS1 had the highest mass loss of 73.3% in freshwater and the lowest of 9.5% in sunlight exposure. LS2 recorded the highest mass loss of 59.3% in compost exposure and the lowest of 2.9% in sunlight exposure. Waste bags recorded 1.5% as the highest mass loss in the sand with overlying freshwater and the lowest 0.3% under direct sunlight which is the lowest among all four samples. FP has shown the highest and lowest mass loss in composting and direct sunlight exposures at 79.7% and 6.2%. The degradation of FP indicates that the conditions required for biodegradation were present in the exposure environments. Direct sunlight exposure does not show a significant impact on the degradation of any of the test materials. The waste bag does not show considerable degradation under any exposure. The carbon dioxide gas production was 8.76×10^{-4} mol, 18.49×10^{-4} mol, and 2.88×10^{-4} mol in LS1, LS2, and waste bag, respectively. LS1 and LS2 showed visual damages and also changes in the FTIR spectrum. However, waste bags did not show any changes visually or in FTIR spectra. Therefore, it can be concluded that LDPE and LLDPE products did not undergo a detectable degradation though PLA, PBAT, and corn starch products show clear signs of degradation. The study needs to be repeated in situ to better understand the degradation behavior in actual exposure situations.

Keywords: Biodegradable plastics, Degradation, Plastic pollution

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

66

(157)

Photocatalytic Degradation of Rhodamine B under UV Light Catalyzed by Alpha Titanium Phosphate and Metal Modified Titanium Phosphate

Jayasinghe K.W.P.V.*, Palliyaguru L., Jayaweera P.M.

Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*pasinduviduranga123@gmail.com

Abstract

Wastewater management is a crucial issue in most emergent nations with ever-growing global industrialization. From textiles to food, mankind uses dyes and pigments which pose a threat to the environment due to organic non-biodegradable dyes contained in wastewater. Rhodamine B (RhB) is a conventional colorant in many industries producing a large amount of dye effluent, thus becoming a serious threat to the environment as well as human health. Additionally, RhB is dangerous even at extremely low quantities, making treatment of the RhB effluent more essential. Even though TiO_2 is considered as the best photocatalyst to remove many organic pollutants, acceptable alternatives are needed due to being uneconomical in large-scale usage. Synthesis of titanium bismonohydrogen orthophosphate (α-TiP) can be achieved by refluxing ilmenite with phosphoric acid via a previously reported novel method. Solid state reactions of α-TiP and oxides of Co and Cu at 800° C result in various metal titanium phosphates (M-TiP) with unique colors. XRD, FTIR, and Diffuse reflectance UV-vis techniques were used for characterization of the obtained solids. Bandgap of α-TiP changed with the modification of different transition metal cations lowering bandgap from 4.01eV (α-TiP) to 3.57 eV (Cu-TiP). Aqueous RhB degradation under UV irradiation was used to investigate the photocatalytic abilities of these catalysts. For that 0.2 g sample of catalyst was added to a solution that contained 200 mL of a 5 mg L^{-1} Rh B which was kept for 15 mins in dark to reach adsorption-desorption equilibrium before exposing the sample to UV irradiation for 3 h. A clear enhancement of photocatalytic activity was observed from using Co-TiP as the catalyst, which only took around 80 min to remove almost all Rh B contained in the sample compared to α-TiP which took close to 3 h to become colorless. It was in alignment with spectrometer results where a clear reduction of intensity can be seen in wavelength at 552 nm. Photocatalytic activities of these catalysts decreased in the following order: Co-TiP>α-TiP>Cu-TiP. The Co-modified TiP showed degradation of 99.5% after 3 h of UV irradiation and pseudo first-order kinetics were followed by the degradation.

Keywords: Titanium Phosphate, Photocatalyst, Rhodamine B, Wastewater management

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

67

(165)

Chemical Analysis of Kitchen Waste for Developing Formulae for Compost Fertilizer

Ranasinghe S.D.*, Prashantha M.A.B., Godakumbura P.

Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*sdevanmini@gmail.com

Abstract

The rapid growth of the global population and changes in food consumption patterns have resulted in issues relating to food insecurity. Improved strategic solutions are needed to allow easy access to food and also to manage large volumes of waste efficiently. From this research, a microeconomic-level solution to manage the aforementioned issues is addressed. Common kitchen waste such as peels and discarded parts of fruits and vegetables can be combined to produce compost fertilizer. Producing compost fertilizer in this manner can be considered a microeconomic-level waste management strategy. Compost fertilizer produced using kitchen waste can subsequently be used in home gardening. Many vegetables and fruits can easily be cultivated in small, confined spaces such as in home gardens. This study analyzed chemical parameters such as total carbon and other total nutrient levels (N, P, Ca, Mg and K) in ten kitchen waste and two supplementary samples using standard methods. The kitchen waste samples consisted of peels and discarded parts of fruits and vegetables. The two supplementary samples- *Tithonia diversifolia* (Wild sunflower)*,* and *Gliricidia sepium* were chosen because they are nutrient-rich organic fertilizers. The analysis results were then fed to a computer program developed for this study. It was based on the simulated annealing algorithm. The program generated different formulae for producing 100 g mixtures of raw materials for composting, by mixing the 10 kitchen waste and 2 supplementary samples in 24 different combinations. The nutrient levels of these mixtures were expected to match or exceed a calculated "target nutrient level". It was calculated based on local compost fertilizer standards and the chemical analysis results. The target nutrient level calculated as the minimum required level by dry mass of each material was 25.00% Carbon, 1.25% Nitrogen, 0.63% Phosphorus, 1.25% Potassium, 0.88% Calcium, and 0.63% Magnesium. The program was able to generate mixtures of raw materials in which most of the levels matched or exceeded the target level. However, the phosphorus levels of all formulae fell below the target phosphorus level and in some mixtures, the magnesium level also was less than the targeted level. The actual nutrient level of one of the 100 g mixtures (combination C3) containing 0.19 g banana stem, 0.21 g discarded tea grounds, 0.41 g discarded scraped coconut, 0.57 g banana peel, and 97.34 g *Gliricidia* leaves was (% by dry mass), 85.68% Carbon, 2.20% Nitrogen, 0.25% Phosphorus, 1.32% Potassium, 2.24% Calcium and 0.71% Magnesium. This promising method can further be developed by adding more nutrient-rich raw materials to the program. The program could be a useful tool for compost fertilizer manufacturing, especially for small-scale horticultural purposes.

Keywords: Compost, Waste management, Nutrient analysis, Kitchen waste

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

68

(169)

Mycoremediation Approach to Green Air: Phenanthrene and Anthracene Degrading Ability by *Fusarium solani* Isolate P[11]M-46

Dharmasiri R.B.N.[1, 2], Undugoda L.J.S.[1]*, Nilmini A.H.L.[3], Manage P.M.[2, 4], Nugara N.N.R.N.[1], Udayanga D.[1]

[1]*Department of Bio-systems Technology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[3]*Department of Material and Mechanical Technology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[4]*Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
*lankaundugoda@sjp.ac.lk

Abstract

There are many health issues associated with air pollution that are rapidly increasing with time across the globe. Among many air pollutants, polycyclic aromatic hydrocarbons (PAHs) are of particular concern because of their carcinogenicity, genotoxicity, and long persistence in the environment. The majority of these PAHs release into the air through anthropogenic activities and natural sources. After releasing into the air, PAHs usually return to the ground due to their high molecular weight. These hydrocarbon depositions can be categorized as wet or dry depositions. One of the most prominent deposition surfaces of these pollutants is the phyllosphere. Microorganisms such as fungi perform a key role in PAHs elimination through bioremediation processes. Epiphytic fungi such as *Fusarium solani* isolate P[11]M-46 utilizes the deposited phenanthrene and anthracene on the phyllosphere and convert those PAHs in to non-toxic levels. The aim of this study was to evaluate the ability of *F. solani* isolate P[11]M-46 to degrade phenanthrene and anthracene, through a mycoremediation approach. Leaf samples were collected from Panchikawatta, Orugodawatta, Pettah, Maradana, Colombo Fort, and Sapugaskanda urban areas in Sri Lanka. Furthermore, PAH degradation ability of isolated *F. solani* isolate P[11]M-46 was confirmed through High Performance Liquid Chromatography (HPLC). The effects of by-products produced from the biodegradation process on living beings were evaluated using *Artemia salina* and the by-products were identified using Gas Chromatography and Mass Spectrometry (GCMS). According to HPLC results, *F. solani* isolate P[11]M-46 showed 68% of degradation percentage in phenanthrene while exhibiting 76% degradation in anthracene within 6 days. The GCMS analysis confirmed that the by-products were Phenol, 2-(phenylmethyl) from phenanthrene and 9, 10-anthracenedione from anthracene. Toxicity assay with *A. salina* confirmed that these byproducts were not toxic to the phyllosphere. The findings of the present study revealed the potential use of phyllosphere *F. solani* isolate P[11]M-46 in the remediation of environmental pollutants phenanthrene and anthracene. And also the by-products produced during their degradation mechanism were also confirmed as nontoxic compounds. Therefore, *F. solani* isolate P[11]M-46 could be effectively used in the bioremediation of phenanthrene and anthracene in polluted environments as a bioremediator.

Keywords: Polycyclic aromatic hydrocarbons, Bioremediation, HPLC, GCMS, Toxicity

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

69

(183)

Microplastics Trophic Transfer in Seafood Varieties Caught from the Coastal Waters off Negombo

Gammanpila G.D.N.P., Ranatunga R.R.M.K.P.*

Center for Marine Science and Technology, Department of Zoology,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*ranatunga@sci.sjp.ac.lk

Abstract

Microplastics are a pervasive global pollutant that poses risks to marine organisms including commercially important species and poses threats even to humans. However, the trophic transfer of microplastics is yet to be understood. The present study was to study the occurrence of microplastics in five species used as seafood and in zooplankton, representing different trophic levels and feeding habits caught within coastal waters off Negombo. The Negombo coastal environs are known for high ecological diversity still subjected to massive anthropogenic activities as a major fishing and tourism hub in Sri Lanka. The same area was subjected to contaminating microplastics after the MV X-Press Pearl ship disaster which caught fire and spilled the largest point source of microplastic nurdles pollution in the world. Field sampling was carried out from October to-December 2021 in Negombo, Sri Lanka. The study included zooplankton, some fish (*Sardinella gibbosa* (n=10)*, Hemiramphus archipelagicus* (n=10)*,* and *Ephipphus orbis (n=10))*, crustaceans (*Scylla serrata,* (n=10)) and a bivalve (*Perna perna*, (n=10)). The samples were subjected to wet peroxide oxidation and acid digestion. Microplastic identification was conducted microscopically and confirmed with Fourier-Transform Infrared (FTIR) spectroscopy, Raman spectroscopy, and Nile red staining techniques. Microplastics were present in all the species studied except zooplankton samples. Four polymer types were identified and confirmed as Polyamide (PA), Polystyrene (PS), Polypropylene (PP), and Polycaprolactone (PCL). According to the literature, this is the first recorded PCL contamination in marine species in Sri Lanka. Fibers were the most abundant microplastic type recorded followed by fragments, films, spheres, and flakes. Red, green, blue, yellow, black, and transparent microplastics were recorded while blue colour was the most prominent. The mean number of microplastics recorded was 0.93±0.29 for *S. gibbosa*, 0.97±0.17 for *H. archipelagicus*, 0.53±0.09 for *E. orbis*, 0.36±0.16 for *S. serrata* and 1.13±0.29 items/g for *P. perna*. Investigation of microplastic concentrations at different trophic levels suggests that organisms at lower trophic levels are at greater risk of microplastics.

Keywords: Microplastics, Trophic transfer, Marine organisms, Seafood, Negombo

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

70

(190)

Degradation Potential of Some Biodegradable Polymers: Do they Degrade?

Wijetunge D.S.[1, 2], Ranatunga R.R.M.K.P.[1]*, Manage P.M.[2]

[1]*Center for Marine Science and Technology, Department of Zoology,*
University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
*ranatunga@sci.sjp.ac.lk

Abstract

Biodegradable products were invented and commercially introduced to curb the catastrophic impacts of non-degradable plastics. These intend to act as a green solution since they are manufactured to degrade in the environment without accumulating as waste plastics. Three commercially available products labeled as "biodegradable" i.e. salad plate (SPL), lunch sheet (LS), and garbage bag (GB), were tested for degradation potential in six different exposure media i.e. seawater (SW), beach-sand (BS), freshwater (FW), freshwater sediment (FWS), compost, and ultra-violate (UV) rays, with controlled and uncontrolled conditions simulating the natural environment. Cellulose filter paper (CFP) was the positive control. SW, FW, FWS, and BS were placed in four separate glass tanks while compost was prepared in a 100L plastic storage box. A UV chamber was fabricated to expose samples to UV radiation. SW tank was equipped with a wave pump, and FW tank was continuously aerated. All samples were cleaned, cut into manageable sizes, inserted in synthetic mesh pockets (except for those exposed to UV), labeled, and placed inside the media in triplicates. UV-exposed samples were directly placed in boiling tubes inside the chamber equipped with 15 W LED UV bulbs providing 280-320 nm irradiation. Initial weights were measured and the weight loss over five months was recorded. Physical parameters including temperature, pH, salinity, and conductivity were measured in each sampling. RAMAN spectroscopy and Scanning Electron Microscopy were performed initially to find out the test samples' chemical composition and surface structure. CFP and SPL contained cellulose, LS contained Poly Lactic Acid (PLA) and Poly Butylene Adipate Terephthalate (PBAT), and GB contained Poly Ethylene (PE) as major components. Degradation potential was calculated in terms of percentage weight loss with time, and visual remarks of degradation were recorded. The highest weight-loss percentages of CFP (100%), and SPL (100%) were observed in FWS (both in 122 days) and compost (in 92 days, and in 122 days respectively) media. LS showed faster degradation (20% weight loss in 92 days) in compost while GB showed slight fragmentation (2% weight loss in 57 days) under UV during the first five months of sampling. Comparatively minimum signs of degradation were observed in GB in all exposures. CFP, SPL, and LS samples were discoloured and fragmented into small pieces during the degrading process. All products showed lesser degradation potential in SW, FW, and UV exposures. The experiment will be continued further to understand the degradation process.

Keywords: Degradation, Biodegradable products, Abiotic degradation, Plastic pollution

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

71

(213)

A Comparative Benefit-cost Analysis for the Potential Waste Management Options for the Western Province, Sri Lanka

De Silva K.W.C.V.*, Gunawardena U.A.D.P.

Resource Economics Unit, Department of Forestry and Environmental Science,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*chathuryaadesilva@gmail.com

Abstract

Sri Lanka generates 7,000 metric tons of solid waste per day while only 3,242 tons are being collected. Within the Western province 1783 metric tons are collected daily. Management of municipal solid waste is mainly a responsibility of local governmental entities. Only a few waste management options are often practiced while economic aspects of this problem are rarely taken into consideration. The present study was designed therefore with the objective of analysing current and potential waste management options for the western province and identifying the best option that maximises the net benefit to the country. Seven different options for municipal solid waste management were identified for the analysis (option 1–open dumping; 2-sanitary landfilling; 3-recycling paper, polythene, glass and other recyclable waste (15%) and open dumping the rest; 4-composting the biodegradable (62%) and open dumping the rest (38%); 5-composting the biodegradable (62%), recycling paper, polythene, glass and other recyclable waste (15%) and open dumping the remaining; 6–waste to energy handled by the government; 7–waste to energy collaborated with private organizations). Then costs and benefits, including environmental costs related to each option were identified and quantified using literature and information obtained from interviews held with coordinators of waste management projects under both government and private sectors. Economic cost-benefit analyses were conducted for the seven options for a period of 30 years assuming that a constant amount of municipal solid waste (100 MT) per day is treated by each method. All seven models were developed on the basis of current municipal solid waste composition. According to the net present value analysis, five options resulted in negative net present values, while options four and five showed positive net present values. In the next step, the value of compost was re-estimated considering the replacement benefit of imported nitrogen, phosphorus and potassium fertilizer which has yielded a much higher net present value than earlier. Furthermore, option five was identified as the economically most profitable option. The results of the study will provide guidance toward designing the most economically and environmentally viable waste management options for urban areas of Sri Lanka.

Keywords: Municipal solid waste, Composting, Recycling, Cost-benefit analysis

Proceedings of the 27ʰᵗ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

72

(233)

Chemically Modified Coconut Shell Biochar for Removal of Losartan Potassium in Aqueous Solutions

Perera W.P.A.[1]*, Pathirana C.D.K.[1]., Kannan N.[2]

[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Department of Agricultural Engineering, University of Jaffna, Jaffna, Sri Lanka*
pubudiama100@gmail.com

Abstract

Emerging contaminants (EC) are newly recognized significant water pollutants and conventional wastewater treatment facilities are not sufficient at removing these trace contaminants. Biochar is well-known effective adsorbent for the removal of complex inorganic contaminants and organic contaminants from water. The present study, comprehensively investigates the sorption removal of Losartan potassium (LOS) through chemically modified biochar (CMBC) developed from green coconut (*Cocous nucifera*) shell. Effect of pyrolysis temperature (400° C, 500° C and 600° C), initial concentration of LOS ($20-150$ mg L^{-1}), pH ($3-11$), temperature ($20-40^o$ C), dose of adsorbent ($1.0-5.0$ g L^{-1}) and contact time ($15-1620$ mins) on the adsorption of LOS onto CMBC has been analyzed using a successive batch study. Biochar treated with 5% H_3PO_4 and pyrolyzed at 600° C shows the optimum result which is 60.72% removal of LOS with initial LOS concentration of 20 mg L^{-1}, pH~6, temperature 20° C, dose of adsorbent 5 mg L^{-1}, agitation speed 150 rpm and contact time 24 h. The kinetic data of the adsorption study was best fitted into pseudo-2nd-order kinetics model. The Langmuir, Temkin and Freundlich isotherm models were studied and the experimental data were best represented by the Freundlich model. The thermodynamic study reveals the LOS adsorption was non-spontaneous, exothermic nature on CMBC.

Keywords: Biochar, Emerging Contaminant, Isotherm, Kinetics, Thermodynamics, Losartan Potassium, Pyrolysis

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

73

(12)

Economic Importance of Consuming Homemade Turmeric: A Case of Kandy District in Sri Lanka

Hewage R.G.S.M.*, Malkanthi S H P.

Department of Agribusiness Management, Sabaragamuwa University, Belihuloya, Sri Lanka
*sajinihewage97@gmail.com

Abstarct

Turmeric or *Curcuma longa L.* is prized in Sri Lankan cuisine for its delicate flavor, distinct yellow color, and potent aroma. This great spice is highly praised in Ayurveda medicine for its anti-inflammatory properties as well. However, unlike the ancient time, cultivation of turmeric at household level at the recent past was not so significant and the country heavily relies on imported turmeric. Short-time after COVID 19 pandemic in the country, the government banned on non-essential imports including turmeric. Due to very high price and shortage of turmeric in the market and impact of black market of turmeric, while some people adopted to cultivate turmeric in small scale some people did it at large-scales. This study was conducted to study the present situation of consumption of homemade turmeric in Kandy district of the country and understand the economic importance of it. 150 turmeric cultivators were selected for the study. Data collection was conducted using questionnaire survey from June to August 2022. Data analyses were done using descriptive statistics and multiple regression analysis. According to the results, it was discovered that after drying turmeric, convert into a powder and consumed by them. When economic importance are concerned, their average income was found as 11,095.238 rupees per season and average saving was found as 797.13 rupees per person per season. Also a positive relationship was found between consumption of homemade turmeric and its independent variables (family members, monthly income, interest for turmeric, and market price of turmeric) by the study. As a whole, the growers adopted to homemade turmeric as consumption of homemade turmeric is economically and hygienically very important. If there is a good market, most of the turmeric cultivators are willing to grow turmeric continuously. So, they expect proper knowledge related to do cultivation and processing of turmeric. It is very important to pay attention on this and provide proper training programs and good market price for turmeric, in order to enhance the turmeric production of the country in the future.

Keywords: Turmeric cultivation, Homemade Turmeric, Consumption, Economic importance

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

74

(37)

Ascertainment of Photosynthetic Biomass Curves in the Early Growth Stages of Selected Dominat Native and Endemic Plant Species in Lowland Rainforest Ecosystems, Sri Lanka that as a Proxy for Value Primary Ecosystem Services and towards Conservation

Aberathna W.S.S.L.[1,2]*, Chaturanga H.N.[1], Senanayake F.R.[1], De. Zoysa D.[1]

[1]*Earth Restoration, Belipola Arboretum and Research Center, Walimada, Sri Lanka*
[2]*Postgratuate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka*
*ethnosameera40000@gmail.com

Abstract

The lowland rainforests play a significance role in maintaining the rich biodiversity of threatened endemic and native species of flora. However, the physiognomy of many species is still poorly known. The main objective of this study was to established the gains in photosynthetic Biomass (PB) during the early growth phases of three native and endemic tree species *Garcenia quaesita*, *Dipterocarpus zeylanicus* and *Artocapus nobilis*, which are frequently found in the low land rainforest ecosystems in south-west Sri Lanka. The study was based on field data collection and through observations based on empirical measurements which focused on PB accumulation in the early growth stages of above tree species. The sampled individuals were found in the reforested site in Hinduma, Sri Lanka and Sampling was carried out in four sites which represented the growth at 1, 2, 3 and 4 years. Purposive sampling was carried out and 30 individuals from each and individual age group as mentioned above, totaling 360 individuals of the plant species. Fresh weight was measured from collected leaves and analyzed to derive PB curves using statistical software Minitab version 15. Oxygen production (1 g of PB gives 0.4 g of Oxygen) was quantified using the measured PB value applied to the standard allometric equation. PB and Oxygen production of selected tree species demonstrated an exponential growth after the age of 3 years. Results shows that at the end of 4th year *D. zeylanicus* produce highest PB value, i.e., 2,483.55 grms and then 550.92 and 421.36 grams occupied by *A. nobilis* and *G. quaesita*. Also, PB and Oxygen production had a significant relationship with the age. In conclusion all the selected species under the given climatic conditions shows an increasing rate of PB, and oxygen production with age up to 3 years with an exponential growth thereafter. The findings of this study will be used to explored and included in the contractual process of value Primary Ecosystem Services (PES) hence all the PES derivatives such as carbon sequestering values and oxygen production based on the PB value of that given plant species. Therefore, it creates new scientific proven records to archive economic opportunities, which are not still identified and value of primary ecosystem services of tree dominated ecosystems/land uses to achieve national green economic policy management objectives. Such an economy described above, can generate new ecosystem servicing values and socioeconomical benefits which, at the same time, promotes conservation of these species and their unique environments.

Keywords: Conservation, Green economy, Lowland rainforests, Photosynthetic Biomass, Primary ecosystem services

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

75

(131)

Economic Feasibility of Reverse Osmosis (RO) Water Treatment Plants: A Case Study from Dimbulagala, Polonnaruwa, Sri Lanka

Bandara T.*, Witharana A.

Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*thilinibandara995@gmail.com

Abstract

Social wellbeing is strongly linked with economic feasibility when it needs to attain with the technological advancements. Installation of Reverse Osmosis (RO) water treatment plants have been considered as a promising solution to provide clean water for human consumption, especially in the areas where the CKDu (chronic kidney disease of unknown etiology) prevails. At present, over 2,000 RO treatment plants were installed in the dry zone of Sri Lanka, yet economic feasibility for operation and maintenance of RO plants has not been assessed so far. The present study was intended to identify economic feasibility of operation and maintenance of RO plants. Investigations were carried out in six community RO plants which provided drinking water for over 17,000 people which accounts for 20% of total population in Dimbulagala Divisional Secretariat over a period of 12 months. Six in-depth interviews and questionnaire survey were caried out with RO plant operators. The operational cost per production of cubic meter of filtered water was computed by considering electricity consumption bills. The maintenance costs and service charges were also obtained from the records available with RO plant operators. The results found that the average electricity consumption to produce 1 cube of filtered water is approximately 9kWh and cost is LKR 734 (based on 2021 rates). The average water selling price ranged between LKR 1.00-2.50 per liter. The average monthly income generation from one RO plant is approximately between LKR 561-875 per cube of filtered water and it largely depended on the type of water source, climatic conditions. It was found that the income generated from RO plants was sufficient enough to cover the operation cost (monthly electricity bill) and for the subsequent maintenance and service charges whenever required. It can be concluded that the use of RO treated water is an economically viable option to provide portable drinking water.

Keywords: CKDu, Economic sustainability, Drinking water, Purification cost

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

76

(147)

Determination of Heavy Metals in *Etroplus suratensis* from Koggala Lagoon in Southern, Sri Lanka

Abeysooriya A.P.S.W.[1]*, Wijesinghe R.D.N.[1], Bandara E.G.K.Y.C.[1], Sanjaya H.L.K.[2]

[1]Department of Fisheries and Aquaculture, University of Ruhuna, Matara, Sri Lanka
[2]Department of Limnology, University of Ruhuna, Matara, Sri Lanka
*sajiniabeysooriya@gmail.com

Abstract

Fish is one of the best organisms in many scientific studies to evaluate heavy metal pollution and human health hazards as they are well-understood organisms in the aquatic environment. The present study was carried out to examine the level of heavy metals in different tissues of *Etroplus suratensis* (Green chromide) in Koggala lagoon, Sri Lanka. Atomic absorption spectrophotometer (AAS) was used to determine the levels of copper (Cu^{2+}), cadmium (Cd^{+3}), lead (Pb^{+2}), and chromium (Cr^{+3}) ions in the different tissues (skin, liver, gill, and flesh) of fish belonging to three different sizes; small (7.8–10.2) cm, medium (14.1–16.6) cm, and large (19.8–25.2) cm. The number of thirty-six fish were collected from the lagoon randomly. According to available sizes, 12 fish for each size class were used for the analysis. Furthermore, the histological analysis was carried out to identify the changes at the tissue level in the gill and liver of fish in three different size classes. Heavy metal concentrations in fish samples were compared with the standard levels of heavy metals. Heavy metal concentrations in body tissues of three different body sizes of fish were found to be mainly in the order of Cu>Pb>Cr> Cd. The highest concentrations ($P<0.05$) of heavy metals were found in the fish flesh and skin, while the lowest concentrations were found in the gills. The range of heavy metal concentrations ($\mu g\ g^{-1}$ dry weight) in body tissue of small size, *E. suratensis* fish were, Cu: 0.0443-0.6210, Cd: 0.0110–0.0214, Pb: Below Detection Level (BDL)-0.46 and Cr: BDL-39.633, Medium size fish were, Cu: 0.0713–0.6210, Cd: 0.0134-0.0170, Pb: BDL-40.906, Cr: 0.0014–0.0500 and large fish were, Cu: 0.0553–0.345, Cd: 0.0110–0.0256, Pb: 0.0204–0.2103 and Cr: 0.0194–0.0773. However, Cd, Cr and Pb concentrations of flesh tissues were under the standard recommended limits referred by the FAO. Through the Cu concentration in flesh, tissues exceeded the standard limits of FAO. It is not considered as a toxic heavy metal. Histological analysis revealed that the deviation of shape of hepatic cells in the liver may due to the exposure to heavy metals in the lagoon. According to the overall result, the bioaccumulation and biomagnification nature of heavy metals, and the consumption of *E. suratensis* in the Koggala lagoon may create health hazards to consumers.

Keywords: Green chromide, Koggala Lagoon, Heavy metals, Histology

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

77

(160)

Ayurveda Perspective of Environmental Sustainability for the Economic Crisis–A Review

Kaushalya H.B.D.*, Gunawardhana R.M.R., Nishan S.P.A.S.

Institute of Indigenous Medicine, University of Colombo, Colombo 03, Sri Lanka
*hbdulanikaushalya@gmail.com

Abstract

Ayurveda, the science of life is a comprehensive system of health care of great antiquity, based on experiential knowledge and grown with perpetual expansion. Ayurveda treatment combines products of plant derivatives as well as animal, metal, and mineral, diet, exercise, and lifestyle. According to WHO 88% of all countries are estimated to use traditional medicine, such as herbal medicines, acupuncture, yoga and indigenous therapies. U.S. Environmental protection Agency defines, Environmental sustainability is the responsibility to conserve natural resources and protect global ecosystems to support health and well-being, now and in the future. The objective of this study has been aimed to review on Ayurveda system of medicine for environmental sustainability. The study was carried out as a review study and data was collected from Ayurveda authentic texts, previously published research papers and journal articles. As per findings, Ayurveda provides clear guidelines for lifestyle and nutrition, all of which fit within the framework of *Dharma* (Moral principles) which promotes responsibility for the whole society. According to Ayurveda, lifestyle helps to protect a healthy environment and support nature. It also means the natural care of sustainable food sources and agriculture preserves not only life but also responsible and safe ways of nutrition, careful approach and planning to preserve and guarantee the abundance of all medicinal plants in nature. Sustainable food aims to avoid damaging or wasting natural resources. The major four elements of environmental sustainability which are air and water management and risk reduction have been described in Ayurveda authentic texts. As adaptations the concepts such as the knowledge of *Ritucharya* (regimen for various seasons) and *Dina Charya* (daily regimen) in Ayurveda, are the key to survival, thus essential to maintain a healthy life which helps to free from lifestyle diseases in humans and leads to maintaining good relationship with their environment. The predictive approach of Ayurveda based on the constitutional knowledge about human being shall assist to solving a serious challenge of the modern life. Modern drug-based medicine is becoming increasingly inaccessible to the majority of the world's poor. The neglect of environmental, spiritual and psychological factors behind health and disease does not allow a simple, abstemious lifestyle. Ayurveda offers a sound, millenary natural alternative to the prevailing medical system on its way to individual well-being, improving health economy and social-economic development.

Keywords- Ayurveda perspective, Economic crisis, Environmental sustainability

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

78

(179)

A Comparison of Resources Usage for Two White-Leg Shrimp (*Penaeus vannamei*) Farming Systems (Earthen Pond System and Round Tank System)

Darshika K.A.N.*, De Silva D.N., Subasinghe R., Pallewatta P.K.T.N.S.

Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*nimalidarshikaa@gmail.com

Abstract

Shrimp farming plays an important role in providing nutritious food and generating livelihoods for many millions of people worldwide. Asia is the biggest producer of shrimp contributing nearly 80% of the global shrimp aquaculture production. Black tiger shrimp (*Penaeus monodon*) is the main brackish water aquaculture species in Sri Lanka before 2018. White-leg shrimp (*Penaeus vannamei*) was a new species that was introduced in 2018 expecting a rapid increase in production in the country. Shrimp farming is classified into several categories: extensive, semi-intensive, intensive, and super-intensive based on the intensity of management practices such as stocking density, supply of feed and fertilizer, and management of water qualities. The round tank system is round-shaped and is a type of lined pond that uses an impermeable geomembrane for the retention of water. It belongs to the super-intensive category. The earthen pond is a water body that is basically enclosed by the earth. It belongs to the intensive category. The purpose of this study was to assess the amounts of land, water, and energy required per ton of harvested shrimp in two different production systems and identify the most sustainable system that is used minimum natural resources. The round tank system is located in the Erukkalampiddy area in the Mannar district, Sri Lanka. The earthen pond system is located in the Maikkulama area in the Puttalam district, Sri Lanka. Data on water usage, electricity usage, land area usage, and weight of harvested shrimp were collected during two cycles of production from August 2021 to May 2022. The t-tests were performed to compare resource usages. Land usage of the earthen pond system (950.00 m2/t shrimp, 1266.67 m2/t shrimp) is significantly greater than the round tank system (190.77 m2/t shrimp, 139.33 m2/t shrimp). Water usage of the earthen pond system (950.00 m3/t shrimp, 1266.67 m3/t shrimp) is significantly greater than the round tank system (190.77 m3/t shrimp, 139.33 m3/t shrimp). Energy usage of the round tank system (473.84 kWh/t shrimp, 591.46 kWh/t shrimp) is significantly greater than the earthen pond system (119.91 kWh/t shrimp, 154.78 kWh/t shrimp). It concludes that less land and water resources and high energy usage are required for a round tank system compared to an earthen pond system. Although establishing a round tank system will need more capital, compared to that of an earthen pond system, it is evident that the round tanksystem is more environmentally sustainable.

Keywords: Shrimp farming, Round tank system, Earthen pond system, White-leg shrimp (*Penaeus vannamei*)

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

79

(181)

Comparative Analysis of Sustainable Banking in Public and Private Sector Banks in Sri Lanka

Wickramarathna D.T.N.[1]*, Halwatura D.[1], Pallewatta P.K.T.N.S.[1], Seneviratne B.Y.H.[2], Dharmarathne H.A.S.G.[3]

[1]*Department of Zoology and Environmental Science, University of Colombo, Colombo 03, Sri Lanka*
[2]*Hatton National Bank, Colombo, Sri Lanka*
[3]*Department of Statistics, University of Colombo, Colombo 03, Sri Lanka*
*taniya1996nayomi@gmail.com

Abstract

Sustainable banking is still an emerging concept in the world. While different World Bank organizations interpret sustainable banking differently using different dimensions, it will contribute for the sustainability and longevity of the earth by reducing the indirect negative impacts of the banking sector generated through customer activities. In Sri Lanka, attention on sustainable banking is still emerging. Thus, the objectives of this study are to analyze the strategies used in sustainable banking worldwide, to compare sustainable practices of selected public and private sector banks in Sri Lanka, to determine the advantages of sustainable banking practices to Sri Lankan banks and customers, to determine the customer perception on sustainable banking in Sri Lanka and to provide recommendations for future development of sustainable banking concept in the country. This study was commenced from June 2021 until May 2022. World-recognized standards related to sustainable banking were reviewed and a comparative analysis in the public and private banks operating in Sri Lanka was carried out using the primary data collected by interviews with sustainability officers of banks and secondary data collected from the annual reports of banks. Questionnaire surveys were conducted among 302 retail customers and 82 corporate sector customers. Information was gathered on customer perception on sustainable banking and the benefits of sustainable banking on banks and customers through these studies. The results revealed that out of 2 public sector banks and 11 private sector banks in Sri Lanka, 9 private sector banks and 2 public sector banks showed a satisfactory level of implementation. Questionnaire surveys of customers have shown that there is low customer perception towards the concept. The awareness of the concept among retail customers and corporate customers on sustainable banking is 32.12% and 9.8% respectively. 92.1% of retail customers have responded that there are benefits from sustainable banking for customers, while 78% of corporate customers have responded that there are benefits for them through sustainable banking initiatives. As per the findings, banks could gain benefits such as a good corporate image, enhanced reputation, business growth, moving towards new eras of financing, cost reduction, managing risk using the thorough process in risk management and awards. As Sri Lanka is slowly implementing sustainable banking practices it is recommended to have a regulatory approach. Under this regulatory approach, the banks will have action plans within a specific time period to develop and implement sustainable banking practices more effectively. The requirement of a rating system/ assessing tool is highlighted in this study's recommendations and this would direct Sri Lankan banking sector for better future developments in sustainable banking.

Keywords: Green banking, Environmental sustainability, Triple bottom line, Customer satisfaction, Commercial banks

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

80

(186)

Analysis and Characterization of Four Selected Sri Lankan 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

As a tropical country, Sri Lanka has a wide variety of oil-bearing seeds explicitly used in Ayurvedic and indigenous medicine. Plant seed oils offer an exciting avenue for the use in cosmetic and dietary supplements due to their fatty acid composition and other non-polar constituents specially found in unsaponifiable fraction. This study aimed to characterize plant seed oils by determining Fatty Acids (FA) composition, constituents in unsaponifiable matter, and other physical properties. *Mesua ferrea* L. (Na)*, Crotalaria juncea* L. (Hana)*, Ricinus communis* L. (Thel edaru)*, and Bauhinia acuminata* L. (Koboleela) seeds having some medicinal values were selected. The oil was extracted using soxhlet extraction method with Hexane. Moisture and ash content, Acid Value (AV), Iodine value (IV), and Smoke Point were also determined. Prepared Fatty Acid Methyl Esters (FAME) and unsaponifiable matter were analyzed using GC-MS. Thermogravimetric Analysis (TGA) was performed to access the thermal stability. *M. ferrea* obtained the highest oil yield of 63.87% while others lay within the range of 28.59-29.94%. Smoke point values of these oils varied from 179.0 ± 10.5^{o}C to 241.5 ± 6.2^{o} C. AVs lay between 4.62 ± 1.18-49.64 ± 2.92 mgKOH/g range. IVs ranged from 6.82 ± 0.89 to 16.82 ± 0.45 gI$_2$/100g. Ash content values varied from $1.42\pm0.33\%$ to $3.69\pm0.29\%$ while the moisture content ranged from $0.69\pm0.09\%$ to $4.46\pm0.51\%$. The yield of unsaponifable matter of these four seed oils ranged from $0.7024\pm0.0001\%$ to $1.5864\pm0.0001\%$. All except *M. ferrea* oil exhibited higher levels of unsaturated fatty acids than saturated fatty acids. In contrary *M. ferrea* contained almost equal amounts of UFAs and SFAs. The most abundant FA constituents of all the oils were long-chain FAs like Oleic, Linoleic, and α-Linolenic Acid. γ-Sitosterol was the most dominant compound in unsaponifiable fraction in most of the seed oils which indicate their potential use in dietary supplements. The high level of Squalene found in *R. communis* shows its applicability in the cosmetic industry as a moisturizing agent. This analysis found that all 4 oils have the potential to use in dietary supplements and cosmetics.

Keywords: Seed oils, Unsaponifiable matter, Fatty acids, Cosmetics and dietary supplements

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

81

(208)

Influence of Environmental Factors in Determining Tourist Destinations

Karunarathna M.M.S.A.

Department of Economics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
samadhiabhisheka@sjp.ac.lk

Abstract

Tourism is a growing industry in many countries of the world and for many countries it is a potential source of economic growth and employment opportunities. Focusing on Sri Lanka in terms of tourism, tourism is the third largest foreign exchange earner in Sri Lanka. It is important to correctly identify the internal tourist destinations in Sri Lanka, as well as the environmental factors that influence those destinations' decisions, so that development projects can be made. Accordingly, through this study, the environmental factor has been studied in determining the tourist destinations. The three places chosen as the study area of this research are Sinharaja Rainforest in Kalawana Divisional Secretariat Division of Ratnapura District of Sri Lanka, Bopath Ella Waterfall located in Kuruvita Divisional Secretariat Division and Sitawaka Botanical Garden located in Seethawaka Divisional Secretariat Division of Colombo District. The judgment-based method was used to select the three tourist destinations. Also, 120 people were used as a sample for data collection. A simple random sampling method was used. Primary data and secondary data were used for this study. Participant observation, interview method and questionnaire method were used to collect primary data. IBM SPSS-26 version software was used for data analysis and a Binary Logistic model was used to identify how much influence the environmental factor has in determining tourist destinations. Accordingly, it was studied here whether the environmental factor affecting the decision of a tourist destination changes according to variables such as age, gender, marital Status, education level, occupation, income level etc. According to the results of the research, the Chi-square value is 56.435. The P value is statistically significant at the 1% level. That means the P value of the model is 0.000 (P<0.01). That means that the model is statistically significant. That is, according to the independent variables used above, it can be concluded that there is a change in the influence of the environmental factor to determine a tourist destination. In the analysis, the statistical significance of each independent variable was tested by the Wald test, which can identify the effect of each independent variable on the model. Accordingly, it was clear from this research that the variables of profession and education have a significant effect on the environmental factor that affects the decision of a tourist destination.

Keywords: Education, Environmental factor, Profession, Tourist destinations

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

82

(211)

Valuation of Ecosystem Services for Driving Community-assisted Forest Landscape Restoration in Endane Biodiversity Corridor, Sri Lanka

Madawala M.M.G.I.N.M.B.[1], Rajasooriya P.G.C.L.[2], Fernando A.P.S.[2], Perera A.[1], Gunatilleke I.A.U.N.[3], Nanayakkara S.[1], Geekiyanage N.[1]*

[1]*Dilmah Conservation, Dilmah Ceylon Tea (Pvt) Ltd, Peliyagoda, Sri Lanka*
[2]*Department of Plant Sciences, Rajarata University, Anuradhapura, Sri Lanka*
[3]*Department of Botany, University of Peradeniya, Peradeniya, Sri Lanka*
*nalaka.geekiyanage@agri.rjt.ac.lk

Abstract

The ecosystem services: direct or indirect benefits of ecosystems to human well-being, need to be recognized in conservation and restoration decision-making. In the human-dominated southwest Sri Lanka, we have established a forest landscape restoration project (Endane Biodiversity Corridor) linking a peripheral forest reserve to Sinharaja Rainforest Complex. The ecosystem services provided by tea monocultures, abandoned tea lands, and lowland home gardens were estimated employing a range of methods for estimating respective ecosystem service values with data collected from household surveys, key stakeholder interviews, and survey of tree flora in 20 m × 20 m plots for estimating aboveground carbon stock. The benefit transfer approach was used to value the supporting and regulating services. The total value of ecosystem services provided by this forest corridor landscape was 6,465 USD ha/yr in 2021. This amount included: provisioning services of 1,950 USD ha/yr, supporting services of 645 USD ha/yr, regulating services of 3,807 USD ha/yr, and cultural services of 38.8 USD ha/yr. Overall, our forest corridor landscape of 59.3 ha provided 382,362 of USD of ecosystem services a year. In comparison to tea monoculture, species-rich home gardens generate a high amount of provisioning services. Our study site is prone to ecosystem degradation due to human activities like forest land encroachment, illegal gem mining, and over-harvesting of forest products. However, we recognize the opportunity of enhancing the biodiversity of monoculture tea gardens and home gardens of the corridor following the principles of agroforestry and enrichment planting. These results i.e., the ecosystem service values among different land uses, are imperative for financing and encouraging community participation for forest restoration activities.

Keywords: Forest resources assessment, Forest restoration, Common-based restoration

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

83

(214)

Consumer Awareness and Buying Behavior on Coconut Spread in Sri Lanka

Sudari D.K.P.G.K.*, Malkanthi S.H.P.

Department of Agribusiness Management, Sabaragamuwa University, Belihuloya, Sri Lanka
*ksudari97@gmail.com

Abstract

The plant-based fat spread marketing is rapidly expanding globally with the recent increase of consumers concern in health. The coconut has long been a popular superfood, providing numerous cultures with significant health benefits as a valuable source of both food and medicine. Coconut spread has almost all of the same health benefits as other coconut products for example, include weight loss, immunity boosts, and many more. Therefore, study of consumers' awareness on coconut-based fat-spread is important for food industry of the country. This study aimed at understanding of the level of awareness and of the buying behavior of consumers in Sri Lanka related to coconut-based fat spreads. A sample of 400 respondents was randomly selected from Kurunegala District, data were collected via consumer survey conducted through google forms using structured questionnaire, from May to July 2022. The data analyses were done using descriptive statistics (to analyze the level of consumers' awareness towards the coconut spread as a substitute for dairy fat spreads) and multiple linear regressions (to identify the factors affecting consumers awareness and consumption of coconut spread in addition to regular dairy fat spreads). According to the results, fifty three percent (53%) of respondents were aware on coconut spread. According to the results, more than fifty percent (>50%) of respondents have awareness on coconut spread. The results of the multiple regression analysis showed that the consumers' awareness is significantly affected by the socio-demographic factors such as age, educational level and monthly family income level. According to the results consumer buying behavior significantly affected by consumers' educational level, monthly income, products attributes such as product quality, taste, price and market attributes such as product availability in the market and promotional strategies used by marketers. Approaches such as motivating dairy- butter users to switch towards coconut-based fat- spreads by increasing their knowledge about health benefits of coconut-based fat-spreads should be a strategy by the industry. The findings of the study play an important role in promoting coconut spread market and essential for marketing planners, researchers and policymakers to enhance the coconut spread industry in the country in the future.

Keywords: Consumers' awareness, Buying behavior, Coconut spread, Sri Lanka

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

84

(215)

Attitudes Towards Turtle Conservation: An Island Wide Study in Sri Lanka

Ranasinghe H.M.D.M.*, Gunawardena U.A.D.P.

*Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka*
*ranasinghedilshani58@gmail.com

Abstract

Sri Lanka is visited by the five of the seven living sea turtle species recorded in the world. Sea turtle populations are declining, as is their ability to perform critical services in ocean ecosystems. Some of the obvious risks faced by marine turtles in Sri Lanka include incidental bycatch, illegal egg poaching, habitat change, destruction, and natural causes such as predation and erosion. Attitudes towards conservation of turtles and underlying motives for such attitudes is a lesser researched subject in the country. The present study therefore aims at assessing the attitudes of Sri Lankans towards conservation of sea turtles. A household survey was conducted using a pre-tested questionnaire adopting simple random sampling among 1084 households across the twenty-five districts of Sri Lanka through telephone and in-person interview from December 2021 to May 2022. The socioeconomic data of respondents, membership in a wild life or environmental organizations, recreational experience of turtles were also collected. A set of statements on sea turtles were presented for which the respondents indicated their preferences. Their willingness to contribute towards conservation was also recorded. The results of the study indicate that individuals from twenty-five districts had already been exposed to a wealth of knowledge regarding marine turtles and were well-informed. There were 603 individuals from coastal districts while 481 were from non-coastal districts. The average age was 45 years while number of respondents who had a membership of any environmental related wildlife organization was 164. Seventy four percent of the sample had seen live marine turtles; 37.6% of them had seen marine turtles in zoological gardens. Majority of respondents strongly agreed that (84% on average) sea turtles are worth protecting. Forty one percent of respondents agreed that it is everyone's duty to ensure the existence of plants and animals for future generations, showing that respondents had bequest motive for marine turtle conservation. Majority (63.3%) of respondents strongly agreed that sea turtles have the right to exist in the environment, showing that there is a strong existence motive for the conservation of sea turtles. The study emphasize the need to better utilize the strong motives of people for sea turtle conservation efforts in Sri Lanka that requires attention of legislators and decision-makers.

Keywords: Sea turtle, Attitudes, Conservation, Motives

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

85

(216)

Valuation of the Bar Reef Marine Sanctuary from the Perception of the Visitors

Jayaratne C.T.[1]*, Gunawardena U.A.D.P.[1], Wattage P.[2], Edirisinghe J.C.[3]

[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka*
[2]*Faculty of Economics, University of Portsmouth, Portsmoutd, United Kingdom*
[3]*Faculty of Agriculture and Plantation Management, Wayamba University, Kuliyapitiya, Sri Lanka*
*chamathi2013@gmail.com

Abstract

Bar Reef is a diverse ecosystem with near shore coral reefs, sea grass beds and associated ecosystems with over 120 coral species and over 300 fish species reported from the surrounding sea. It has been declared as a marine sanctuary by the Department of Wildlife Conservation in 1992. Despite of the efforts it is subjected to over exploitation by extractive users, destructive fishing practices and visitor pressure on the ecosystem. The study sought to value the ecosystem degradation prevailing in the bar reef from the perception of the visitors using choice experiment method. Different attributes for the choice experiment were identified using two focus group discussions and 10 key informant interviews held prior to the mail survey. Identified attributes were level of plastic accumulated, use of illegal fishing nets, level of crowding and monetary contribution. An orthogonal main effect design was generated and 9 choice cards were prepared, each with 4 different attributes. Randomly selected 250 visitors were interviewed onsite during January to June 2021 and conditional logit model was used to analyze the significance of their preferences. Paying LKR 1,000, reducing crowding the beach area by 15% and reduction of plastic and polythene by 50% were the significant factors according to the results obtained at α=0.01. People are willing to pay LKR 1,001.18 if plastic pollution can be reduced by 50%. People are willing to pay LKR 998.92 if the crowding of the beach can be reduced by 15%. The results of this research emphasize the importance of protecting this habitat to the relevant stakeholders. Further, this research will enable to introduce new policies and practices so that sustainability of the ecosystem can be ensured.

Keywords: Ecosystem sustainability, Choice experiment, Conditional logit, Marine plastic pollution, Visitor access management

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

86

(217)

Effectiveness of a Disaster Management Education Program among Youth: A Case Study in Three Disaster-prone Provinces

Perera M.A.U.[1]*, Gunawardena U.A.D.P.[2]

[1]*Airport and Aviation Services Pvt Ltd, Bandaranaike International Airport, Katunaike, Sri Lanka*
[2]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
*achini.uthpala.perera@gmail.com

Abstract

Environmental Education has emerged to integrate knowledge on the need to conserve and to protect the natural environment and to minimize hazards associated with the polluted environment and natural disasters. The present study aimed at evaluating the effectiveness of an environmental education programme conducted among participants of National Youth Corps (NYC) training centres. NYC recruits two batches per annum within the age group of 15–26 years. The survey was carried out in year 2019 for its first batch at three provinces: Southern, North Central and Sabaragamuwa. A workshop was conducted for all the trainees by the Disaster Management Centre followed by a two-day disaster drill programme to apply the theoretical knowledge into practice. Total intake of 5688 NYC recruits were reported in this year. 1062 of them were selected from 8 NYC training centres out of 14 total centres located within the three provinces that are considered as prone to natural disasters. A quota sampling approach was used to obtain a representative sample from these districts. Selected participants were advised to complete two self-administered questionnaires: one before the workshop and the other soon after completion. Knowledge and attitudes were measured, and the scores were compared with the hypothesis that participants reported higher scores after the workshop. Knowledge and attitudes toward disaster preparedness was evaluated before and after conducting the workshop. 71% from Southern province (Tsunami); 60% from Sabaragamuwa (landslide); and 75% of North Central province (flood) reported prior experience of natural disasters. The level of awareness of having either a local disaster management plan or a local person responsible for disaster preparedness was low. Only 14.8% from Southern, 11.0% from North Central, 17.0% from Sabaragamuwa Province knew the presence of a local DMP in which 15.0%, 19.3% and 21.6% respectively, knew the presence of the DM personal. About 75% from Southern province, 64% from North Central province and 84% from Sabaragamuwa province were not aware of the existence of an early warning system. An increase in the positive attitude was observed and the perceived change in behavioral change of the trainees have increased after the study. They were highly motivated in assisting disasters in a real situation and were willing to volunteer in minimizing the environmental hazards associated with environmental degradation. Despite the high motivation, lack of experience indicates the need for inclusion of disaster management training into National Youth Corps curriculum with annual educational activities after the initial training. The assessment framework established by this study could facilitate regular inspection and verify various disaster management tasks, in-order to enhance youth capability in response to disasters.

Keywords: Environmental education, Disaster management, Youth, Knowledge enhancement, Attitude change

---

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

87

(218)

Study of Consumption and Disposal Practices Related to Polythene Shopping Bags

Karunaratne C.M.W.*, Gunawardena U.A.D.P.

*Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka
chethikaruna123@gmail.com

Abstract

The widespread use of polythene shopping bags raises significant environmental concerns about adverse effects to marine ecosystems, wild life and impacts resulting from litter all of which require public resources to mitigate or manage. The main objective of this study is to understand the consumer behaviour on polythene bag usage, their awareness on adverse impacts and their willingness to pay for a tax on reducing polythene bag usage. Data were collected from 100 respondents selected from different locations in Sri Lanka conveniently using a structured online questionnaire. In investigating an economic instruments for reducing pollution from polythene bags, payment from the polluter was obtained from two different methods such increasing the price of the polythene bag and imposing a tax on production of polythene shopping bags. In this analysis, it was considered two different dependent variables and the four independent variables. Those dependent variables are willingness to pay for polythene shopping bag and imposing tax on production. Four independent variables were considered for each regression models such as Household income, number of times of usage of polythene shopping bags, environmental impacts and adequacy about government initiatives. The results indicate that among the respondents 86% have all types of polythene waste and 81% separate polythene waste from their collected waste stream, 60% sort polythene waste as clean and unclean before disposal, 61.50% hand over polythene waste to municipal solid waste collectors and 18% of respondents dump the garbage pit in the backyard and 13% of respondents burn it. Most (85%) of respondents don't agree that burning polythene is harmful to life and 92% don't agree that dumping polythene bags to garbage pits will provide breeding grounds to mosquitos. Majority is using the bags only one or two times but printed /branded bags are being used one to five times. Majority (36%) of respondents suggests a tax of Rs. 5.00 to pay for a polythene shopping bag which can carry 2-3kg per bag and 31 per cent respondents suggested Rs. 2.00. Most of the respondents prefer to switch to a bio-degradable or reusable bag completely if the government put a blanket ban on polythene. The study suggests that educating and making awareness related to the usage and disposal practices related to the polythene shopping bags is very important for the behaviour of the consumer. Introducing an economic instrument related to increasing the price of the polythene shopping bag or imposing a tax at the production or switch to a reusable bag or any other environmentally friendly alternative as a substitute for polythene shopping bags would be a timely action as the majority of the selected sample is ready and willing to embrace these alternatives.

Keywords: Polythene, Shopping bags, Reusable, Consumer behaviour, Price

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

88

(221)

The Opportunity Cost Analysis of using Jack Fruit Timber as a Construction Material in Sri Lanka

Kaluwila K.M.C.N[*], Udawattha C.D.

Department of Estate Management and Valuation, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka
*chemi.kaluwila@gmail.com

Abstract

The miracle tree in the world is thought to be the jackfruit tree. Its fruit-bearing capacity was well-documented by history academics. However, jackfruit wood is also regarded as one of Sri Lanka's more expensive wood types. Instead of considering the quality of the actual lumber material, this is only dependent on its legendary value. It was not considered how much money the timber was worth. They are carelessly used as one of the finest luxury lumber materials, disregarding the fact that they were originally planted as fruit trees. In an effort to compare the true worth of jackfruit wood to the current palette of premium timber materials, this study was initiated. Thus, it will assist legislators in passing a new law that forbids Sri Lanka from using jackfruit trees as a source of lumber. First, a life cycle model was used to determine the yield value and market value of jackfruit timber. The perceived value of the timber and the yield were then contrasted with the timber's real market worth. The study discovered that, before the age of 50 years, the jack fruit tree's yield value was significantly higher than its timber value. Only Rs. 100,000.00 is the typical timber value anticipated from a jackfruit tree. Only eight years of average yield value are required to restore the value of the timber. In order to preserve the jack fruit tree as one of the top fruit-bearing trees in the world, a new policy should be developed to change the jack fruit tree cutting age to a minimum of 50 years.

Keywords: Jack fruit tree, Yield value, Selling price, Timber value

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

89

(226)

Farmers Perspectives on Negative Impacts of Chemical Pesticide Usage in Vegetable Cultivations: Case Study from the Periyaneelavanai Area, Ampara District

Tharangani P.K.S.J.*, Sanjula K.R., Sahr A.K.S., Rushdha M.J., Bandara W.A.R.T.W.

Department of Zoology and Environmental Management, University of Kelaniya, Kelaniya, Sri Lanka
*shammi2534@gmail.com

Abstract

Indiscriminate use of pesticides causes health hazards to humans and long-lasting negative impacts to the environment. The major objectives of this study are to evaluate the current status of pesticide usage in the Periyaneelavani area, to evaluate farmers' perception on health, environmental effects due to usage, of pesticides, to identify the awareness level of farmers about proper usage of chemical pesticides and alternatives. This study was carried out in two GN divisions of Periyaneelavanai area, Ampara district. To represent 20% respondents, 50 farmers from each GN devisions which upto total 100 were randomly surveyed using a structured questionnaire. In order to gather the necessary data on vegetable cultivation, a preliminary study involving interviews with the Agricultural Instructor-Officer in Charge and affiliated farmers in Periyaneelavanai area were conducted before the actual survey. Discriptive analysis, P test, T test, anova were performed using minitab 14.0 version to conduct data analysis. The present study revealed that Chili, Brinjal, Okra, Tomato, Long beans, Cucurbites, Onion and Leafy vegetables were primarily grown in this area. Abamactin, Coragan, Applaud and Virtako were used as insecticides and Abamactin was the most popular (42%) among farmers. Mancozeb, Propineb and Canazole were used as fungicides and the highest usage was Mancozeb (45%). Mortin rat kill was used as a rodenticide by all the respondent farmers, and they have not used herbicides for their vegetable cultivation; instead, they manually remove the weeds. Skin irritation was the most prominent (60%), acute disease, and Asthma was the most common chronic disease (31%), that can be seen among farmers. The most common adverse environmental impact in this area was the empty pesticide containers piling up along roadsides (95%). All the farmers use at least one PPE while applying pesticide though the frequency of wearing PPE is different among each other. The majority of respondents use gloves, eye protection, and foot ware but lack of awareness towards face, head and body protection. The highest number of farmers selected indoor places (51%) for pesticide storage which cause to have a high risk of exposure among farmers. Most of the farmers selected the option of burying or burning pesticide bottles after using it. Majority of respondents preferred to use chemical pesticides (76%), rather than alternative methods due to the reliability of those methods. It is proposed to educate farmers on application, storage, cleaning and carrying the pesticides, the methods of effectiveness of different individual protection facilities, and utilizing the behavior to reduce the exposure to poisons should be developed and be available to farmers. This will help to reduce negative health and environmental consequences. Moreover, it is recommended to introduce reliable and effective alternative methods for chemical pesticides.

Keywords: Periyaneelavanai area, Vegetable cultivation, Pesticides, Environmental impacts, Disease

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

90

(34)

Sri Lankan Contribution to Climate Change by Enteric Fermentation of Large Ruminants: An Overview

Manewa R.M.S.S. *, Madumadhawa M.H.D., Palliyaguru O.G., Senaratne D.

Department of Animal Science, University of Ruhuna, Matara, Sri Lanka
*rmssbhanu96@gmail.com

Abstract

The Sri Lankan livestock sector (LS) which is essential to rural households' food systems and means of subsistence, contributed to 0.6% of the GDP in 2020. The cattle industry has contributed <40% to the LS. The objective of the review was to determine how Sri Lankan LS, especially ruminants contributed to climate change (CC) by emitting greenhouse gasses (GHG). In the year 2020, in total there were 1 426 570 cattle, including neat cattle and buffaloes. Sri Lanka has experienced various impacts of CC as it is a tropical island in the Indian Ocean. The cattle industry is involved in CC directly and indirectly. Global warming (GW) is a predominant factor in CC. The emission of GHG in different ways is a root cause of GW. As a GHG, 17% of methane emissions in the atmosphere are accounted by the enteric fermentation of ruminants, especially by the large ruminants; cattle, and buffaloes. It is a complex process that occurs within the fore stomach (rumen) of ruminants where gases are released outside via a process called eructation. As a GHG, methane (CH_4) contributes to GW 28 times higher than carbon dioxide produced in large ruminants by enteric fermentation. In Sri Lanka, the majority of the local indigenous cattle and buffaloes are used to eat low-quality grasses, straws, and other roughage which significantly increases the emission of CH_4. A past study revealed that the CH_4 emission factor estimated according to the IPCC (2006) Tier 2 methodology for an improved dairy cattle is 42 kg /head /year while a local dairy cow is 52 kg /head /year and 65 kg /head /year for dairy buffalo in Sri Lanka and the values are lower compared to default emission factors given by the IPCC (2006). The expected temperature rise in Sri Lanka, which would be primarily caused by GHG, will be slightly less than the average worldwide. However, the highest emission scenario predicts a 2.9° C–3.5° C increase in temperature by the 2090s. Therefore, instead of focusing solely on production, it is important to investigate measures to minimize GHG emitted by large ruminants under local management conditions.

Keyword: Climate change, Enteric fermentation, Livestock, Methane

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

91

(59)

Estimation of Aboveground and Belowground Carbon Stocks in Homegardens of Low Country Wet Zone, Sri Lanka

Nilupuli M. D.*, Lokupitiya E. Y. K.

Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*dilminm@gmail.com

Abstract

Homegardens are one of the most significant and oldest types of land use systems in Sri Lanka which have been recognized as an essential component in providing a variety of ecosystem services. In these systems, trees and shrubs are grown together with food crops under family labor, creating a multitude of biological interactions. Due to rich tree diversity and density, homegarden agroforestry systems are known to have a great capacity to capture and store carbon in their biomass and soils, and thus greatly contribute to mitigation of climate change. Even though the importance of homegardens with regard to the above is highlighted significantly, large knowledge gaps remain on their total carbon storage potential, particularly in low country wet zone homegardens of Sri Lanka. Therefore, the current study aims to estimate the total aboveground and belowground carbon stocks of homegardens in Kalutara district. The study was conducted in ten homegardens ranging from 0.15 Ha to 0.43 Ha. The study focused on all perennial woody trees present in the homegardens. Heights and diameters at breast height (DBH) were measured in a total of 966 woody trees. Aboveground biomass of each tree was calculated nondestructively, using allometric equations which incorporated wood density, DBH and tree height. Belowground biomass was calculated using root: shoot ratios of trees. Total biomass of each tree was converted to total carbon stocks using a conversion factor of 0.5 extracted from literature, considering that total carbon stock of a tree is equivalent to half of its biomass. In order to get the total carbon stock, soil organic carbon (SOC) content of each home garden was analyzed in the laboratory from collected soil samples using the Loss-on-ignition method. Belowground biomass carbon stock and the SOC stock together were taken as the total belowground carbon stock of each homegarden. Estimated mean aboveground carbon stock was 91.4±11.4 Mg ha^{-1}, while the mean belowground carbon stock was determined as 134.3±12.3 Mg ha^{-1} in low country wet zone home gardens. Aboveground carbon stock, together with the belowground carbon stock, was taken as the total carbon stock of the homegardens. Calculated total carbon stock per unit area for low country wet zone homegardens ranged between 179.873 Mg ha^{-1} and 286.606 Mg ha^{-1} with a mean value of 225.7±11.9 Mg ha^{-1}. Above findings of the study present evidence for significant carbon storage capacity of low country wet zone homegardens.

Keywords: Homegarden, Low country, Wet zone, Carbon stock, Climate change

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

92

(60)

Review of Climate Change's Impacts on Tea Quality

Jayawardhana, J.M.S.S.

Department of Environmental Management, Rajarata University, Mihintale, Sri Lanka
*sitharas252@gmail.com

Abstract

Subsequent to water, tea is the most consumed beverage worldwide. Tea could be identified as one of the oldest drinks prevailing since prehistorical era. This article's objective is to expedite that there is any significant impact on the major four aspects of Tea namely quality—aroma, taste, color, and yield with climate change. While observing on how climate patterns affect the Tea yield and quality, Tea farmers who has long cultural traditions of managing tea plantations are among the most knowledgeable people according to the literature review. Warmer temperatures, increased weather unpredictability such as higher rain variability, and altered plant phenology, such as earlier bud burst, are just a few of the reported alterations. These tea growers assert that such weather variations directly affect commercial tea gardens. An early tea harvest is linked to higher temperatures. Extreme droughts, which are thought to have become more common recently, are associated with drier tea leaves with less blossoming. It is also said that tea harvested during a drought has a substantially stronger flavor and scent. Farmers report that tea harvested during exceptionally rainy periods has lovely leaves and increased blooming but a relatively watered-down flavor and scent. The drought this spring has benefited tea production since consumers enjoy the robust aroma and sticky-sweet aftertaste of the beverage. In the absence of any other changes, a rise in average temperatures imposed on by global warming will lessen the production of tea plantations. Climate change will have a higher impact on tea yield than any other tea characteristics, such as aroma, taste, or color. In addition to immediate benefits such research studies, actions to lessen the vulnerability of tea plantations to heat and precipitation variability will also aid in climate change adaptation.

Keywords: Climate Change, Aroma, Color, Taste, Yield

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

93

(67)

Climate Injustice in Sri Lanka through the Lens of Flooding Events

Gunawardena D.H.*, Wickramasinghe D.

Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*dilishagunawardena@gmail.com

Abstract

Climate change is an issue of social justice as much as it is an issue of the environment. The impacts of climate change induced disasters are known to be felt disproportionately by those in the low socio-economic status. Against this backdrop, this paper investigates flood disasters in the light of climate injustice and the impacts on the socio-economic rights of affected communities in the Gampaha district. The present study used a cross-sectional study design with qualitative data from key informant interviews and quantitative data from secondary sources and primary data from a questionnaire-based survey in 200 households in the most affected Grama Niladhari Divisions of Wattala and Kelaniya Divisional Secretariat Divisions (DSDs). Receipt of Samurdhi relief was considered to represent the low socio-economic status. The study mobilized the disaster risk assessment factors and the findings revealed that those of low socio-economic status were of a significantly higher risk (Chi squared test, $p<0.05$) to flooding in terms of proximity to flooding source, structural vulnerability of housing, poor coping up ability, limited risk reduction measures and lack of opportunities to build resilience. Consequently, a significantly higher proportion (Chi squared test, $p<0.05$) of those of low socio-economic status were found to have faced difficulties in enjoying the aspects of the right to standard of living namely, right to health, water, food and adequate housing. In conclusion, floods have resulted in an injustice to those of low socio-economic status due to their disproportionately higher risk to flooding and the resultant impact on the full enjoyment of their socio-economic rights.

Keywords: Climate change, Climate injustice, Floods, Socio-economic rights, Low socio-economic status

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

94

(75)

Floods and Land Use Land Cover Changes in the Kalu River Basin: A Call to Action

Amarakoon V.[1]*, Wickramasinghe D.D.[1], Premasiri H.M.R.[2], Shaw R.[3], Mukherjee M.[4]

[1]*Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*
[2]*Department of Earth Resources Engineering, University of Moratuwa, Moratuwa, Sri Lanka*
[3]*Graduate School of Media and Governance, Keio University, Tokyo, Japan*
[4]*Department of Architecture and Planning, Indian Institute of Technology Roorkee, Uttarakhand, India*
*vihangaresearch21@gmail.com

Abstract

Floods are one of the most common natural disasters worldwide. Apart from rainfall, Land Use Land Cover (LULC) changes too are a main contributory factor for floods. This study attempted to understand the link between floods and LULC changes in Kalu river basin, which is the second largest river basin and an area that experiences recurrent floods in Sri Lanka. We studied peak water levels, number of flood events, changes in land use types and impacts in rapidly urbanizing two districts, Rathnapura (upper basin) and Kalutara (lower basin) during 2001-2020. The satellite images (LANDSAT) were obtained for 2001, 2009, 2015 and 2020 and land use classification was done using ArcGIS and Remote Sensing Tools. Main land use types and their transformations were investigated and ground-truthing was carried out. Accordingly, the main types of land uses identified were Natural Vegetation and forests (NV), Settlements (ST- housing and industrial lands), Cultivated Lands (CL), Water Bodies (WB) and Bare Lands (BL). The results indicated that the most drastic change was found in the natural areas (NV) and they have diminished while the lands with anthropogenic impacts (ST, CL and BL) have increased across years. The NV had occupied the highest land area in 2001 (42.4%) and has reduced by 14.2% by 2020. The ST and CL have increased by 8.6 % and 5.2% respectively. The monthly rainfall of Rathnapura and Kalutara (Source: Department of Meteorology, Sri Lanka) has increased with time, which is a main reason for the increasing peak water levels of these areas (Source: Department of Irrigation, Sri Lanka). However, a significant correlation also exists between the change of the settlement area with the peak river water levels in the lower basin (p=0.03, R^2=99%; regression analysis). Rathnapura has experienced 3 major floods (floods above the high water alert level) from 2001-2020, while 16 major floods have occurred in Kalutara. During the major flood in 2017, the number of child deaths in Rathnapura was 14 while in Kalutara it was 24. Accordingly, the LULC changes of the whole basin along with rainfall seem to influence on the severity of floods in Kalutara more, as it is located in the lowest elevation level. When natural lands are transformed to anthropogenic-impacted areas with disturbances to the water cycle, increased impervious surfaces, reduced water storage capacities and loss of natural drainage, the flood risk tends to increase. Proactive approaches including proper land use planning and rainwater storage are urgently needed as the climate change too would trigger more floods. Thus, the flood mitigatory actions, especially, in the lower river basin should be a priority to ensure resilience and sustainability.

Keywords: Kalu river basin, Land Use Land Cover (LULC) changes, Floods

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

95

(94)

A GIS-based Binary Logistic Regression Model for the Inundation Analysis; A Case Study on Elapatha DS Division, Ratnapura District, Sri Lanka

Ekanayaka H.D.M.[1]*, Jayasinghe G.Y.[1], Priyankara P.[2]

[1]*Department of Agriculture Engineering, University of Ruhuna, Matara,Sri Lanka*
[2]*Computer Unit, Faculty of Agriculture, University of Ruhuna, Matara, Sri Lanka*
*hasinidilthara@gmail.com

Abstract

Flood susceptibility analysis (FSA) is a prerequisite for adopting flood mitigation and adaptation techniques. A number of technologies and models have emerged through time, and this study focuses on the Binary Logistic Regression Model (BLRM) to investigate flood vulnerability of Elapatha Divisional secretariat (DS), Ratnapura District, Sri Lanka where has high impact from inundation. Rainfall, land use and land cover (LULC), elevation, slope, slope aspect, distance to the river, topographic wetness index (TWI), and stream power index (SPI) were the factors used in the model construction. These components were investigated in terms of their contribution to flood susceptibility using all location data and field plotting of responsible parameters in the study area using Geographic Information System (GIS) software, and all extracted data points were 96489, of which 50% were used for BLRM development using SPSS statistical software and remaining 50% for model validation. The coefficient of rainfall parameters, log value of elevation in meters, the tan value of slope in degrees, radiant value of aspect in degrees, (distance from the river)0.1, the ratio between SPI and TWI (SPI/TWI) and LULC band values of built-up area, water bodies and vegetations were 0.023, -2.254, -1.018, -0.005, -0.164, -0.003, 2.707, -.067 and -0.004 respectively. The accuracy was validated using Mean standard error (MSE) and area under curve (AUC) analysis, with values of 0.031 and 0.724 respectively. The Built-up area, elevation, and slope had the most impact on the inundation Elapatha DS division, and model performance represents 72.4% accuracy. Therefore, mitigation of inundation problems can be achieved through proper landscaping in the area.

Keywords: Binary logistic Regression, Flood susceptibility Analysis, GIS software, Spatial analysis

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

96

(98)

Knowledge, Attitudes and Practices among Medical Officers on Disaster Preparedness: Study from Base Hospital Panadura (BHP) and Kethumathi Maternity Hospital (KMH), Panadura in Western Province

Kumara P.G.H.[1]*, Pathirana T.E.A.[2], Wickramasinghe D.D.[3], Premasiri H.M.R.[4]

[1]*Administrative unit, District General Hospital, Horana, Sri Lanka*
[2]*Health Informatics Unit, Base Hospital, Panadura, Sri Lanka*
[3]*Department of Zoology and Environmentl Sciences., University of Colombo,*
Colombo 03, Sri Lanka
[4]*Department of Earth Resources Engineering, University of Moratuwa, Moratuwa, Sri Lanka*
*drhemanthakumara@gmail.com

Abstract

Climate change is contributing to increased disasters in the world. As the disaster events are rising, health, socio-economic and political consequences are inevitable. Therefore, managing disasters to reduce the risk and impacts is given high priority in any development agendas. In this context, emergency and disaster preparedness have become a vital element in disaster management. To manage disaster induced health impacts that include deaths and injuries, hospitals play a major role. The objective of this study was to investigate the knowledge, attitudes, and practices of medical officers on disaster preparedness in two key hospitals in the country. The present study focused on the medical officers in Base Hospital Panadura (BHP) and Kethumathi Maternity Hospital (KMH) regarding disaster preparedness. Cross-sectional research was designed to collect data from the health personnel working in two hospitals through a questionnaire which was prepared and distributed online. Data were collected from 95 and 17 doctors, who were randomly chosen, from BHP and KMH respectively. The majority of the respondents (93%) stated that hospital disaster preparedness plans could assist in reducing morbidity and mortality during an event of a disaster. In both hospitals, 40% of respondents were familiar with the disaster preparedness (DP) programs and 60 % were aware that such programs exist in their hospital. Around 67% and 65% of the medical officers from BHP and KMH respectively had stated that the prior experience of the medical officers is the key to handling a post disaster health management. The statistical analysis indicated that knowledge and practices of the medical officers were significantly linked to DP while the attitudes of the participants did not demonstrate any link to the DP programs. In summary, enhancing knowledge and good practices aiming at post disaster medical care as well as enhanced disaster preparedness activities among the medical officers contribute to disaster risk reduction.

Keywords: Disaster preparedness, Knowledge, Attitudes, Practices, Medical officers

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

97

(106)

A Critical Appraisal of the International and National Legal Framework on Climate Change

Samaradiwakara H.S.

Department of Law, University of Jaffna, Jaffna, Sri Lanka
sujathaasamaradiwakara@gmail.com

Abstract

The decade starting from 2010-2020 was recorded the warmest decade in the history. The new principles such as Climate litigation, climate justice, climate legislation have been catapulted to the forefront of the environmental litigation and environmental laws. As per the United Nations Framework Convention on Climate Change (UNFCC) the human activities is the substantial cause for increasing of Greenhouse gases in the atmosphere which would results in additional warming of the earth's surface and the atmosphere and also may adversely affect the natural eco system and human kind. Article 2 of the UNFCCC defines climate change as, a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. Changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare are the effects of climate change. As a matter of fact climate change is the direct result of global warming and the emission of greenhouse gases to the atmosphere has escalated the earth's temperature level. The Resolution adopted by the General Assembly which includes 2030 Agenda for Sustainable Development urges States to take urgent action to combat climate. UNFCC, Kyoto Protocol and Paris Agreement constitute the international legal regime that deals with climate change. These were the results of entering into international consensus in the aim of reducing the greenhouse emission and thereby to effectively handle the climate change impacts. The objective of the paper is centered on the appraisal of the international and national legal framework that have been enacted to curb the climate change. To this end the research paper employs a qualitative methodology. Conventions, Resolutions adopted by the United Nations, legislations such as National Environment Act, Fauna and Flora Act, Coastal Conservation Act etc , policies and regulations, case laws from foreign jurisdiction are utilized as primary sources and the scholarly articles, journals, peer reviewed articles are utilized as secondary sources. The findings of the paper emphasizes that the synergy between the international and national legislations should be strengthen if the legislature is to find prolific solutions to this complex issue. Finally the paper concludes that it must be taken into consideration that if all States are to combat this unprecedented crisis, no instrument can be ignored.

Keywords: Climate change, Climate litigation, Environment, Global warming, Sustainable development

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

98

(140)

Analysis of Climate Variable and Fisherman Perception on Climate Change Divers in Negombo Lagoon Area

Fernando R.[1], Bellanthudawa B.K.A.[2], Halwatura D.[1]*

[1]*University of Colombo, Colombo 03, Sri Lanka*
[2]*University of Ruhuna, Matara, Sri Lanka*
**devan.halwatura@zoology.cmb.ac.lk*

Abstract

Climate change has undoubtedly become one of the most contentious issues in the international environmental debates and has escalated the impacts on fishery industries and fishing communities globally. This study was conducted to quantify the variations in climate variables, and coastal vegetation that may affect the fisheries industry due to climate change over past three decades in the Negombo lagoon area. Further, the knowledge and awareness of fisheries and associated communities on climate change was investigate. To understand the dynamics of the precipitation and temperature, monthly data for 30 years (1989-2022) were collected from the Department of Meteorology and 19 Module Bio-climatic Variables (MBV) were calculated to determine the climatologycal variation. The change in the coastal vegetation was analyzed using the Landsat 8 satellite using ArcGIS 10.8. A questionnaire survey and a focus group discussion were carried out as assess the knowledge, awareness and impact of climate change in the fisheries community (n=80). The mean annual and minimum and maximum precipitation ranged from 118.6 mm-268.6 and 0.6 mm - 826.6 mm. The mean, maximum, and minimum temperatures varied from 28.8^o C-32.3^o C, 33° C-34° C and 29° C-30° C. Out of 19 MBV variables, 9 variables had increasing trends while 3 variables had decreasing trend. The change percentage of coastal vegetation cover from 1992-2002, 2002-2012, 2012-2022 was observed as 35.71%, 4.99% and 6.13%. As per the peoples' knowledge of climate change, it was highlighted that around 50% of respondents does not have a proper idea on what is climate change (40% of respondents stated that the variation of precipitation and wind is the climate change drivers; Further, 40% of respondents attested that land use change with time has accelerated climate change while 30% of respondents mentioned that lack of coastal awareness and restoration programs is the second main reason for accelerated climate change that affect the fishery industry). The outcomes of the focus group discussion revealed that fishing activities are heavily affected by climate change drivers, and some engage in alternative jobs in extreme climatic conditions to feed their families. Finally, fishery communities highlighted the need for the government and other responsible authorities to take necessary actions to adapt and strengthen the resilience to climate change. This study corroborates the timely and topical obligation for sustainable fisheries management action planning for the Negombo area.

Keywords: Climate change, Coastal mangrove vegetation-precipitation-temperature change, Fisheries communities, Knowledge, Awareness, Negombo

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

99

(223)

Climate Change Vulnerability and Adaptation: The Case of Western Province, Sri Lanka

Ranasinghe D.M.S.H.K.

Department of Forestry and Environmental Science, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka
*hemanthi.ranasinghe@gmail.com

Abstract

Sri Lanka, as an island and developing nation, is highly vulnerable to the adverse effects of climate change. Occurrences of natural disasters due to extreme weather conditions such as prolonged droughts, flash floods and landslides deprive lives and livelihoods of people. Building resilience of vulnerable communities and ecosystems over climate change effects within a broader framework of sustainable development remains the country's priority. The Western Province is one of the nine provinces of Sri Lanka. It is the most densely populated Province in the country and is home to the legislative capital Sri Jayewardenepura Kotte as well as to Colombo, the nation's administrative and business center. The Province is located in the southwest of the country and has an area of 3,684 square kilometres and 5,821,710 people. It comprises of three administrative districts; Colombo, Gampaha and Kalutara. The Western Province provides the highest contribution to the Gross Domestic Product contributing 41.2% of the Provincial Gross Domestic Product (PGDP), the highest being the service sector (56.5%) followed by Industrial sector (34.6%) and then agriculture (1.7%). With regards to the climate change impacts, the most significant ones for the Province are recurrent flooding as a result of an increase in average rainfall coupled with heavier rainfall events, increase of the minimum temperature and thus the decrease in the difference between maximum and minimum temperatures and also sea level rise as certain parts of the Province borders the coast. The key vulnerable sectors of the Province are food security which comprise of agriculture (including both crops and livestock) and inland fisheries; water resources which includes both drinking water and irrigation, coastal and marine, ecosystem and biodiversity, human settlement and infrastructure, tourism and health. In addition to these sectors there are cross cutting sectors which includes policy, legal, economic and governance, Institutional development and coordination, International cooperation and partnerships and research and development which have a significant stake to the magnitude of impact. Among the adaptation interventions the following are being implemented/proposed for implementation; Climate Smart agriculture/practice and other alternative agricultural systems, increase storage capacity of water, rational management of water distribution and use, collection of data on the endangered/to be extinct/vulnerable fauna and flora due to climate change and protect them, conduct research including citizen research to identify the changes in biodiversity due to climate change, integration of climate change impacts into new and already prepared development plans and construction of salinity barriers. Most of these interventions had been included in the implementation plans of the Nationally Determined Contributions (NDC) by relevant agencies which is in accordance with the Paris Agreement (2015) and submitted to the and the submission of the revised NDC to the UNFCCC with the approval of the Cabinet of Ministers in the country. However, the full implementation of same requires to improve the capacity in institutions including human resources, finances and technological interventions which needs urgent attention.

Keywords: Climate change, Adaptation, Western Province, Impact, Vulnerability

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

100

(41)

A Study on the Potentiality of Bioethanol Production from Selected Weed Species of the Asteraceae Family

Alwis W.L.N.S.[1]*, Pratheepkumar M.[1], Ranganathan K.[2]

[1]Department of Bioscience, University of Vavuniya, Vavuniya, Sri Lanka
[2]Department of Botany, University of Jaffna, Jaffna, Sri Lanka
*lukshialwis07@gmail.com

Abstract

Increasing population growth, industrialization, and the harmful impacts of fossil fuel burning on the environment fascinated the researchers to find a low-cost, environmentally friendly alternative substitute. A potential substitute feedstock for the synthesis of second-generation bioethanol is the lignocellulosic biomass from invasive weedy plants. The aim of this study was to determine the potential of bioethanol production from two weedy plant species using physical, chemical, and physiochemical pretreatment methods, as well as to optimize the pretreatment and culture conditions to obtain a higher reducing sugar amount and ethanol yield. The collected invasive weedy plants, *Chromolaena odorata* and *Tridax procumbens,* were cleaned, then pretreated with different acids and bases (4% v/v) at 121°C for 15 min. Then the filtrate was incubated with *Saccharomyces cerevisiae* (baker's yeast) in the peptone yeast extract and nutrient medium (PYN) at room temperature, the pH was maintained at 5.0. *T. procumbens* plant substrate with the performic acid pretreatment agent produced a significant amount (0.2%) of ethanol, and further studies were conducted with the same substrate and the pretreatment agent. The conditions were optimized successively by changing one factor at a time while keeping the other variables constant. Several important hydrolysis factors were studied for the optimization, including performic acid concentration (0.2–5%), hydrolysis time (10–60 min), fermentation time (24–120 h), inoculum concentration (1.25–7.5 g/100 ml), and rotation speed (50–250 rpm). The maximum ethanol yield of 0.47% was observed at 0.6% performic acid concentration, 30 min of hydrolysis time, 48 h of fermentation time, 5 g/100 ml of inoculum concentration, and 100 rpm rotation speed with *T. procumbens* using *S. cerevisiae.*

Keywords: Bioethanol, Lignocellulosic biomass, Acid hydrolysis, *Saccharomyces cerevisiae*

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

101

(49)

In vitro Screening of Antioxidant and Anti-inflammatory Activities of Plant Extract *Adenanthera pavonina*

Wijesekara M.A.[1]*, Goonerathne L.V.[1], Soysa P.[2], Perera D.B.[2], Jayasena S.[2], Jayasiri A.[3], Kottahachchi D.U.[4]

[1]*Department of Pathology, University of Colombo, Colombo 03, Sri Lanka*
[2]*Department of Biochemistry and Molecular Biology, University of Colombo, Colombo 03, Sri Lanka*
[3]*Instittues of Indigenous Medicine, University of Colombo, Colombo 03, Sri Lanka*
[4]*Faculty of Allied Health Science, Kotalawala Defence University, Borelasgamuwa, Sri Lanka*
*manojwijesekara@gmail.com

Abstract

Adenanthera pavonina (AP) is a medicinal herb used in traditional systems of medicine in Sri Lanka. It is considered a rich source of bioactive compounds as they are able to produce a great variety of secondary metabolites with great anticancer and antioxidant properties. In the present study, the bark of the plant was used and water extract was prepared in order to screen Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Ferric ion reducing power, DPPH radical scavenging capacity, inhibition of lipid peroxidation, inhibition of protein oxidation and inhibition deoxyribose oxidation. Anti-inflammatory activity was screened *in vitro* using Human Red Blood cell Membrane stability assay (HRBM) and inhibition of protein denaturation assay. All methods were carried out according to the standard protocol. The TPC and TFC were 80.3±0.1 mg GA/g (Gallic Acid/g) and 46.1±0.1 mg EGCG/g (epigallocatechin gallate /g) respectively. The DPPH radical scavenging capacity, inhibition of lipid peroxidation, protein oxidation and deoxyribose oxidation were IC50, 15.8±0.5 (Gallic acid, 4.5±0.3 µg/ml), 46.1±0.5 µg/ml (Ascorbic acid , 58.4±2.2 µg/ml), 72.6±3.1 µg/ml (Ascorbic acid, 51.2±0.1 µg/ml) and 7.4±0.7 µg/ml (Ascorbic acid, 8.7±0.6 µg/ml) respectively. Reducing power of the AO extract increased with the concentration. HRBM and inhibition of BSA denaturation of AO extract were IC50 that 49.7±1.4 µg/ml (Diclofenac sodium, 47.8±2.1 µg/ml) and 29.1±1.5 (Diclofenac sodium 23.8±3.6 µg/ml) respectively. The results of the study suggest that the bioactive molecules present in the AP water extract can be used as a prototype for the development of new drugs or as a source of antioxidants and anti-inflammatory pharmaceutical raw material.

Keywords: Adenanthera pavonina, Inhibition of lipid peroxidation, Inhibition of protein oxidation, Inhibition deoxyribose oxidation.

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

102

(150)

The Effect of Nitrogen-Enriched Partially Burnt Paddy Husk on Growth and Yield of Rice (*Oryza Sativa*)

Jayarathna J.G.S.N.[1], Godakumbura P.I.[1]*, Ratnayake W.M.U.K.[2]

[1]*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Rice Research and Development Institute, Bathalagoda, Sri Lanka*
*pahanig@sjp.ac.lk

Paddy husk can be defined as a material that can be easily accessed by small-scale, resource-poor farmers in Sri Lanka. It is being produced in large quantities during the production of milled rice as by-products. Currently, most paddy husk is underutilized or left unused due to their intrinsic properties. Partially burnt paddy husk (PBPH) is an organic material that is prepared by incomplete combustion of paddy husk. The use of PBPH as a soil amendment to fix soil fertility problems has been well recognized. It contains a higher porous structure and an enhanced adsorption capacity, therefore, has the ability to slow down nutrient leaching by capturing nutrients in its porous structure. In the present study, a farmer-friendly, biochar-based organic nitrogen fertilizer was developed by nitrogen-enriching PBPH using nitrogen-rich liquid fertilizers in order to determine its effect on the growth and yield of rice. A pot experiment was conducted at the Rice Research and Development Institute, Bathalagoda based on a Completely Randomized Design (CRD) with eight treatments and five replicates.The treatments included T1 (Gliricidia extract+PBPH), T2 (cow urine+PBPH), T3 (poultry manure+PBPH), T4 (fish tonic+PBPH), T5 (compost tea+PBPH), T6 (urea+PBPH), T7 (PBPH only) and T8 (no treatment). Nitrogen (N) content of raw materials, liquid fertilizers, N-enriched PBPH, and N uptake of plants were determined using Kjeldahl method. Phosphorus (P) and potassium (K) contents of PBPH were determined by using UV-Visible Spectrophotometer and Flame Photometer, respectively. Plant height and greenness (SPAD results) were recorded as growth parameters and finally, number of tillers, panicles, grains per pot and grain weight per pot were obtained as the yield parameters. Significantly, the highest N content was found in urea liquid fertilizer (3.42%) whereas the lowest was found in Gliricidia extract (0.35%). Significantly, the highest N content (1.735%) of N-enriched PBPHs was found in T6 (urea+PBPH), while the lowest (0.058%) was found in T7 (PBPH only). Significantly, the highest N uptakes (1.98% and 1.86%) of rice plants were found in T6 (urea+PBPH) and T4 (fish tonic+PBPH) respectively while the lowest (0.56%) was found in the T8 (no treatment). SPAD readings, the number of panicles, tillers and grain yield, and biomass were significantly increased in all treatments over T7 (PBPH only) and T8 (no treatment) treatments. The overall study concluded that the application of N-enriched PBPH has improved the growth and yield of rice, therefore it can be used as a farmer-friendly, sustainable, and organic nitrogen source in paddy cultivation in Sri Lanka.

Keywords: Nitrogen, Partially burnt paddy husk, Nitrogen enrichment

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

103

(201)

Water Hyacinth (*Eichhornia crassipes*) As a Possible Alternative Energy Source: A Case Study for INSEE Cement Manufacturing Plant in Puttalam, Sri Lanka

Chandrathilake G.G.T.[1]*, Rathnayake O.M.S.C.[1], Silva A.P.[2]

[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*INSEE Ecocycle Lanka (Pvt) Limited, Puttalam, Sri Lanka*
* thilakawansha@sjp.ac.lk

Abstract

Cement manufacturing is typically energy-intensive process and currently using alternative fuels partially or totally to replace fossil fuels to reduce the energy and environmental costs. Biomass is one of the main alternative fuel utilized by the cement industry with the potential to replace up to 20% of total energy demand. Water hyacinth (WH) is a problematic invasive alien species in aquatic ecosystems of all climatic zones in Sri Lanka. Because of it is non-edible, rapid growth, and freely available in larger quantities, WH has the potential to be used as biomass energy. Several countries have been studied for WH as feedstock for bioenergy production while physical and chemical composition of WH biomass has been tested by many researchers. However, biomass physiochemical properties may be varied by different place and conditions and there is no significant study for industrial application of WH biomass to burn in cement plant kiln as alternative energy source. Thus, this study aimed to elucidate the potential of WH biomass as an alternative energy source for the INSEE cement plant in Puttalam. The study was conducted in three selected reservoirs namely, Tabbowa reservoir (TR), Murukkuwatawana reservoir (MR), and Nawadankulama reservoir (NR) located in Puttalam district Northwestern province of Sri Lanka. The quantity of fresh and dry WH biomass was estimated with the WH covered area and fresh and dry weights of WH in unit area. WH covered area of in each reservoir during 2020 and 2021 was digitized directly in Google earth satellite images using Google Earth Pro software with help of visual interpretation techniques. WH biomass per unit area were measured by the subjective sampling method. WH samples from each reservoir were collected for analyzing biomass, and to determine the fuel characteristics such as net calorific value (NCV), Chlorine and Sulfur content, moisture, volatile matter, fixed carbon, and ash content. According to the results, the fresh WH biomass was recorded as 692.62, 389.85, 23.58 tons in 2020 and 3570.82, 584.53, 33.31 tons in 2021 in the TR, MR, and NR respectively, while the dry WH biomass was recorded as 41.65, 24.65, 1.31 tons in 2020 and 214.74, 36.96, 1.85 tons in 2021 in the TR, MR, and NR respectively. NCV of the WH composite sample was 12.02 MJ/kg. Moisture content, ash content, chlorine and sulfur content were recorded as 13.56%, 10.95%, 1.06%, and 0.14% respectively. Except for chlorine content, other parameters agreed with the acceptable limits for using WH as an alternative energy source for cement industry. To replace 1 ton of coal, 2.2 tons of dry WH were required from 35 tons of fresh WH biomass while to produce 1 ton of clinker, 0.32 tons of dry WH were required from 5.2 tons of fresh WH biomass. Since relatively large quantities are freely available and with high volatile content and calorific value, WH is suitable as an alternative energy source for cement industry. However, economic feasibility should be studied prior to the commercial application.

Keywords: Alternative fuel, Biomass, Water hyacinth, Calorific value

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

104

(40)

Elephant Based Volunteer Tourism in Sri Lanka (On the Perception of Volunteer Service Providers and Volunteer Participants in Elephant Related Activities)

Perera P.K.U.

Department of Indigenous Health Sciences, Gampaha Wickramarachchi University of Indigenous Medicine, Yakkala, Sri Lanka
kasunu@gwu.ac.lk

Abstract

Volunteer tourism is an emerging sector of modern tourism. Elephant based volunteering activities, which means activities related to conservation and protection of animal rights and welfare related to elephants, plays a contemporary role among them, that perceive the aspect of animal conservation and preservation while also promoting tourism which describes both well-being of the elephants and tourism markets. This study is a collaboration to depict these types of contemplating the current profile of elephant-related activities and volunteer tourism in Sri Lanka, while creating and promoting a niche market for elephant-based volunteer tourism that would guide to identify and understand volunteer service providers and volunteer participant's perspective of captive and non-captive elephant welfare. The researcher has selected Pinnawala Elephant Orphanage, Wasgamuwa National Park, Hurulu Eco Park and Minneriya Forest Reserve as the research sites for the study. The population of the study is consisted with all the participants of elephant-based volunteer programs and volunteer service providers related to the elephant related activities of Sri Lanka. As the sample the researcher selected 30 participants who they are both volunteer service providers and volunteer participants from the areas of selected research sites. For selecting the sample, the researcher adopted purposive sampling technique. Qualitative method is adopted for the study and structured interviews were used as primary data resource, while journal articles, research papers, books and online sources were used as secondary data sources and thematic analysis method was utilized in analyzing the data. According to the findings the elephants are using in entertainment purposes which are; elephant back riding, elephant shows, perahara events, elephant seeing safaris, elephant based souvenirs and products and photography. As the data analysis the short comings in elephant-based tourism are lack of awareness about the concepts throughout the country, lack of government involvement and unavailability of strict legal structure, lack of consideration about the animal welfare by the respective organizations and restriction of animal freedom. Major opportunities generated by the elephant-based volunteering activities includes generation of good income through the tourism industry and volunteering is a major tool of self-improvement. When searching for the challenges in promoting elephant-based volunteering activities the following are identified; language barriers, unacceptable human behavior and attitudes, monetary constraints and improper uses of private tour operators. When discussing about promoting elephant-based volunteering activities, based on the research it can be suggested to use social media for promoting, holding awareness programs in forest areas as well as in urban areas, conducting collaborative research studies and taking measures to alter the attitudes of people.

Keywords: Volunteer tourism, Elephant-based tourism, Animal welfare, Volunteer service providers

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

105

(61)

Assessment of the Potential to Promote Nature-based Tourism Industry in the Protected Area Network of Sri Lanka

Wijethunga A.R.L.*, Subasinghe D.

United Nations Development Programme, Sri Lanka
*ramitha.wijethunga@undp.org

Abstract

Promoting the tourism industry is one of the proven strategies for Sri Lanka to address current economic crises. Sri Lanka has a high potential to develop nature-based tourism with its high biodiversity. The Forest Department and the Department of Wildlife Conservation manage 30% of the country's land as Protected Areas. In comparison to the tourism income generated through archeological sites of the country, the biodiversity sector has earned 83%-90% from 2012 to 2016, without any significant promotions and it shows the potential to develop nature-based tourism. This study aimed to examine the potentiality of using the Protected Area network to promote nature-based tourism. The PESTEL approach was utilized to assess the potentiality, and primary data was gathered through ten structured Key Informant Interviews of senior officials of both the destination management agencies, tourism authorities, and experts. The secondary data were obtained by reviewing official reports and records. The Fauna and Flora Protection Ordinance, Forest Ordinance, and their amendments provide legal provisions relating to tourism in Protected Areas with certain limitations. The Wildlife Preservation Fund can be utilized for conservation and development activities in protected areas, including tourism promotion. Even if a higher degree of 'tourism friendly' provisions is available with the Forest Department, there is no mechanism for utilizing the income generated through tourism activities for conservation as revenue credits to the Treasury. Insufficient financial allocation through the treasury, lack of innovative financial solutions for resource mobilization, and ineffective governance mechanisms for promoting public-private partnerships are identified as challenging factors in forest and biodiversity conservation in protected areas. This leads to environmental degradation and biodiversity loss in the country. The study found the potentiality of developing projects worth one billion LKR per annum with more than 20% internal rate of return, if the government develops a mechanism that increases the benefits/incentives available for the Forest Department from tourism, ensures cooperation and comprehensive planning among both the departments, introduce innovative sustainable financing solutions, amend the policy and institutional framework in favour of public, private community partnerships, and develop a tourism promotion roadmap for both the Departments. Such initiatives would increase the socioeconomic and environmental benefits to the communities living in the Functional Resource Unit of the Protected Areas. It could be strengthened with an innovative Protected Area management model such as the community forestry approach. The study recommends that tourism should be considered an effective entry point for sustainable use, biodiversity conservation, and economic growth at local and national levels.

Keywords: Protected areas, Nature-based tourism, Innovative financing, Public-private partnerships, Tourism for conservation

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

106

(83)

Exploring the Potential of Geotourism with a Focus on Kahagolla Landslides Area in Sri Lanka

Senavirathna C.

Department of Indigenous Social Sciences, Gampaha Wickramarachchi University of Indigenous Medicine, Yakkala, Sri Lanka
chinthani@gwu.ac.lk

Abstract

Geotourism is a new type of tourism based on geological features. As such, the primary goal of this research is to identify the possibility of converting protected natural hazard areas into profitable Geotourism sites. A geologic hazard visible in the geological environment is a natural event that occurs within the earth's crust which poses a threat to life and property. One such example is landslides. The Kahagolle landslide area is 3.5 ha in size and landslide prevention and mitigation activities have been conducted here as part of a Japan International Cooperation Agency (JICA) project costing millions of rupees. The attractiveness and profitability of this location lie in the availability of different landslide mitigation methods within a single area. Located along the Beragala-Hali Ela highway (A16) in close proximity to Haputale and Bandarawela, the site has the potential to attract many domestic as well as international tourists who visit the central hills of Sri Lanka. This was an inductive study using field observations as primary data, and content analysis of published papers and NBRO documents that have been used as secondary, qualitative data. The main conclusion drawn based on the results is that there certainly is a possibility of improving this area as a Geotourism site aimed at foreign and local tourists mainly for educational purposes. The recommendation is to build an information center with the capacity to raise awareness and enhance knowledge about the history of this landslide, the geological quality of the area along with details of the mitigation project. As such, tickets could be issued, and the site arranged into zones from top to bottom while the methods used could be shared with visitors.

Keywords: Geotourism, Landslides as tourist sites, Mitigation activities

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

107

(122)

Combining Health and Well-being: Designing a Modern Medicinal Garden to Meet Tourists' Expectations

Perera P.R.M.[1]*, Kudavidanage E.P.[2], Udayakumara E.P.N.[2], Wijesekara H.[2], Zoysa A.I.U.D.[3], Kodithuwakku N.D.[4], Perera H.M.R.P.[5]

[1]*Faculty of Graduate Studies, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*
[2]*Department of Natural Resources, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*
[3] *Sri Lanka Institute of Architects, Colombo, Sri Lanka*
[4]*Department of Ayurveda, Institute of Indigenous Medicine, University of Colombo, Colombo 03, Sri Lanka*
[5]*Department of Livestock Production, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*
*rumeshikaperera00@gmail.com

Abstract

The tourism sector, a fast-growing, competitive, and diversified industry is a significant contributor to the global economy. Modern-day tourism embraces characteristics associated with history, nature, and leisure, thereby linking them with new destinations in a continual expansion. The main objective of this study was to develop a perception-based conceptual model for a sustainable medicinal garden (MG) that could benefit the tourism industry while supporting biodiversity conservation. The proposed MG aims to fulfill six intentions, such as, relaxing the mind from a busy day while treating illnesses and improving mental healthiness; incorporating leisure activities that are closely related to medical treatments; disseminating knowledge on Sri Lankan traditional medicine; promoting sustainable eco-friendly practices; increasing economic benefits for the country; and improving the community livelihood of the people in the region. The research focused on developing an MG using the perception intended for 144 local and foreign participants representing four tourist hubs (Galle, Kandy, Dambulla, and Udawalawe) in Sri Lanka. The study examined the expectations of MGs and their preference for the experience. The questionnaire was used to evaluate the visitors' perceptions of the proposed 40 components for the proposed MG, which enabled their ranking based on preferences. The mean preference value for the MG experience was recorded as 72.1%. 97.0% of tourists who participated in the survey preferred to experience the MG, exceeding the 50% acceptance level for all 40 components. Therefore, all 40 components were applied to the MG. However, 18 components exceeded the 75% acceptance level; therefore, they could be incorporated into the MG without changes. The other 22 were considered the accepted components with some minor modifications. Considering the selected region (Dambulla) and the architectural view, 124 medicinal plants were accepted for application to the MG, including terrestrial, water, fruit, and poisonous plants. The model MG consists of 3545 medicinal plants. Creating an MG with the concepts of traditional, cultural, sustainable, and eco-friendly was a different angle to addressing the Sri Lankan tourism sector. This research presents an overturned vision that considers tourism demand on novel concepts of traditional herbal tourism. A model MG was developed with modern architectural and environmental knowledge. Within a five-acre arbitrary land, three-dimensional structures were designed around the proposed model MG. The actual structure of the MG was visualized with a virtual walk-through using architectural software (i.e., AutoCAD 19.0, Sketch-Up Pro 2015, and Lumion 5.0). This model can promote minimal environmental impact through the processes, conserve the environment and gain economic benefits from all these eco-services to the tourism sector and Sri Lankan economy to the advantage of the community or country.

Keywords: Eco-tourism, Architectural software, Medicinal plants, Traditional medicine, Sri Lankan economy

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

108

(162)

Review of 'Kalpitiya Urban Development Plan 2021-2030' using TIES Ecotourism Principles

Weerasinghe M.A.M.T.[1]*, Jayasinghe L.D.C.[1], Dissanayake, D.M.S.B.[2]

[1]*Faculty of Graduate Studies, University of Colombo, Colombo 03, Sri Lanka*
[2]*Institute of Development Studies, Colombo, Sri Lanka*
*mamtweerasinghe@gmail.com

Abstract

Rapid urbanization-driven economic growth creates opportunities and challenges for inclusive and sustainable urban planning. Kalpitiya, being the only city in Sri Lanka surrounded by both sea and lagoon, with its unique ecosystems, and historical and cultural structures, has become an attractive tourism destination. Kalpitiya, as an emerging tourism destination, contributes 10 percent to the local economy through tourism. It experienced 15,500 visitations in 2017, while the projection for 2030 is 29,770. In 2018, 18 % of residents engaged in ecotourism as an alternative income source while 69 percent expressed their willingness. The Kalpitiya Urban Development Plan 2021-2030 (the Plan) was formulated envisioning, "Blue Peninsula Emerging from Nature Resort"-the first goal to make Kalpitiya the most attractive tourism destination. In this context, adopting ecotourism principles in development planning seems prudent for Kalpitiya. The study aimed to assess the extent to which the Plan had incorporated 8 TIES (The International Ecotourism Society) ecotourism principles, which, according to UNEP, have been embraced by a growing constituency of NGOs, private sector businesses, governments, and local communities. Utilizing a qualitative approach, incorporation of 8 TIES principles [P1-minimize impacts, P2-increase awareness, P3-positive experiences, P4-financial benefits for conservation, P5-financial benefits for locals, P6-increase sensitivity to local conditions, P7-low-impact facilities, P8-recognize community rights] into the components of the plan [Introduction-C1, Preliminary studies-C2, Need of the Plan-C3, Framework-C4, Summary and SWOT-C5, the Plan-C6 and Zoning-C7] were assessed. Secondary data were obtained from official sources and reviewed journal articles. Within all components of the Plan, the importance of tourism development was mentioned while addressing P1, P3, and P5. P6 is recognized in C6, while P7 was not mentioned. P8 was recognized in C2, C6 and C7. Although it specifically identified an ecotourism zone, C6 only addressed P2, and P4-through the development of a mangrove garden. The respective project was prioritized as 19 of 25. Rehabilitating and conserving income-earning cultural assets were prioritized as 10 and 11 of 25-without any carrying capacity considerations, despite their importance for the industry. Considering P1, water effluent control measures for shrimp farming-a means of income for many-were not mentioned, despite the pollution of groundwater and estuarine system, on which the ecotourism industry depends. The review reveals that the Plan has not adequately considered or addressed the 8 ecotourism principles, therefore, it is recommended for Kalpitiya Local Government Authority to pass bylaws in line with ecotourism principles, while enforcing a guideline by the Urban Development Authority.

Keywords: Urban development planning, Ecotourism principles, Kalpitiya urban development plan, Local economy, Environmental conservation

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

109

(57)

Assessment of the Spatiotemporal Variability of Urban Heat Island Intensity in Colombo Metropolitan Area

Withana P.M.[1]*, Lokupitiya E.Y.K.[1], Rajapaksha I.[2]

[1]*Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka*
[2]*Department of Architecture, University of Moratuwa, Moratuwa, Sri Lanka*
**pasanmadhawaw@gmail.com*

Abstract

During the last few decades, the Colombo Metropolitan Area (CMA) has experienced rapid population growth and unplanned urbanization, resulting in the replacement of natural landcover with more impervious surfaces. The primary approach of current study was to determine the gradients of air temperature and assess the spatiotemporal variation of atmospheric urban heat island (AUHI) intensity in the CMA considering a range of rural sites extending in different radial directions from the urban center. A total of sixteen rural observation sites that extend from an urban center in four directions were selected within the CMA, with four sites 3.5 km apart from each other in any direction. The air temperatures at each site were measured using HOBO UX-100-003 temperature data loggers for an 8-day period from 21st to 28th, of February 2022. The normalized difference vegetation index (NDVI) and normalized difference building index (NDBI) were used to determine the influence of land use/land cover on air temperatures. The results revealed that air temperature had a strong positive correlation with NDBI. Thus, the current study suggests that the impervious surface/s is a significant predictor of air temperature over the study area. The higher air temperatures were observed at the urban center in relation to the selected suburban and rural observation sites. Hence, the current study confirms that AUHI exists within the selected study area over the CMA. It was found that AUHI tends to be present throughout the day in the CMA. However, it becomes strong between 12.00 A.M. and 6.00 A.M and mostly weakens in the late afternoon hours. Furthermore, this study found that the timing and magnitudes of AUHI vary from direction to direction across the study area depending on the site-specific characteristics of the rural observation sites. The current study emphasizes that site-specific land use/land cover characteristics can have a significant impact on the interpretation of UHI study results even within a single metropolitan area. Therefore, taking only one rural site might not be effective in determining the UHI intensity and a range of sites need to be considered (to select from) for in-depth analysis of UHI in any given area. The findings of the current study will provide firsthand knowledge for urban planners to identify future trends in UHI in the CMA and will promote further UHI research in this area.

Keywords: Rural observation site, Atmospheric urban heat island, Normalized Difference Vegetation Index

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

110

(58)

A New Three-Pillar Score System to Reduce the Sustainable Subset Heterogeneity within the GREENSL Rating System in Sri Lanka

Thiwanka S.P.D.*, Halwatura D., Pallewatta N.

Faculty of Science, University of Colombo, Colombo 03, Sri Lanka
*dinithithiwanka28@gmail.com

Abstract

Sustainable development is achievable only by integrating and acknowledging three main sustainability pillars (Environment, Social, and Economic) during the decision-making process. Sustainable/Green construction has become a major part of the sustainable development process in Sri Lanka today. Sustainable/Green buildings are evaluated using both international (LEED, BREEAM, CASBEE, Green globes, etc.) and local (GREENSL, Blue-Green Sri Lanka) green building rating systems. Most of these international green building rating systems have unequal credit point distribution among three sustainability subsets which causes heterogeneity among subsets. Thus, this research was designed to evaluate two local green building rating systems (GREENSL Version 2.0, and Blue-Green Sri Lanka for government constructions Version 1.0) to identify this heterogeneity in the local context. The credit point distribution among three sustainability subsets within the two selected rating systems was evaluated by analyzing the categories and criteria of these two rating systems. Here, when criteria represented one or more pillars of sustainability, the credit points belonging to such criteria were equally divided into those two subsets. The results revealed that three subsets were not equally considered in the GREENSL (Environment (52.1%), Social (21.6%), Economic (26.3%)) and Blue-green Sri Lanka for government constructions (Environment (48.4%), Social (17.2%), Economic (34.4%)) rating systems. Thus, there is a sustainable subset heterogeneity that is dominated by environmental sustainability. As achieving the exact 33.3% point distribution among three sustainability pillars is difficult, new point distribution percentages were proposed as 40% for the environment and 30% each for both social and economic sustainability pillars. Finally, a new three-pillar score system was proposed that can be used together with the GREENSL overall score for the buildings to reduce this subset heterogeneity by adopting the proposed point distribution percentages above. This study suggested that the building needs to fulfill both the total category score and the proposed three-pillar score to qualify for the respective GREENSL award (Platinum, Gold, Silver, and Green certified) to reduce the sustainable subset heterogeneity within this rating system.

Keywords: GREENSL for the built environment, Sustainability subsets, Sustainable subset heterogeneity, Three-pillar score system

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

111

(115)

Conversion of Marginalized Tea Lands into Timber Plantations and its Impact on Soil Organic Carbon Content: A Case Study in Central Highlands of Sri Lanka

Rotawewa B.*, Lokupitiya E.Y.K.

Department of Zoology and Environment Sciences, University of Colombo, Colombo 03, Sri Lanka
*rotawewa@yahoo.com

Abstract

Tea (*Camellia sinensis*) plantations can be in production for about 100 years under well-managed conditions. However, soil degradation makes the tea lands marginalized and uneconomical. Land use conversion is an option for marginalized tea lands that could gain numerous environmental and economic benefits. This study estimated and compared the soil organic carbon stocks (SOC) in the surface soil layer (0–30 cm) of marginalized tea lands against those converted to timber plantations in the Badulla and Nuwaraeliya districts. Disturbed and undisturbed soil samples were collected from the top layer (0-30 cm) of the selected sites of marginalized tea lands and those converted to timber plantations for analysis. Organic matter percentage in the site-level dry soil samples was analysed using the loss on ignition method. The final carbon stocks (t C ha^{-1}) for samples from both land use types were then estimated using the SOC percentages and bulk density estimates. The carbon stocks for the soil samples collected at marginalized tea lands and the marginalized tea lands converted to timber plantations were then statistically analysed (descriptive statistics, normality tests and two-sample t-tests) using Minitab 21.2 software. The pH of marginal tea lands (5.34±0.14) and the marginal tea lands converted to timber plantations (5.20±0.13) was slightly acidic in nature. The bulk density estimates of marginalized tea lands and marginalized tea lands converted to timber plantations were very close and estimated as 1.15±0.02. The statistical analysis showed that overall mean SOC was significantly higher under the marginalized tea lands converted to timber plantations (155.3±10.0 t C ha^{-1}) compared to the marginalized tea lands (126.7±5.8 t C ha^{-1}). Land use conversion has increased the SOC stocks gradually after forest establishment. The increased carbon stocks could be attributed to consistent addition of litter layer on the soil, less soil disturbance, and retarded soil erosion contributing to the buildup of soil organic matter and SOC. On the other hand, low carbon stocks in the marginalized tea land could be attributed to unsustainable agronomical practices. Our findings suggest that converting marginalized tea lands in central highlands into timber plantations could enhance the sequestration of atmospheric CO_2, significantly contributing to climate change mitigation.

Keywords: Soil organic carbon, Land use change, Climate change, Tea plantations

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

112

(141)

A Sustainable Form of Land Use under *Borassus flabellifer*: A Case Study in Jaffna District of Sri Lanka

Gnanavelrajah N.[1]*, Sathasivam T.[1], Jeyavanan K.[1] Raveendran S.[2]

[1]Faculty of Agriculture, University of Jaffna, Jaffna, Sri Lanka
[2]Faculty of Arts, University of Jaffna, Jaffna, Sri Lanka
*nalina@univ.jfn.ac.lk

Abstract

Perennial plantations play a significant role in mitigating climate change and improve the plant diversity. This study was carried out to estimate the carbon sequestration potential of Plamyrah (*Borassus flabellifer*) land use in twelve different soil series in Jaffna district and to estimate the plant diversity of the same. Samples were collected from sampling quadrates of 10 m x 10 m. A total of 75 quadrates were sampled. Numbers of quadrates in each soil series were selected based on the extent of Palmyrah plants and soil series. From each quadrate following data was collected: number of Palmyrah trees and other trees and their height and diameter at breast height. Soil samples were also collected within each quadrate at three depths, up to a depth of 30 cm. For the estimation of biomass carbon stock Palmyrah wood density was determined using 15 wood samples. Biomass carbon was estimated using the standard equations. Soil organic carbon percentage was determined by loss on ignition method. The total carbon stock was determined by the summation of carbon in palm biomass and soil carbon. Plant diversity was estimated in terms of number of species, Shannan Weiver index (SWI) and evenness. Soil organic carbon percentage of Palmyrah land use in different soil series ranged between 1.1-4.5%. Soil organic carbon stock in different soil series ranged 51-190 Mg/ha. There was no significance difference among soil organic carbon percentage of Palmyra land use in different soil series. Top most layer (0-10 cm) had significantly higher amount of soil organic carbon than sub surface layers (10-20 cm, 20-30 cm). Palm density of Plamyrah land uses in different soil series ranged 5-13/100 m^2. Biomass carbon stock ranged between 2.83-6.80 Mg/100 m^2. Biomass carbon stock in different soil series was significantly differed. Total carbon stock ranged 4.06-7.97 Mg/100 m^2. A total of 22 plant species belonging to 13 families were identified in the Palmyrah land uses in the study area. Arecaceae family was vastly distributed in the palmyrah land use while Poaceae and Malvaceae were the poorly distributed ones. The mean value of Shannan Weiver Index (SWI) was 1.2 while evenness was 0.74. This study therefore concludes that the Plamyrah land use in the study area has great potential to sequester carbon in long term, while maintaining a reasonable tree species diversity.

Keywords: Soil carbon, Biomass carbon, Plant diversity, Carbon stock

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

113

(161)

Socioeconomic Sustainability of Chena Cultivation in the Forested Land of Hambantota District, Sri Lanka

Pramod C. W.[1], Jeyavanan K.[1]*, Sivananthawerl T.[2]

[1]Department of Agronomy, University of Jaffna, Jaffna, Sri Lanka
[2]Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka
*kjvanan@univ.jfn.ac.lk

Abstract

Chena cultivation is one of the major agriculture systems and extensively practiced in rural areas of low country dry zone as their main livelihood. Generally, a slash-and-burn method is used to clear the land in the forested area where the land is prepared before the North-East monsoon starts. Short-duration, comparatively drought resistant crops such as grains, legumes, oil crops, and vegetables are commonly grown in Chena. However, scientific studies on Chena cultivation to assess socioeconomic status were limited in Sri Lanka. Therefore, this study attempted to assess the socioeconomic status of Chena farmers in the close proximity of forest lands in Southern part of Sri Lanka. Chena cultivation areas at Tissamaharama (8 Grama Niladhari divisions namely Gotabhayapura, Yodakandiya, Rathnelumwalayaya, Uddakandara, Viharamahadevipura, Ranakeliya, Wijayapura and Joolpallama) and Lunugamwehera (7 Grama Niladhari divisions namely Udamaththala, Padawgama, Pahalamaththala, Rabukwewa, new town-Lunugamwehera, new town-Weerawila and Keerthipura) Divisional Secretariats in Hambantota district was studied. 40 Chena farmers were purposively selected for the study. Primary data were collected from the farmers by using pre-tested structured questionnaire, personal interviews and field observations. Descriptive statistics and correlation tests were employed to analyse the data. Results revealed that farmers practiced four types of Chena such as *Navadali Hena* (clearing an untouched forest area), *Ath Danduwa Hena* (regrowth and cut), *Mukulan Hena* (consists of medium-sized trees) and *Hen Kanaththa* (land exist for survival). 98% of farmers are fully involved in chena cultivation in the study area. 32.5%, 22.5%, 20%, 12.5%, and 7.5% of farmers had 11-20, 21-30, 0-10, 31-40, and 41-50 years of experience, respectively in Chena cultivation. The result also revealed that 80% of the farmers were not a member of farmer`s societies and other organizations. A small number of farmers had received some relief from government such as fertilizer, agricultural extension services, 50% of subsidy seed, and 50% of subsidy loan. Chena farmers earned more than Rs.500,000.00 whereas the average income was Rs. 802,392.16 per annum. Further, 63% of the cost was contributed by labour followed next to land preparation (16%) and agrochemical (13%). Sweet melon, green gram, long beans, and tomato were recorded as major cultivated crops. Further, Chena areas were highly problematic by wildlife and cattle damage (87.5%), marketing issues (67.5%), legal (37.5%), drought (30%), and pest and diseases (27.5%). However, around 74% of respondents were willing to continue the Chena cultivation, because they have no other alternative livelihoods in this area. On the other hand, the majority (54%) were neutral or dissatisfied about their situation because they did not have land ownership. Introducing a registration procedure for land ownership, constructing the electrical fence to avoid wildlife damage, establishing a wildlife management unit to protect the wildlife habitat, and planning a proper irrigation method to secure the water supply throughout the year were the major suggestions to improve farming at a sustainable level of production and consumption.

Keywords: Forest land use, Chena cultivation, Dry Zone, Hambantota

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

114

(166)

Light Spectral Regimes under a Closed and Dense Canopy: Evidence from *Mesua ferrea* Trees for Human Comfort in Urban Landscape Planning

Makuloluwa M.W.H.B.K., Dahanayaka P.D., Silva K.S.U.S., Indramali O.S, Makuloluwa M.W.L.B., Beneragama C.K.*

Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka
*chalindab@agri.pdn.ac.lk

Abstract

Trees play an important role in urban landscape planning due to their multi-faceted functions including the provision of human comfort through shade and cooling and air pollution abatement. Mesua ferrea is the national tree of Sri Lanka with multi-colored leaves and pyramidal dense canopy architecture, which can be promoted to grow in roadside gardens and parks to gain more attraction and attention. It is important to know how different trees provide human comfort under the canopy. In the present study, we measured the transmittance spectra in the 318-885 nm range using a high-resolution spectroradiometer under the canopy of selected Mesua ferrea trees on bright sunny days. The change in shade casting on the ground during the day was modeled. In addition, the temperature, CO_2, and relative humidity were also measured. The light transmittance through the canopy is reduced when moving from the outer edge of the canopy (1,142 $\mu W.cm^{-2}.nm^1$) to the trunk-base (0.82 $\mu W.cm^{-2}.nm^{-1}$) on the horizontal plane. It was obvious that the irradiance received closer to the base of the tree is not sufficient to support the understory plant growth. The irradiance levels of blue (B: 400-500 nm), red (R: 650-680 nm), and far-red (FR: 700-885 nm) components of the transmittance spectra under the canopy were also found significantly low compared to sunlight, with significantly altered R:B, R:FR and B:FR ratios. Importantly, a 14 fold cut down in the UV radiation (318-400 nm) under the canopy beyond half of the canopy diameter towards the trunk was also observed. Under the canopy, there was a temperature reduction of about 1° C on bright sunny days perhaps due to the reduced irradiance and the altered spectrum, and the reduced CO_2 concentration (by 5%). We identified that the Mesua trees are suitable for human comfort, and thus can be recommended for roadside planting and for public parks in urban landscape planning.

Keywords: Shade caste, Radiation spectrum, Mesua ferrea, Landscape planning, Urban planning

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

115

(187)

Green Building Rating of High-Rise Buildings in Sri Lanka

Abeywickrama B.K.A.I.*, Witharana A.

Department of Zoology and Environmental Sciences, University of Colombo,
Colombo 03, Sri Lanka
*induwaraabeywickrema@gmail.com

Abstract

As a result of urbanization, constructions of high-rise buildings become a major component of urban development. Constructing high-rise buildings contributes to social, economic and environmental development as well. There are many stages of construction including planning, designing, procurement and implementation. There is a wide range of sustainability practices which can be implemented in each stage of construction. In leading Sri Lanka to Sustainable Development, the green building rating system was introduced by National Green Building Council of Sri Lanka in 2002. This rating system has 100 total points and minimum of 40 points is required for green building certification. The rating system has different components. Among them sustainable sites category includes 25% of total points in green building rating system. This research study highlights the significance of sustainable sites category in order to award the green certification in green building rating system. For this research five major high-rise building construction sites in Colombo were selected and existing site selection practices of each site were investigated. Each site was visited and in-depth discussions were carried out with the planning engineer and other people in the construction site. The structured questionnaire was filled and scores were given accordingly where they have met the sustainable sites criteria. Two sites out of five could not earn single point as they did not fulfill the prerequisites of the site section category. The rest of the sites (three) earned 20, 19, and 18 respectively out of 25 points. In this study, lack of awareness in sustainable site selection practices has dropped the chances of being eligible for the green building certification. Since the minimum points required for green building certification is 40, buildings which are under planning or pre-construction stage have higher chances of obtaining silver, gold and platinum awards for green building certification. Therefore, sustainable sites category of the green building rating system contributes significantly to increase the score and therefore it is highly important in green certification & sustainable construction.

Keywords: Green concept, Gigh-rise buildings, Gustainable development, Sustainable site selection

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

116

(194)

Visitor Perception on Urban Green Space and its Contribution for Human Well-being, A Case Study for Henarathgoda Botanic Garden

Chandrathilaka G.G.T.*, Samarasekara S., Jayasooriya V.

Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*thilakawansha@sjp.ac.lk

Abstract

Botanical gardens vary widely in design and purpose, but most are typically associated with Ex-situ conservation, education, or historical interpretation. Yet, few studies have shown that botanic garden visitors are often motivated by recreational and leisure interests. While visitor motivations and benefits have been the focus of a number of botanical garden and green space visitor studies. The main objective of the study was to investigate the perceptions of benefits for wellbeing of community, by visiting Henarathgoda Botanic Garden (HBG) and the Specific objectives were; to identify the range of different specialized visitors to the HBG, identify the activity patterns of community visitation associated with HBG and to examine visitor preferences/perceptions for various combinations of social, resource and management conditions, and study the different wellbeing benefits obtained by visiting the garden related to physical and aesthetics aspects. This study employed means-end theory to investigate the links visitors make between garden attributes, consequences, and values. Structured questionnaire based in-person interviews were conducted with garden visitors (n=200) and surveys took place representing whatsoever the community visiting the HBG during February to March 2022. The overall study resulted that the garden visitation has been drastically affected by COVID-19 pandemic situation before, during, and after the pandemic respectively. This study reveals that the main top two reasons for visiting the HBG of respondent were because of relaxation and pleasure. This shows HBG should provide a suitable place for recreational activities for visitors. Further, the highest percentage of the respondents (36%) were commented that HBG's management should consider improving the services providing and maintaining more facilities and need for the visitors. The most positive benefit wanted to gain responders by visiting HBG, which was understanding and enjoying nature in different garden sections established at HBG (42%).

Keywords: Urban green spaces, Well-being benefits, Botanic garden, Psychological benefits, Questionnaire survey

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

117

(199)

Spatial Analysis of Locational Vulnerability of Fish Drying Cottage Industry of Kudawella, Sri Lanka

Weerakoon K.G.P.K.*, Abeysooriya G.

Department of Estate Management and Valuation, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*kgpk@sjp.ac.lk

Abstract

Informal fishing industries in Sri Lanka are in vulnerable areas and their industrial locations are risky. Fish Drying cottage industry of Kudawella is fast growing and spreading in the recent years within the village and to the outside. The industry has informal economy and perfectly competitive market characteristics which enables free entrance and exit and less legal bindings. Although the industry generates a significant direct and indirect employment opportunities and income, it has also created social, economic and environmental vulnerabilities. Vice versa, the industry has become vulnerable due to various social, economic and environmental factors too. Therefore, it the study aims to spatially identify the vulnerability of fish drying cottage industry. The study identified the factors affecting the vulnerability of the industry by conducting a literature survey and were evaluated through observations and the experience of the researchers. 381 industry locations and the relevant 9 criteria maps were mapped by using Open Street Mapping and ArcMap 10.8, such as proximity to the harbour, accessible roads, environmentally sensitive areas, access to the major tourist attraction in the village; "Hummanaya" the blowhole, the coast, Tsunami reservation, social infrastructure and population density and selection for projects conducted by the government. For the weighted overlay analysis, each criterion was weighted based on their relative contribution to the vulnerability of the industry. The resulting map showed that higher portion of the village a higher percentage of existing number of manufactures are moderately vulnerable while a 4.2% of land in the village is severely vulnerable for the industry. However, no manufacturing site was found to be severely vulnerable within the concerned period. The village is an Urban Development Authority declared urban area which is having economic potential due to factors such as existence of the Blowhole and abundancy of coastal and shallow water resources. Therefore, the study suggests the decision makers to make decisions to upgrade informal sector to ensure to avoid vulnerable locations of Industry and they can earmark suitable locational area to ensure the sustainable utilization of land.

Keywords: Cottage industry, Fish drying, GIS, Sustainable land use, Weighted overlay analysis

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

118

(227)

Urban Farms for Neighborhood Improvement and Social Well-being of Urban Areas in Kandy

Dilshani C*., Kulathunga S., Udawaththa C.

Department of Estate Management and Valuation, University of Sri Jayawardhanapura, Nugegoda, Sri Lanka
dilshanicharushika@gmail.com

Abstract

In the latter half of the 20th century, as urban populations increased in the majority of emerging nations, the reliability of urban food production and delivery networks decreased. Urban hunger increased concurrently with the urban population, speeding up by in response, urban farms spread over a growing worldwide. However, later other purposes were added to it and urban farms were nurtured. Globally, urban farms are changing as a result of political, economic, environmental, and technical advancements. With time, urban farming activities are becoming a reason to improve the value and quality of life in terms of economic, social, and other elements. In this research, it was investigated how urban farming affects the social well-being and neighborhood improvements of urban areas. Furthermore, it focuses on urban farms' relative attachment to the neighborhood and confidence, their impact on agriculture literacy and youth development, and the economic and food crises in the urban areas. It was sought to understand community perceptions of how urban farms can benefit cities through a qualitative study conducted in two urban farms in Kandy. Interviews with visitors, laborers, and professionals related to urban farming revealed the pathways by which community members view farms as improving neighborhoods and social well-being. According to this study, six characteristics are highlighted and evaluated: neighborhood attachment, neighborhood confidence, youth development, food access, agricultural literacy, and economic development. Benefits stemmed from a primary changes urban farms made to neighborhood improvement: the creation of public project involvement, the physical improvement of degraded space, the production of local food, and the creation of new businesses. These changes led to multiple perceived benefits, including increased social connectedness, a transformed physical landscape, an improved neighborhood reputation, and employment opportunities. But there were some points that should be developed. especially in cases of food access and youth development. Urban farms with strong social aims may appear to contribute little to economic development if measured using traditional indicators of success such as job creation or fiscal impacts, but they provide numerous other benefits for community development.

Keywords: Urban farms, Social connectedness, Physical improvement, Food access, Youth engagement, Economic development

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

119

(229)

Spatial and Temporal Assessment of Land Use and Land Cover in Wilpattu National Park Restricted Zone, Sri Lanka

Kumara U.I.[1], Jayawardene D.T.[1,2], Gunathilake B.M.[1]*

[1]*Department of Forestry and Environmental Science, University of SriJayewardenepura, Nugegoda, Sri Lanka*
[2]*Center for the Forestry and Environment, Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
*bhanukagunathilake@sjp.ac.lk

Abstract

The Wilpattu National Park (WNP) is the country's oldest and largest National Park. Aside from the direct destruction of plant and fauna ecosystems that sustain humans with vital resources, removing forest cover throws many crucial natural processes out of balance, which could have several detrimental effects. It is still unknown how the various management alternatives will affect the economic, ecological, and social elements of sustainable forest management because of the diversifying demands on forests that have led to more complicated forest management and planning. Sustainable development and environmental protection are aided by wise land use and resource management. Many of the farmers reside in these marginal, underproductive forest communities. Through scenario analysis and using a forestry decision support system, this study evaluated the effects of several management approaches on crucial aspects of sustainable forest management. Geographical Information System (GIS), such as participatory online mapping, GPS mapping, and satellite image classification (Remote Sensing Technology), was used. The study employs an evaluation model for land use that considers biophysical and human-related variables as part of an integrated land use assessment. Based on the classification of the images, the environment's impact has been evaluated. Forty-nine Grama Niladhari (GN) divisions are in the influenced zone in the national park. Eight sample GN divisions were selected for detailed assessment based on the area's different landscapes and ecological and cultural settings. The current situation and encroachment were studied in each sample GN division. Also, Current threats, land use, and pressure activities were studied. The land use analysis of the Wilpattu restricted zone revealed the area of encroachment. Analyses conducted in the human village clearly show that the restricted area for human settlement is being encroached upon 2019, permanent building/housing units were found in 2003 satellite image categorization within the 1.6 km restricted zone. By 2021, the number mentioned above will be 3,810 instead. The past 20 years have seen an 89% growth in housing units. Land use analysis indicates nine zones of encroachment. Zones are dominant in encroachment in 19 GN Divisions in total. The Wilpattu forest village's Mullikulam and Eluwankulam GN Divisions are the most crucial and quickly encroaching areas. The highest percentages of restricted zone, land use analysis contain Paddy cultivation, and Chena cultivation shows the second highest value. Minimum land used is utilized for abandoned Chena cultivations. The highest percentage of land use agriculture is Kudawilachiya, Dematamalagama, and Nelumvila. In addition, the lowest agricultural land use was utilized in Horawila, Thalgaswewa, Helabawewa, Mirichchukaadi, and Adiyapualwakkulam.

Keywords: Sustainable, Deforestation, Forest management, GIS, Restricted zone

---

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

120

(230)

Application of Multispectral Drone for Quantitative Assessment of the Fertilizer Requirement for the Up-country Tea Plantation in Sri Lanka

Kumara U.I.[1], Jayawardene D.T.[1,2], Gunathilake B.M.[1]*

[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Center for the Forestry and Environment, Department of Forestry and Environmental Science University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
*bhanukagunathilake@sjp.ac.lk

Abstract

The amount of chlorophyll content and structure would differ between diseased and healthy plants, affecting the NDVI values, which strongly correlated with fertilizer applications. The primary goal of this research is to use a multispectral drone to quantify the fertilizer requirements for the sample tea plantations in Nuwara Eliya, Sri Lanka. In contrast, a drone with multispectral imaging camera sensors was used to gather images covering blue, green, red, red-edge, and near-infrared bands. The collected images were analyzed, and geographic outputs were generated. The processed geospatial data were used to determine the NDVI values for each tea field, and the general health of the tea was estimated. Finally, NDVI readings and geospatial products from each tea field related to soil analytical data. Based on the NDVI values, 25 selected soil samples were collected using sampling plots. The concentrations of pH, electrical conductivity (EC), nitrogen (N), phosphorus (P) and potassium (K) were then determined using standard soil testing procedures. Finally, soil analysis results were combined with the geospatial data. In addition, the amount of Dolomite for each tea field was calculated based on the pH values, and the amount of nitrogen, phosphorus, and potassium was calculated as yield and area and based on the number of tea bushes. The tea plantations show an NDVI range of 0.76-0.81 for low healthy tea, 0.81-0.86 for medium healthy tea and 0.86-0.97 for healthy tea. The healthiness percentages of one of the tea plantation show 18% healthy tea, 54% medium healthy tea, and 22% low healthy tea. Conversely, the healthiness percentages of the other tea plantation show 44% healthy tea, 39% medium healthy tea and 17% low healthy tea based on the NDVI value. The average value of pH, EC, N, P, and K are 4.84, 41.58, 0.29, 0.11, 0.04 in tea plantations, respectively, and in other planation, average values of pH, EC, N%, P%, and K% are 4.83, 40.96, 0.36, 0.25, 0.04 respectively. The amounts of Dolomite for each tea field are 2685.32 Kg/ha and 977.34 Kg/ha. In one tea field, an average annual NPK fertilizer need is 685 kg per hectare, 94 kg per hectare, and 269 kg per hectare, respectively. Additionally, calculations based on tea bushes indicate that the average annual NPK fertilizer requirements are 685 kg, 89 kg, and 254 kg, respectively. Other tea filed average annual NPK fertilizer need is 88 kg per hectare, 24 kg per hectare, and 68 kg per hectare, respectively. Additionally, calculations based on tea bushes indicate that the average annual NPK fertilizer requirements are 90 kg, 25 kg, and 70 kg, respectively. However, these values have several limitations, such as climate, soil, plant, and cultural practices. This study mainly focuses on and creates Insights into Plant Health by assessing precise plant-level data using a multispectral imaging system. It had not been correlated with other factors except soil conditions.

Keywords: Unmanned aerial vehicles, Multispectral, NDVI, Tea, Fertilizer

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

121

(80)

Preliminary Investigation on the Effect of Termites on Wood Decay in Selected Sri Lankan Timber Species

Arachchi C.I.M.*, Muthumala C.K., Jayalath J.A.C.S.

Research Development and Training Division, State Timber Corporation, Colombo, Sri Lanka
*chinthani310@gmail.com

Abstract

Wood in suitable environmental conditions can be attacked by bacteria, fungi, insects, marine borers and some other biological organisms. Wood is the main biodegradation material which is naturally occurred in surrounding environment. As heartwood of wood consist most of the nonliving cells it shows more resistance to decay than sapwood. But insects can cause degrade in both heartwood and sapwood which are not preserved well. Termites belong to Class: Insecta, Order: Isoptera which are one of the most important as ecological contributors by breaking down the organic material of the wood structures directly. This study was done to analyze the effect of termites of selected 27 species with having different densities varying from 400 kg/m^3 to 1100 kg/m^3 at 12% moisture content. Ten pieces of each and every species of Wewarana, Jack, Badidel, Halmilla, Dawata, Walukeena, Hulanhik, Kaluwara, Hora, Pihimbiya, Damaniya, Godakirilla, Pelan, Hik, Etamba, Lunumidella, Diya Na, Palu, Mora, Kirihembiliya, Nedun, Kon, Kumbuk, Dummala, Milla, Kirikon and Burutha were stored in a separate same type wooden boxes and kept in same environmental conditions where termites can be seen in high densities for one year of time period in Head Office premises of State Timber Corporation at Battaramulla. According to the naked eye observations taken after one year time period Hora, Dummala, Godakirilla species were severely attack by termites while Halmilla, Walukeena, Pihimbiya, Damaniya, Pelan, Etamba, Lunumidella, Diya Na, Kirikon also attack at considerable level by termites. Other species were not attack by termites. Therefore altogether out of 27 species 12 were degraded by termites for the allocated one year time period. The other species of Wewarana, Jack, Bedidel, Dawata, Hulanhik, Kaluwara, Hik, Palu, Mora, Kirihembiliya, Nedun, Kon, Kumbuk, Milla, Burutha species were resistant to the termite attack during one year time period. However further studies are underway to develop the relationships of degradation due to termite attack with climatic conditions, geographical conditions, timber properties such as strength properties as well as the densities, mechanical properties with considerable time period which allocated to degrade.

Keywords: Ttermites, Decay, Density, Time period

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

122

(220)

Alternative Timber Applications for Sri Lankan House Construction during the Economic Crisis

Dabare E.T.D.*, Udawattha C.D.

*Department of Estate Management and Valuation, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka
tharushidivyanjalee19@gmail.com

Abstract

A crucial component of civilization, housing construction has evolved in a variety of ways based on new technology and materials. However, due to Sri Lanka's economic crisis, house building is now one of the most in-danger industries there. Subjectively, the cost of imported base building materials has grown due to the danger of inflation, and this increase is dependent on the US dollar exchange rate. The reason is that more than 50% of the building and raw materials are imported, and a rise in the US dollar value will raise the price of construction supplies. In order to find the best materials to reduce the cost of building a house based on imported materials, this study compares the life cycle quality of imported and local alternatives for imported materials made of timber. There are many various kinds of materials that have been utilized in house construction, but the focus of this study is on timber-based alternatives. The study is mainly focused on aluminum and glass as imported materials and timber as an alternative material. Based on life cycle cost analysis, these materials were compared using material costs and data gathered through interviews. Additionally, weighted analysis has been utilized to choose the optimum material based on consumer preferences, appearance and aesthetics, durability, and local availability of resources. Even though local materials are more affordable and score higher on other metrics, it was discovered that they may no longer be comparable to imported materials. People also rapidly switch back to imported materials when they are affordable after the economic crisis. It also found that local timber consumption increased during the economic crisis leading to deforestation.

Keywords: Alternative materials, Appearance, Durability of materials, Finishing materials, House construction, Life Cycle Cost Analysis, Timber

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

123

(20)

Preparation and Characterization of NPK Nutrient Loaded Electrospun Cellulose Acetate Nanofiber Mat to be used as a Slow-release Fertilizer

Fernando W.A.M.B.[1], Munaweera I.[1,2]*, Kottegoda N.[1]

[1]*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda.Sri Lanka*
[2]*Instrument Center, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[*]imalka@sjp.ac.lk

Abstract

A major unsolved issue with chemical fertilizers is the low nutrient use efficiency. It has been reported that an excessive amount of up to 70% of the nitrogen applied to plants with traditional fertilizers is lost to the surrounding. Hence, the drastic pollution effects of chemical fertilizer usage. Slow-release fertilizers aim to reduce such losses via slow and sustained release of nutrients to the plant. In this study, we report the successful fabrication and characterization of a novel and biodegradable cellulose acetate (CA) electrospun nanofiber (NF) mat loaded with nitrogen, phosphorus and potassium plant nutrients of urea, hydroxyapatite nanoparticles (HANPs) and MOP respectively to be used as a slow-release fertilizer (SRF). It was envisaged that the unique properties of the electrospun NFs could overcome the shortcomings of traditional slow-release fertilizers (SRFs). The fabrication of the NFs was done with 8.5% w/v CA polymer dissolved in a 6 mL solvent system of acetone to dimethylformamide in a 2:1 volume ratio along with the addition of the aforementioned nutrients at 10% of the polymer weight. Electrospinning parameters were set after parameter optimization. The high-voltage supply was set at 16 kV, the spinneret to collector distance was 13cm and the flow rate was 1.5 ml/h. The solutions were electrospun only when the relative humidity was approximately between 65 to 70%. The HANPs incorporated were synthesized by the wet chemical precipitation method. The successful synthesis of the HANPs was confirmed via Fourier transform infrared (FTIR) spectroscopy and powder X-ray diffraction (PXRD) analysis. The successful loading of the nutrients onto the electrospun NF mat was evident from FTIR, Raman and EDX analysis. Furthermore, the scanning electron microscopy images of the nutrient loaded NFs depicted a reduced average diameter with respect to those of the neat NF mat. The total nitrogen percentage of the nutrient loaded NF mat was determined to be 2.60% from Kjeldahl analysis. The initial nutrient release studies in water depicted a biphasic release model for orthophosphate and potassium nutrients while only a burst release profile was observed for nitrogen. It can be concluded that the electrospun NF mats display a potential application with regards to SRFs. However, several modifications to the NF mat fabrication such as the usage of coaxial electrospinning will have to be made in order to better optimize the nutrient loading and enhance its slow-release properties.

Keywords: Electrospinning, Nanofiber mat, Slow-release, Hydroxyapatite nanoparticles

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

124

(28)

Effect of pH and Light Intensity on the Growth of *Dunaliella Salina*

Dilshan W.L.T.[1], Asanthi H.B.[1]*, Maithreepala R.A.[1], Atapaththu K.S.S.[1], Costa A.M.K.C.J.[1], Suranga D.K.A.I.[2]

[1]*Department of Limnology and Water Technology, University of Ruhuna, Matara, Sri Lanka*
[2]*Lanka Salt Ltd., Hambantota, Sri Lanka*
* asanthi@fish.ruh.ac.lk

Abstract

Dunaliella salina is a unicellular halophilic green alga dominantly found in salt lakes, and high saline ponds in slatterns all over the world. A rigid cell wall is absent in *D. salina* while the cells are covered by mucous materials that are enclosed by a thin elastic plasma membrane. This species has both environmental and economic validity as they are capable of producing β–carotene during photosynthesis. Synthesis of β–carotene in *D. salina* is a function of environmental factors, and thus, the present study was designed to study the effect of pH of the medium and light intensity on the growth of *D. salina*. The Algae sample was collected from a crystalizing pond of Hambantota Saltern, Sri Lanka, and a monoculture was maintained under suitable laboratory conditions. The seawater sample with pH 7.66 was used to prepare a series of pH using sodium carbonate anhydrous. These cultures were exposed to a series of pH (7.66, 8.0, 8.50, and 9.0) at two light intensities (885 lux and 200 lux). All experimental setups were maintained at 25°C with the photoperiod of 12h light and 12h dark. Four replicates of each pH medium were arranged into a 4×4 setup of flasks for each light intensity and the experiment was conducted for four weeks. At the end of the fourth week, the pH level of all flasks ranged from 8.27 to 8.53 due to the self-adjustment of the pH level in the culture medium in parallel to algal growth. The maximum growth was reflected by the highest absorbance of 1.46 at 750 nm. Taken together, our findings revealed that the optimum pH range and light intensity for culturing *D. salina* is 8.27-8.53 and 885 lux respectively. This study recommends further research on culturing of *D. salina* for extracting the bioproduct of β -carotene at various light intensity levels.

Keywords: Cell density, β –carotene, Light intensity, Self-adjusted

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

125

(36)

Potential of a Charcoal Evaporative Cooling Chamber for Extending the Shelf Life of Vegetables

Karunathilaka T.D.*, Rupasinghe C.P., Samaraweera M.D.S.

Department of Agricultural Engineering, University of Ruhuna, Matara, Sri Lanka
*thilinakarunathilaka1997@gmail.com

Abstract

There are wide varieties of vegetables in Sri Lanka. The ambient temperature and relative humidity have an impact on rate of vegetables deteriorate. Evaporative cooling is a well-known, cost-effective way to reduce postharvest lost in order to lower the temperature and increase the relative humidity. This research was done to create a charcoal cooling chamber for increase the shelf life of vegetables combining polythene packaging and active packaging additives. The study was carried out in wet zone, Sri Lanka with a sizable chamber made of coconut shell charcoal. A rectangular box made of chicken wire with a 1 m^3 capacity serves as the evaporative cooling chamber. It made of chicken wire mesh with a hardwood frame. The walls filled with 50 mm thick coconut shell charcoal and a water outflow 8.33 ml/min for wetting the walls. Vegetable samples without any treatment were placed in the charcoal chamber along with vegetables wrapped in sealed polyethylene (gauge 300) with and without active packing components. With a control sample held in ambient settings, the treatments were put to the test four times over the course of nine days. Both unloading and loading situations were used to evaluate the performance of chamber. Temperature drops of 4° C on average and 2.07° C on average, respectively, were seen in dry and wet climate conditions. 92.49% on average was the cooling efficiency. Sealed polyethylene bags without active packaging components were found to be the best treatment when taking into account physiological weight loss and sensory tests. When compared to the control group on days 3, 6 and 9 physiological weight loss was considerably ($P<0.05$) less in the sealed polyethylene bags without active packing components. When compared to the control sample total soluble solid content less in sealed polythene bag. The sensory evaluation for the treatments inside the chamber was more acceptable than for the control. Vegetables can store fresh for up to three days in evaporative cooling chamber without packaging. These chambers can install vegetable stalls on the side of the roads in Sri Lanka for temporary purposes.

Keywords: Charcoal, Evaporation, Shelf-life, Temperature, Vegetables

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

126

(39)

Thermal Evaluation of Vertical Greeneries for Building Façade with Different Orientations and Shading Percentages by Design-builder Simulation

Jayakody G.D.C.[1]*, Jayasinghe G.Y.[1], Halwatura R.U.[2], Weerasinghe K.G.N.H.[2]

[1]*Department of Agricultural Engineering, University of Ruhuna, Matara, Sri Lanka*
[2]*Department of Civil Engineering, University of Moratuwa, Moratuwa, Sri Lanka*
*chathudeepthi19@gmail.com

Abstract

Green facades are the innovative forms of vertical greenery systems which are good strategies for urban greenery to improve the micro-climatic conditions of the area. This research study examines the benefits of cooling load by the simulation of the typical building. Design-builder energy plus simulation tool is used to estimate the annual cooling energy of the typical building which consists of three stories with four façade orientations with varying shading percentages to determine the optimum vertical greenery solution while taking shading percentage and façade direction into account. Design-builder software was validated by measuring the 24-hour temperature of the existing indirect vertical garden. The validation study was carried by using a basic linear regression model analysis using Mini tab software. Under five shading percentages (0%, 25%, 50%, 75%, and 100%), the building was designed with four orientations (North, East, South and West). As a consequence, there were twenty possible situations, each with four regions and four orientations. Each scenario's yearly annual cooling load was estimated and compared to a reference condition for a building without plants using the software. For four major orientations with varying different shade percentages, an indirect green façade with *Thunbergia laurifolia* was integrated. Validation results exhibit R^2 value was 0.976, indicating that the model can express 97.6% of the actual data changes. In terms of economics, the building façade with 25% and 50% greenery coverage with a south orientation and 75% greenery coverage with east orientation are the best vertical greenery solutions. The ideal façade is the one that is completely covered in greenery (100%) and faces east.

Keywords: Design-builder, Indirect green facade, Orientation, Simulation

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

127

(42)

Biofilm-based Biofertilizers and Microbial Mixed Cultures: Are they Different on Plant Growth?

Senanayake D.M.N.[1]*, Seneviratne G.[2], Jayasinghe J.A.W.W.[3]

[1]*Central Environmental Authority, Gampaha, Sri Lanka*
[2]*National Institute of Fundamental Studies, Kandy, Sri Lanka*
[3]*Central Environmental Authority, Kegalle, Sri Lanka*
*nirma.senanayake@gmail.com

Abstract

Intensive agriculture has increased crop yields, but at the same time has posed severe environmental problems. Organic agriculture is a good alternative to intensive agriculture in safeguarding the environment. However, handling bulky organic materials in large-scale cultivations limits the widespread use of organic agriculture. In this context, microbial biofertilizers can play a major role in replacing intensive agriculture, which is based only on chemical inputs. As a recent development in microbiology, biofilms have been formulated in vitro to be used as biofertilizers, which are then called biofilmed biofertilizers (BFBFs). Biofilms are complex, surface-attached communities of multiple microbial species that produce a wider range of ecologically important biochemicals. The present study investigated the biochemical expression and the effect on plant growth of BFBFs and just mixed cultures of the BFBF microbes, using tomato (*Solanumlyco persicum*) as the test plant. A plant assay and a pot experiment were carried out to evaluate this. Fourier Transform Infrared (FTIR) spectroscopy was used to analyze the biochemical expression of the BFBFs and the mixed cultures. Seeds inoculated with BFBF showed significantly higher germination percentages and seedling lengths than the mixed cultures. The BFBFs and the mixed culture increased the vigor index of tomatoes up to 177% and 120%, respectively over the non-amended control. BFBFs inoculations significantly improved the root growth and resulted in significantly higher biomass production and plant height than the mixed cultures, and this was proportional to the production of more diverse functional groups and nitrogenous compounds by the BFBFs. Thus, it can be concluded that the BFBFs secrete a wider range of biochemicals than their mixed cultures, thus leading to higher plant productivity.

Keywords: Biofilms, Biofertilizer, Tomato, Organic agriculture

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

128

(55)

Core-Shell Adsorbent Granules Fabricated from Sand/Graphene Oxide Nano-Composite for Adsorptive Removal of Pb (II)

Perera W.P.R.T.[1]*, Perera P.L.R.A.[2], Kumarasinghe A.R.[3], Liyanage J.A.[2]

[1]*Department of Indigenous Medical Resources, Gampaha Wickramarachchi University of Indigenous Medicine, Yakkala, Sri Lanka*
[2]*Department of Chemistry, University of Kelaniya, Kelaniya, Sri Lanka*
[3]*Department of Physics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
*wprtp@gwu.ac.lk

Abstract

Core-shell absorbent granules are produced by coating commercial sand gravels with graphite oxide (few-layer oxidized graphene sheets). Graphite oxide (GO) is synthesized chemically from vein graphite, a rare form of high purity natural graphite. Repeated coatings of graphite oxide on sand followed by low temperature (120^0 C) thermal pyrolysis produce core-shell granules with a hierarchical structure in which sand gravels are covered by graphite oxide layers. The intention of this study is to assessment of feasibility of the mitigation of Pb (II) form the water by sand/graphene oxide nano-composite and study the dynamic behavior of the adsorption mechanism using the mathematical modeling. Individual materials and the resulting nanocomposite are characterized using a range of spectroscopic (FTIR, XRD, XPS) and microscopic (SEM/EDXA) techniques to elucidate the process of transforming individual materials into nanocomposite and to assess its suitability for removing Pb (II) from water. Stable sand/graphite oxide nanocomposites were obtained upon five times coating of GO on the sand surface and characterization shows that functionalized and a porous coating developed on the sand. The Pb (II) removal efficiency increases from high-acidic to neutral pH and decreases after basic (pH-8). The adsorption process takes 150 minutes to reach the equilibrium. After 150 minutes, the Pb (II) ion adsorption rate was constant. The maximum dosage of the nanocomposite needed to reach the equilibrium was 0.06g. Under the optimum conditions, 96.3% of Pb (II) removal efficiency was recorded from simulated Pb (II) containing water. According to the mathematical modeling, adsorption follows the Langmuir isotherm and fits well with the pseudo 2nd order kinetics model, indicating a homogeneous adsorption process via a monolayer process and Pb adsorbed onto the surface of the sand/GO nanocomposite by chemisorption. Sand/GO nanocomposite is an excellent candidate for removing Pb (II) from contaminated water.

Keywords: Adsorption, Graphene oxide, Sand, Water treatment

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

129

(64)

Bio-efficacy and Persistence of Inert Dust Formulations as Stored-grain Protectants against *Sitophilus oryzae* (L.)

Ganhewa H.T., Perera A.G.W.U.*

Department of Zoology, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka
*wathsala@sjp.ac.lk

Abstract

Inert dust formulations of natural origin act as promising alternatives in controlling storage infestations caused by deleterious coleopteran insect pests. In that context, laboratory studies were conducted in order to evaluate the insecticidal activity, progeny inhibition and persistence of three commercially available dust formulations, namely, diatomaceous earth, zeolite and cloisite 20A against *Sitophilus oryzae* adults, a major coleopteran pest of stored grains, throughout 90 days of storage period. Adulticidal and persistence bioassays were conducted to evaluate the toxicity of binary combinations of inert dusts using their sub-lethal doses towards the test insect for 60 days of storage period. Further, ultrastructural architecture of the test insect pest species was examined via Field Emission Scanning Electron Microscopy (FE-SEM), and Energy Dispersive X-Ray Analysis (EDX) to study the uptake/penetration pattern of inert dust particles through the cuticular layers of target insect pest. All inert dust formulations exhibited very efficacious toxic and progeny inhibition activities and extraordinary mortality percentages irrespective of the inert dust used at the end of initial 30 day-long storage period. Thereafter, mortality percentages gradually declined with the progress of the storage time period, declining in the order of, diatomaceous earth>zeolite>cloisite 20A. All the dust formulations successfully inhibited the progeny production and the lowest average progeny production was recorded at the end of initial storage period. Progeny inhibition decreased with the progress of storage time. Binary combinations of inert dust formulations exhibited additive and antagonistic effects against *S. oryzae* and similarly, the mortality percentages gradually decreased with the prolongation of the storage period. The FE-SEM and EDX micrographs clearly indicated the presence of dust particles and the distribution of their constituting elements on the cuticular layer of the exposed insect pests with the appearances of abrasions and scratches that may have led to dehydration and eventual death of *S. oryzae*. Thus, findings of the present study suggest that, naturally-derived diatomaceous earth, zeolite and cloisite 20A can be used as eco-friendly means as stored grain protectants against *S. oryzae* populations successfully in the storage grain systems.

Keywords: *Sitophilus oryzae*, Diatomaceous earth, Cloisite 20A, Zeolite

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

130

(102)

Effect of Natural IAA Produced by *Streptomyces* Strain ACM37 on Seed Germination and Seedling Growth

Gamlath A.G.N.N.A.S., Abayathunga T.P., Widana Gamage S.M.K. *

Department of Botany, University of Ruhuna, Matara, Sri Lanka
*shirani@bot.ruh.ac.lk

Abstract

Biofertilizers play an important role in sustainable agriculture by improving soil fertility, crop tolerance and crop productivity. In this context, exploitation of plant growth promoting rhizobacteria with various beneficial properties is challenging. This study aimed to investigate the plant growth promoting activity of indole-3-acetic acid (IAA)-producing actinomycetes strain, *Streptomyces* ACM37 on the seed germination and seedling growth at early stage. The ACM37 was grown in starch-casein broth for 7 days at 28° C, 80 rpm and supplemented with 50 mg/l L-tryptophan to induce IAA production. After 7 days, IAA concentration in cell-free culture broth was quantified by following the Salkowski's method and it was 50 mg/l. Seed germination and seedling growth of cowpea (*Vigna unguiculata*) and rice (*Oryza sativa* L.) at different concentrations of IAA were estimated as % seed germination, number of roots, primary root length and length of hypocotyl. Initially, seeds were surface sterilized with 10% (v/v) NaOCl and soaked in 10, 20, 30, 40 and 50 mg/l crude IAA preparations for 1 h at 30° C. As controls, seeds were soaked in sterilized distilled water (SDW) and 50 mg/l synthetic IAA. Ten seeds per each treatment with three replicates were placed on 0.8% (w/v) water-agar in Petri plates and incubated in dark at 30° C. The % seed germination of ACM37-IAA-treated cowpea and rice seeds was enhanced at all concentrations compared to SDW and synthetic IAA treatments after 3 days. The highest 100% germination of cowpea was given at 10 mg/l IAA while it was 96.67±3.33% in>30 mg/l IAA in rice. Similarly, there was a significant ($P<0.05$) increase in primary root length and number of lateral roots in cowpea at 10 mg/l of ACM37-IAA. Overall, ACM37 showed significant plant growth promotion in cowpea at low concentration (10 mg/l) of IAA whereas there was a significant ($P<0.05$) reduction at high concentrations (>10 mg/l). On the other hand, there was no apparent increase in all growth parameters except seed germination in rice at all concentrations. It appears that high concentrations of ACM37-IAA may be required to promote plant growth in rice. Overall results highlight that plant growth promotion activity of ACM37 varies at different IAA concentrations and different plant species, probably between monocot and dicot species. Therefore, ACM37 has potential application as a plant growth promoting agent in biofertilizers and plant growth inhibiting agent in bioherbicides at certain IAA concentrations.

Keywords: Actinomycetes, Biofertilizer, Bioherbicide, IAA

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

131

(127)

Potassium Solubilizers, *Aspergillus* sp. and *Trichoderma* sp. Promote Growth in Tomato

Kumari M.D.H.M.[1]*, Athukorala A.D.S.N.P.[1], Vishwajith H.K.I.S.[2], Rajapakse R.M.G.[3]

Department of Botany, University of Peradeniya, Peradeniya, Sri Lanka
[2]Department of Environmental Science, University of Peradeniya, Peradeniya, Sri Lanka
[3]Department of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka
*hashanimangalika@gmail.com

Abstract

Potassium (K) is the third most significant plant macronutrient that plays a crucial role in growth and development of plants. K is abundant in soil, but 90-98% of K exists as insoluble minerals and only 1-2% becomes available to the plants. Certain microbes, K solubilizing microbes (KSMs), can solubilize unavailable forms of K and making it available to plants. The objective of the current study was to evaluate the growth promotion ability of two previously (2019) isolated KSMs, *Aspergillus* sp. and *Trichoderma* sp *in-vitro* and under greenhouse conditions using feldspar as the K source. Khandeparkar's selection ratio calculated based on K solubilizing assay on Alexandrov medium showed that *Aspergillus* (1.72+0.16) has a higher and faster K solubilization ability than *Trichoderma* (1.0+0.16). Effect of KSMs was assayed in a Tomato seed germination assay carried out in Petri plates with KSMs treated and non-treated soils. Both *Aspergillus* (58%) and *Trichoderma* (72%) showed enhanced percentage germination of tomato seeds under *in vitro* conditions compared to that of controls (*Aspergillus* sp.: 24%, 14%, 22.7%, 51.3%, 39.3%, *Trichoderma* sp.: 22%, 12%, 13%, 59%, 51%) which was statistically significant (*Aspergillus*, P=0.026; *Trichoderma,* P=0.003) at 0.05 confidence level. Seedling length (P=0.102, P=0.028) and root length (P=0.453, P=0.002) of tomato were enhanced when raised in non-autoclaved natural soil than autoclaved natural soil inoculated with *Aspergillus* and *Trichoderma* respectively. The greenhouse experiment was carried out with same experimental set up as an *in vitro* assay. No significant difference was observed in shoot length, number of leaves and length of leaves of tomato plants planted in soil treated with *Aspergillus* (P=0.093, P=0.906, P=0.260) and *Trichoderma* (P=0.334, P=0.239, P=0.243) respectively in comparison to controls during the vegetative stage (2 months after sawing). However, flowering was started four days early in plants planted in non-autoclaved soil treated with *Aspergillus* sp. suggesting that the impact of *Aspergillus* sp. starts to become visible in the reproductive stage. The results suggest that K solubilizing ability of *Aspergillus* sp. and *Trichoderma* sp. seem to show a positive effect on germination ability of tomato, however, only *Aspergillus* sp. seems to have a positive effect on the later stages of plant growth where K is mainly needed for flower and fruit development. Therefore, *Aspergillus* sp. can be a potential candidate to be used in up scaling the natural K fertilizers such as feldspar after intensive future experimentation.

Keywords: Plant Growth Promoting Microbes (PGPMs), Growth promotion, K deficiency

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

132

(146)

Removal of Crystal Violet Dye in Textile Wastewater Using Rice Husk Biochar

Pabasara W.G.A.*, Premadasa A.G.K.E., Madushika J.W.A.

Department of Engineering Technology, University of Ruhuna, Matara, Sri Lanka
*ayomiwalagedara@gmail.com

Abstract

Crystal Violet Dye (CVD) is a water-soluble, hazardous organic dye that causes adverse health issues and environmental pollution. This dye was mostly added to wastewater by the textile industries. Treatment of CVD-contained wastewater has become a great challenge due to high investment and operating costs and inefficiency in dye removal of conventional methods such as biological degradation and chemical oxidation. So, the main purpose of this study is to investigate the CVD removal ability of Rice Husk Biochar (RHB). The experiment procedure was designed to determine the influence of initial CVD concentration, adsorbent dosage, pH, contact time, and temperature on dye removal. RHB was prepared by pyrolysis process at 700° C for 3h at a constant heating rate of 10° C min^{-1} in a muffle furnace. Adsorption of CVD by RHB was verified by performing Fourier Transform Infrared spectroscopy. The concentration of the remaining dye after adsorption studies was calculated using Ultra-Violet visible spectroscopy. According to the results, the dye removal efficiency increased with the RHB amount, but the rate of this increment decreased at higher RHB dosages. The highest dye removal efficiency of 97.33% was recorded at 1.5 g RHB amount. In the effect of initial CVD concentration, the efficiency increased up to 600 mg/l and then decreased and the maximum removal efficiency was 96.77%. pH value has no significant effect on dye removal and the highest efficiency of 97.3 % was recorded at pH 4. Further, as the contact time increased, the dye removal increased until it reached an equilibrium state at 60 minutes with 92.03% efficiency. Moreover, when raising the temperature, the adsorption of CVD by RHB marginally increased. According to the kinetic studies, the experimental data followed pseudo-second-order kinetic models than pseudo-first order. Further, adsorption equilibrium data well fitted both Freundlich and Langmuir isotherm models so that it can be assumed that both monolayer and multilayer adsorption of CVD in RHB surface. Thermodynamic parameters such as Gibbs free energy and enthalpy change were calculated, and all values were recorded as negative implying adsorption was favorable and spontaneous and the process was exothermic. In conclusion, the optimum dye removal was recorded at 35^0 C and pH 4 with an initial dye concentration of 600 mg/L and adsorbent dosage of 1.5 g. Thus, this study concluded that RHB could be utilized as a cost-effective, eco-friendly, and affordable adsorbent for the removal of CVD from wastewater with over 90% dye removal efficiency.

Key words: Crystal violet dye, Rice husk biochar, Textile industry, Adsorption

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

133

(173)

Ecofriendly Synthesis of Silver Nanoparticles via *Camellia sinensis* Leaves and their Insecticidal Effects towards the Storage Pest, *Sitophilus oryzae*. (L.)

Sandeepani G.D.V.A.[1], Perera A.G.W.U.[2]*, Chinthaka S.D.M.[1]

[1]*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
wathsala@sjp.ac.lk.

Abstract

Existing agricultural practices are not enough to satisfy the growing demand for food. Therefore, high-yielding varieties, fertilizers, and pesticides must be used to increase productivity with limited arable land. As the crop yield increases, the incidence of pest attack within field and storage ecosystems rise which leads to increased demand for insecticides. Plant-mediated biosynthesis of nanomaterials has attracted much researcher interest in recent years due to many advantages over chemically synthesized conventional insecticides. This study was carried out to evaluate the effectiveness of silver nanoparticles (AgNPs) synthesized using the leaf extract of Sri Lankan tea from *Camellia sinensis* to control a major stored-grain insect pest, the *Sitophilus oryzae* adults (Coleoptera: Curculionidae*)*. The biosynthesized AgNPs were characterized by UV-Vis spectroscopy, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM). The bio-transformed AgNPs were applied at the rates of 1.5, 1.0, 0.5, 0.25, 0.125 and 0.0625 g/kg on pesticide-free rice grains, wherein the mortality percentage was assessed after every 24 hours for seven days continuously. The appearance of the signature brown color of the solution indicated the formation of silver nanoparticles. UV-Vis spectroscopy results showed a peak of absorbance in the range of 400-460 nm, which is in good agreement with previous records for silver nanoparticles synthesized by green techniques. The average crystallite size determined by subjecting XRD results into Debye-Scherrer equation was found to be 61.9 nm, which was further characterized by the electronmicrography results obtained by SEM, whereby particles were confirmed to be within the nano-range. Results of the toxicity bioassay showed that mortality of *S. oryzae* adults increased with increasing dosages and time exposed to each dosage, producing 100% mortality at 1.5 g/kg dosage. Hence, it can be concluded that the green synthesized silver nanoparticles can be applied effectively and successfully in a stored grain integrated pest management programs.

Keywords: Green-synthesized silver nanoparticles, *Camellia sinensis*, Insecticidal, *Sitophilus oryzae*

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

134

(174)

On-water Catalyst-free Synthesis of 3-Alkenyl Oxindoles

Kumarasinghe K.G.U.R.*, Samaradiwakara D.M.T.A.

Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
upulk@sjp.ac.lk

Abstract

3-Alkenyl oxindoles are key structural motifs in organic chemistry with a wide range of applications mainly in the pharmaceutical industry, due to excellent biological activities such as anti-inflammatory, antiviral, antibacterial, and anticancer properties. With the discovery of the importance of oxindole derivatives in the pharmaceutical industry, demand for sustainable protocols for the synthesis increased as most classical methods have their limitations and flaws. In this study on-water, catalyst-free, atom-economical green approach was developed for the synthesis of 3-alkenyl oxindole derivatives using oxindole and aldehyde as starting materials. The reaction between oxindole and benzaldehyde was conducted on water under catalyst-free conditions. Interestingly, 100% conversion was observed when the reaction was carried out for 24 hours at 100° C. As the next step, the applicability of the developed approach was proven for different aldehydes. Furaldehyde, cinnamaldehyde, and vanillin were used as the aldehydes to synthesize 3-alkenyl oxindole derivatives, and the isolated yields were obtained as 77%, 54%, and 51% respectively. The desired product formation was confirmed by comparing the Rf value of the product with that of the previously synthesized well-characterized compounds; 3-benzylideneindolin-2-one, 3-(furan-3-methylene)indolin-2-one, 3-(3-phenylallylidene)indolin-2-one, and 3-(4-hydroxy-3-methoxybenzylidene)indolin-2-one using Thin Layer Chromatography. Further characterization was done by Fourier-transform infrared (FT-IR), Ultraviolet-visible (UVVis), and Nuclear Magnetic Resonance (NMR) spectroscopic techniques. In further optimization steps, the reaction was performed using surfactants as the catalyst. By adhering to the green chemistry principles different sources of biosurfactants were used including *Acacia concinna* pods, *Sapindus emarginatus* fruit pericarp, *Dillenia retusa* fruit pericarp, and *Trigonella foenumgraecum* seeds. In order to compare the effect of biosurfactants, a synthetic surfactant, sodium dodecyl sulfate (SDS) was used as the catalyst. When the reaction was carried out for 21 hours at 100 °C using fruit pericarp of *Sapindus emarginatus* as the source of biosurfactant, 100% conversion was observed. Using water as the solvent, readily available starting materials, higher yield, and eco-friendliness and catalyst-free conditions suggest the possible use of the developed method for large-scale preparations of 3-alkenyl oxindole derivatives.

Keywords: Green protocol, Oxindole derivatives, Surfactant, On water synthesis, Catalyst-free

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

135

(178)

***Olax zeylanica* Leaf Extract-assisted Eco-Benevolent Synthesis of Sulfur Nanoparticles and the Determination of their Insecticidal Potential against *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae)**

Sandeepani G.D.V.A.[1], Perera A.G.W.U.[2]*, Chinthaka S.D.M.[1]

[1] Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*wathsala@sjp.ac.lk

Abstract

Stored-product insects are serious pests of dried, stored, durable agricultural goods and value-added foods worldwide. In spite of the commonest way of controlling pestiferous insects associated with cereal grains and their milled products via conventional insecticides, their usage on stored grains are not recommended due to expensiveness, inefficacy due to insect resistance, and potential health hazards to humans. These deleterious consequences thus have been encouraging to merit investigation on the plant extract-assisted eco-benevolent synthesis of nanoparticles, owing to their sustainable, non-noxious, convenient, and environmental friendly nature. In view of this background, the present study was aimed at evaluating the insecticidal effectiveness of green synthesized sulfur nanoparticles (SNPs) against *Sitophilus oryzae* adults. SNPs have been successfully prepared from sodium thiosulfate ($Na_2S_2O_3.5H_2O$) in the presence of *Olax zeylanica* leaf extract at room temperature. The resulting SNPs were then characterized by UV-Vis spectroscopy, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM). The toxicity of *Sitophilus oryzae* was bio-assayed by exposing the test insects to SNPs-treated rice grains at six different dosages at 1.5, 1.0, 0.5, 0.25, 0.125 and 0.0625 g/kg, whereby mortality counts were taken after every 24 hours for seven days. The UV- Vis spectroscopy showed a peak in the range of 260-280 nm, which showed the successful formation of SNPs, while being in accordance with the previous studies reported in the literature. According to the Debye-Scherrer formula of XRD data, the average crystalline size of the SNPs counted to be 72.7 nm. The particle size of SNPs is also confirmed by SEM images. FTIR results showed peak positions corresponding to S_8 with slight differences due to the presence of biomolecules from the *O. zeylanica* leaf extract being bound onto the surface of SNPs. Bioassay results show that the mortality of insects increased with the increase of dosage and exposure time period, reporting 100% *S. oryzae* mortalities at 1.5 and 1.0 g/kg dosages within 7 days. Accordingly, the results of the present study thus suggest that the bio-transformed sulfur nanoparticles could be utilized not only as biocontrol agents, but also as ecofriendly candidates for the sustained-protection storage grain ecosystems from insect pest infestations.

Keywords: Green-synthesized Sulfur nanoparticles, *Olax zeylanica*, Insecticidal, *Sitophilus oryzae*

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

136

(195)

Effect of Water Sources on the Growth Performance and Chlorophyll Content of
Azolla pinnata **R.Br.**

Amarasinghe S.R.*, Rajapaksha R.A.N.D., Rathnayake N.R.R.W.S.

Department of Soil Science, University of Ruhuna, Matara, Sri Lanka
*rajika@soil.ruh.ac.lk

Abstarct

Azolla pinnata R.Br. is an aquatic fern that grows on the surface of water bodies. The unique quality of *A. pinnata* is its symbiotic relationship with a prokaryotic cyanobacterium (*Anabaena azollae*), which confers a high rate of nitrogen fixation. It is important to find the growing conditions of *Azolla* in different water sources for its optimum biomass production for different usages such as biofertilizers, animal feeds, water purification and biofuel production. This preliminary study was conducted to investigate the effect of water sources on the growth performance (shoot biomass, root biomass, root length), and the chlorophyll content of *Azolla*. Presence of *Anabaena* in *Azolla* fronds was monitored by light microscope and number of filaments were counted per leaflet. The experiment utilized three types of water sources (tap water as control (T1), lake water (T2) and cattle manure mixed tap water (T3), in plastic buckets with 40 cm in diameter and 25 cm in height. Each treatment was triplicated in a completely randomized design and total biomass was collected weekly. Data were statistically analyzed using Minitab 17. The highest biomass of *Azolla was obtained in* T3 from the first week until 8th week and it was higher from T1 and T2. The highest chlorophyll content was obtained in T3 (6.4 SPAD value) showed a significant difference from T1 and T2 ($p < 0.05$). The dry weight of roots and root length in T1 showed a significant difference from T2 and T3 ($p < 0.05$). The highest root length was observed as 5 cm in T1 indicating that roots may be in search of nutrients and the lowest root length was observed as 0.8 cm in T3 with high nutrient concentrations in water. The highest number of *Anabaena* was observed in the leaflet of *Azolla* fronds in T3 which in turn increase N content in *Azolla* plants. It reveals that application of cattle manure in tap water significantly affects the plant biomass and the chlorophyll content of *Azolla*. Further studies are needed to conduct in large scale growing facilities with different nutrient concentrations of water sources to find sustainable and optimum growing conditions for *Azolla* and the nutrient concentrations of the plants.

Keywords: *Azolla*, Chlorophyll, Growth performance, Water sources

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

137

(212)

Characterization of Thermostable Cellulase Enzyme Isolated from a Hot Spring Bacterium:
Bacillus **sp.**

Herath M.N.[1], Sadeepa, H.D.D.[2, 3], Manage, P.M.[2, 3]*, Sirisena, K.A.[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 Graduated Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[4]*Department of Environmental Technology, University of Colombo, Colombo 03, Sri Lanka*
*pathmalal@sjp.ac.lk

Abstract

Cellulase is a complex of enzymes which consists of β-1,4-endoglucanase, cellobiohydrolase, and β-glucosidase. Cellulase contributes a significant share to the world enzyme market and is used in number of industries viz; paper and pulp, food and beverage, bioethanol, detergent and textile. The harsh industrial conditions such as high temperature, extreme pH levels and high substrate concentration etc. which is used in such industries adversely effect on structure and activity of enzymes. Therefore, huge amount of chemical catalysts which cause chemical wastes are used in industrial settings instead of enzymes. Since the chemical wastes adversely affect the ecosystem, isolation and characterization of thermostable cellulase enzyme-producing bacteria and exploring the industrial perspective of thermostable enzymes is a better approach towards green chemistry. The present study focused on characterization of cellulase enzyme produced by *Bacillus* sp., which shows optimum activity at 60° C under neutral conditions, isolated from Gomarankadavala hot spring in Sri Lanka. The effect of different Carbon sources: glucose and lactose, Nitrogen sources: peptone, tryptone, yeast extract and urea on enzyme production and different Carboxymethylcellulose (CMC) concentrations; 0.5%, 1.5% and 2%, on enzyme activity were measured using the DNS method. Under the optimum conditions, cellulase enzyme activity on different substrates: corn cob, rice bran and raw leaves were measured. The highest enzyme production was recorded in the culture medium which added tryptone as the nitrogen source and adding carbon sources to the culture medium showed an increase of cellulase enzyme production. The optimum CMC concentration for the enzyme activity was recorded as 1% and from all the optimized parameters, the substrate; raw leaves showed the highest enzyme activity of 11.305 U/ml. Further, a considerable amount of enzyme activity was recorded on corn cobs and rice bran as well. Thus, the thermostable cellulase enzyme produced by bacterium identified as *Bacillus cereus* isolated from Gomarankadavala hot spring could be successfully used in industrial settings such as kitchen/industrial waste management, bioethanol production, paper and pulp industry and textile industry which use high temperatures and cellulosic substrates as raw materials.

Keywords: Thermostable enzymes, Cellulase, Industrial applications, Hot springs

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

138

(16)

State of Surface and Vertical Salinity in Puttalam Lagoon during North-East Monsoon

Perera H.A.S.D.*, Jayathilake R.M.

National Aquatic Resources Research and Development Agency, Colombo, Sri Lanka
*damithruh@gmail.com

Abstract

Puttalam Lagoon which covers 226 km^2 located in Sri Lanka's Northwest coast, plays an important role in aquaculture and lagoon capture fisheries. Kala oya and Mee oya are the major freshwater sources which empties into the Lagoon by eastern bank. Salinity variability is an important environmental variable in lagoon system that has an impact on aquaculture and aquatic resources. During the Northeast monsoon (NEM) in 2021, the spatial and vertical fluctuation of salinity in the lagoon was studied using SBE 19plus V2 CTD profiler. Field measurements show that the vertical salinity stratification in the lagoon was substantial during the study period. The lagoon has a significant spatial variability of salinity, ranging from 15 psu to 26 psu and Kala Oya river mouth has a salinity of 22 psu which impacted by freshwater and sea water circulation. The Salinity stratification in eastern section of the lagoon where the Kala Oya and Mee Oya streamflow reach is observed with surface salinity of 15 psu. During the NEM season, the average discharge of Kala Oya and Mee Oya to the lagoon was 10.8 m^3/s and 9.4 m^3/s, respectively, with a mean monthly precipitation of 48.89 mm. Fresh water from the Kala and Mee oya rivers flows into the lagoon during the season, while low evaporation and significant rainfall led the salinity to decline during the wet season, influencing the structure and function of lagoon ecosystems. The study reveals that a significant area of the lagoon is covered by the 20-30 psu salinity range, which is more appropriate for brackish water fisheries, particularly for shrimp and prawns during NEM.

Keywords: Salinity, CTD profiling, Northeast Monsoon, Freshwater

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

139

(45)

Review of the Responses of Various Soil Amendments in Sandy Soils

Jayathilini D.L.D.C.[1], Eeswaran R.[1, 2]*, Srikrishnah, S.[1]

[1]*Department of Crop Science, Eastern University, Chenkalady, Sri Lanka*
[2]*Department of Agronomy, University of Jaffna, Jaffna, Sri Lanka*
*eeswaranr@gmail.com

Abstract

The primary constraints with sandy soils are low soil organic matter content, poor nutrient availability, heavy losses of applied nutrients and lower water holding capacity. Improving the productivity of sandy soils, particularly in developing countries, could be a viable solution to food insecurity and poverty. Large extent of sandy soil is one of the major constraints for crop production in the Eastern Province of Sri Lanka. Meanwhile, various soil amendments can be applied to improve the performances of cropping systems in sandy soils. Nevertheless, a comprehensive knowledge on which soil amendment would work better across different scales is not well known. To address this knowledge gap, this review was conducted using published literature. Systematic review approach was adopted, and the data were extracted from 65 highly relevant papers. The data were analyzed to calculate the percentage changes on crop yields, soil organic matter and soil carbon, in response to the applications of different soil amendments. The review highlighted the potential of several soil amendments to improve the crop performances in sandy soils. Interestingly, rice straw biochar and the municipal solid waste compost have greatly increased crop yields especially in rice at the rate of 0.9% w/w and 3% w/w in soil weight basis, respectively. Highest improvement in soil organic matter and soil carbon was observed under the applications of compost and spent grain, respectively. Therefore, rice straw biochar and compost could be evaluated to improve the productivity of sandy soils, especially in the Eastern region of Sri Lanka. Although the spent grain was promising, the availability for large scale applications may be limited in Sri Lanka. Testing of these soil amendments would require long-term experiments incorporating different crops and cropping systems.

Keywords: Compost, Biochar, Sandy soil, Soil amendments

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

140

(54)

Effect of Cinnamon Leaf Compost on Selected Soil Properties in Cinnamon (*Cinnamomum zeylanicum* Blume) Growing Soils

Anuradha M.D.[1]*, Tharanga K.H.G.M.[2], Dissanayake M.L.M.C.[1], Madhurangi H.M.T.T.[3]

[1]*Department of Export Agriculture, Sabaragamuwa University, Belihuloya, Sri Lanka*
[2]*Soil and Plant Nutrition Division, National Cinnamon Research and Training Center, Department of Export Agriculture, Palolpitiya, Sri Lanka*
[3]*Plant Protection Division, National Cinnamon Research and Training Center, Department of Export Agriculture, Palolpitiya, Sri Lanka*
*mullageanu@gmail.com

Abstract

Integrated nutrient-management programs incorporating organic and inorganic fertilizers have been suggested to increase crop yields and reduce adverse environmental impacts in intensive agriculture. This study was conducted to investigate the effect of long-term cinnamon leaf compost (CLC) application on some selected physical, biological and chemical soil properties and the horizontal and vertical distribution of some selected soil properties in cinnamon-growing soils. The study was conducted in the National Cinnamon Research and Training Center, Palolpitiya, from January to April 2022. The experimental design was Randomized Complete Block Design (RCBD) with six treatments (T1-Control, T2-Current recommendation (CR), T3-3/4 CR with 5 t/ha/yr CLC, T4-1/2 CR with 10 t/ha/yr CLC, T5-1/4 CR with 15 t/ha/yr CLC, T6-20 t/ha/yr CLC) and three replicates. Soil samples were collected considering three horizontal distances (15, 30 and 45 cm) and with three depths (10, 20 and 30 cm). Soil physical properties (aggregate stability, bulk density, soil moisture), chemical properties (soil organic carbon (SOC), pH, electrical conductivity (EC)), and biological properties (arbuscular mycorrhizal root colonization) were determined. Water stable aggregate (WSA), SOC, and soil pH were significantly affected by the treatments, and all the variables except EC were significantly affected by the soil depth ($p<0.05$). Soil pH was the only variable that was significantly affected by the horizontal distance ($p<0.05$). Only SOC and pH have shown a significant interaction effect among treatments and depth. The application of CLC (20 t/ha/yr) significantly increases the WSA and SOC. Arbuscular mycorrhizal fungi root colonization was increased with the incorporation of CLC. Continuous application of inorganic fertilizers (T2) caused soil compaction and acidification. WSA, soil pH, and SOC were significantly improved within the 0-10 cm soil depth. The best performances of WSA, pH, and EC were shown in 30-45 cm and SOC in 15–30 cm horizontal distance from the plant base and 0-10 cm soil depth with the application of 1/2 CR and 10 t/ha/yr CLC comparison to other fertilizer combinations.

Keywords: Aggregates, Mycorrhizae, pH, Soil organic carbon

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

141

(81)

Impact of Heat on Soil Water Repellency in Forest Soils from Different Depths using Water-Repellent Japanese Cedar (*Cryptomeria japonica*) Forest Soil

Perera H.T.M.[1], Mori Y.[2], Maeda M.[2], Leelamanie D.A.L.[1]*

[1]*Department of Soil Science, Faculty of Agriculture, University of Ruhuna, Matara, Sri Lanka*
[2]*Graduate School of Environmental and Life Science, Okayama University,*
Tsushima-Naka, Kita-Ku, Okayama, Japan
*leelamanie@soil.ruh.ac.lk

Abstract

Some soils under plant species, such as casuarina, pine, eucalyptus, cedar, and cypress, show water-repellent conditions. Wildfires are common in forests dominated by these plant species as they produce highly flammable debris. The heat generated during wildfires alters soil characteristics, including soil water repellency (SWR). The responses of SWR to heat can differ depending on the heating temperature and the soil depth. This study aimed to examine the effects of different heating temperatures on SWR through a soil profile using Japanese cedar (*Cryptomeria japonica*) forest soil in Japan. Soil samples were collected from four different depths (0-5, 5-10, 10-15, 15-20 cm). Soils were exposed to heat with seven heating temperatures (T_H) (50, 100, 150, 200, 250, 300, and 350° C) separately for 1 h using a programmable muffle furnace. The degree (contact angle) and the persistence of SWR in both heated and non-heated samples were measured using the molarity of an ethanol droplet test and the water drop penetration time (WDPT) test, respectively. In non-heated soils, the 0-5 cm layer showed the highest SWR (contact angle ~110°; WDPT≥3600 s). SWR decreased with depth to be non-repellent at 15-20 cm (contact angle≤90°; WDPT≤1 s). In heated samples, SWR of 0-5, 5-10, and 10-15 cm layers decreased with increasing T_H, while the selection from 15-20 cm was non-repellent in all treatments. Soils of 0-5 cm depth showed extreme SWR (WDPT=≥3600 s) up to 200° C and became non-repellant at 250° C, while those of 5-10 cm showed extreme SWR up to 150° C, severe SWR (WDPT~1350 s) at 200° C, and became non-repellent at 250° C. The soils from 10-15 cm showed severe SWR (WDPT~2100 s) at T_H of 50° C and became non-repellent at 100° C. Results revealed that upper soil layers with higher SWR required higher T_H to become non-repellent, and soils from lower layers with lower SWR became non-repellent at lower T_H. Further experiments are necessary to identify the changes in molecular levels of organic matter in response to the impacts of heat on SWR.

Keywords: Cryptomeria japonica, Laboratory heating, Soil water repellency, Wildfires

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

142

(95)

Variation of Geochemical Properties of Soils in Tropical Lowland Rainforests in Sri Lanka

Bandara H.M.K.S.[1]*, Herath H.M.S.K.[1], Samarakoon S.M.T.N.[2], Chandrajith R.L.R.[2], De Costa W.A.J.M.[3]

[1]*Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka*
[2]*Department of Geology, University of Peradeniya, Peradeniya, Sri Lanka*
[3]*Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka*
*kasunbandarass95@gmail.com

Abstract

Tropical lowland rainforests (TLRFs) of Sri Lanka are considered as diverse ecosystems which play a vital role in climate change mitigation. In recent years, increasing deforestation leads to diminishing their potential ecosystem roles. For efficient forest conservation, knowledge of both above- and below-ground characteristics of TLRFs is required. Currently, above-ground information on TLRFs is sufficiently available but the details on the below-ground characteristics are limited. Therefore, this study was carried out to investigate pedo-geochemical properties of lowland rain forests of Kanneliya (KDN) and Pitadeniya, (PTD) in Sri Lanka. Four sampling plots with 1 ha in size (KDN1, KDN2, PTD1 and PTD2) were established, selecting altitudes of 117, 174, 509, and 618 m asl, respectively. Five representative near-surface (up to 25 cm) samples were collected from each plot for the investigation. Soil pH, electrical conductivity (EC), and cation exchange capacity (CEC) were measured while soil organic matter (SOM) content was determined by (i) Walkey-Black (WB) and (ii) Loss on ignition (LI) methods. Data were analysed by ANOVA and means were compared using Duncan's test. All measured parameters were significantly different ($P<0.05$) among the sampling plots. Soil pH and EC values were ranged between 3.43–3.78 and 0.28–0.44 dS m^{-1}, respectively. The highest CEC was recorded in PTD2 (11.09±3.44 cmol(+)/kg) whereas the lowest was in PTD1 (5.31±1.26 cmol(+)/kg). The highest SOM was recorded in PTD1 (17.71±4.42% in WB, 18.04±3.98% in LI) whereas the lowest was noted in PTD2 (5.81±3.07% in WB, 8.21±2.13% in LI). According to the comparison made between WB and LI methods, LI method recorded higher SOM content. The actual SOM and volatilizable water in hygroscopic mineral fractions might be the reason for the higher values in LI method. All acquired data were compared with standard interpretation data and accordingly, soils of the measured TLRFs are acidic, non-saline and non-reduced with sufficient soil aeration. Even though, TLRF vegetation produce high amount of biomass, soil CEC and SOM contents are low in the study area due to rapid microbial decomposition and absorption of dense vegetation. There was no linear relationship between measured parameters and altitude. Overall, measured soil chemical properties can be considered as ideal indicators of TLRFs conservation and therefore, it needs to be correlated with above-ground properties for understanding the behaviour of TLRFs responding to conservation strategies.

Keywords: Forest conservation, Soil chemical properties, Soil organic matter content, Tropical lowland rainforest

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

143

(116)

Identification of Deep and Shallow Groundwater Potential Zones using GIS Techniques; Case Study: Monaragala District, Sri Lanka

Wickramarathna R.L.[1]*, Illeperuma I.A.K.S.[1], Indrajith W.G.T.[2]

[1]*Department of Remote Sensing and GIS, Sabaragamuwa University, Belihuloya, Sri Lanka*
[2]*National Water Supply and Drainage Board, Ratmalana, Sri Lanka*
*rlwickramarathna823@gmail.com

Abstract

One of the most crucial steps in the management of groundwater sources sustainably is the delineation of the zones with potential for groundwater. However, in addition to taking a lot of time and money, groundwater investigations can be difficult and complex in many locations. To get sufficient results, it needed to demarcate shallow and deep groundwater potentiality separately. Sri Lankan districts have various problems due to a lack of water. With population growth and urbanization, surface water is insufficient to meet the water requirement. This study focused on groundwater potential mapping in Monaragala district covered with the total are 5708 km^2 in Sri Lanka. The fuzzy overlay and weighted overlay method integrated with GIS were mainly used to determine potential zones for deep and shallow groundwater. The final results from the two overlaying methods were compared to identify most accurate locations. Six parameters, namely aquifer type, soil depth, soil group, rainfall, proximity to surface water bodies, and slope, were evaluated for the shallow groundwater studies. Proximity to lineament, geology and shallow groundwater parameters were assessed for profound groundwater potentiality. The final output resulting maps were categorized into five main categories such as extremely low, low, moderate, high and extremely high by considering obtained potential values. The deep groundwater potential map demonstrates that the high groundwater potential areas are located around the lineaments, prominently areas having mountain ranges. Therefore the effect of the lineament is very high for deep groundwater availability. High shallow groundwater potential areas are located in smaller regions from Katharagama, Thanamalwila and Siyambalanduwa. Obtained results were validated using existing 220 tube well data and 100 dug well data.

Keywords: Fuzzy overlay, Geology, GIS, Groundwater, Weighted overlay

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

144

(121)

Potassium Ions Release from Mica by Organic Acids Present in Potassium Solubilizing Bacteria

Kaushalya R.M.M.T., Ratnatilleke A.A.L.*

Department of Chemistry, University of Kelaniya, Kelaniya, Sri Lanka
*ananda1@kln.ac.lk

Abstract

Plants require a variety of life-building ingredients to grow properly and optimally. Plants that lack essential nutrients are unable to reach their full potential, have lesser yields, and are more susceptible to diseases. The primary macronutrients are nitrogen (N), phosphorus (P), and potassium (K), which are the three most critical nutrients without which plants wouldn't survive. Fertilizers must be added to K-depleted soil to produce a feasible soil environment for plant growth. Chemical K fertilizers are costly and cause soil pollution. Bio-fertilizers gaining popularity because of their low harmful effects. In Sri Lanka, new ways of producing Bio K-fertilizer are convenient in the field of agriculture. Phlogopite mica is a natural mineral that contains K as a major component (7.22% of mass as K_2O) that can be used as the source of Bio-K fertilizer production. In this research, the solubilization of phlogopite mica (sample was obtained from Matale district, Sri Lanka) by major types of organic acids which are mainly released from bacteria was determined. In this study special attention was paid to the following main factors: Type of organic acids (Citric, Oxalic, Succinic and Tartaric acid), Acid concentrations (0.01 M, 0.02 M, 0.03 M, 0.04 M, and 0.05 M), Effect of ground mica particle sizes (0.300 mm-0.150 mm and <0.150 mm), the effect of time on solubilization in three shaking time intervals (1 hour, 2.5 hours, 4 hours) the indicated solubilization patterns and pH changes were observed. The current findings show that Citric acid is the most efficient K solubilizer because at 0.04 M, citric releases the 17.00 mg/L of K whereas the lowest value of released K 2.33 mg/L was observed for oxalic acid which is determined by Flame Photometer using 50.00 mg/L of standard K^+ solution. Therefore, Citric acid has a significant potential for the solubilization of K in mica. When particle size increases, the rate of solubilization appears to decrease with each acid. Also, when shaking time was increased the amount of soluble K released has been increased. Future studies of this research will be extended to find and isolation of citric acid-releasing bacteria for solubilizing mica to produce K Biofertilizer to improve soil fertility thereby increasing the crop yield in Sri Lanka.

Keywords: Phlogopite mica, Bioconversion, Bio-fertilizers, Chemical K-fertilizers

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

145

(126)

Release of Potassium Ions from Feldspar by Organic Acids Present in Potassium-Solubilizing Bacteria

Thashmantha M.A.D.S., Ratnatilleke A.A.L.*

Department of Chemistry, University of Kelaniya, Sri Lanka
*ananda1@kln.ac.lk

Abstract

Agricultural production and quality are determined by the nutrient levels in the soil. Permanent agricultural lands are usually nutrient deficient and it is compensated by fertilization. Recent studies have found that potassium-bearing chemical fertilizers caused some environmental issues and these fertilizers are expensive. Therefore, the development of a new method for supplying potassium to plants using ingredients found in Sri Lanka is important. In this respect, the bioconversion of feldspar using biotechnological processing to obtain potassium fertilizers is very promising. The overall objective of this study is to explore the release of potassium ions from feldspar (Microcline-$KAlSi_3O_8$) found in Sri Lanka by organic acids present in potassium-solubilizing bacteria to improve the efficiency of these minerals to use in more sustainable agricultural practices. In this research, the solubilization of feldspar with citric, oxalic, succinic, and tartaric acids (the main acids that are produced by potassium solubilizing bacteria) was studied, concerning the effect of acid type, the effect of each acid concentration, the effect of particle size of feldspar, the effect of incubation time, and the changes in pH over time. Ground feldspar (0.150–0.300 mm and 0.075–0.150 mm) was separately shaken with 0.01, 0.02, 0.03, 0.04 and 0.05 M of each organic acid for different periods (1, 2.5 and 4 hours) and the released potassium ion concentration was measured using a flame photometer and pH change was measured using a pH meter. The extent of solubilization of feldspar was shown to be influenced by the type of organic acid used. In comparison to inorganic acids (H_2SO_4), some organic acids were more successful in solubilizing feldspar. Both oxalic and tartaric acids showed a higher capability of releasing potassium from the feldspar than other acids by up to 9 folds. The solubilization was insignificant for the same acid when the acid concentration was changed. The solubility of feldspar in all acids increased as the particle size decreased. The solubilization of feldspar was increased practically in almost all acids as time increased. pH was increased in almost all acids when the reaction time was increased. These findings show that both oxalic and tartaric acids are the most successful acids in solubilizing feldspar. Finding bacteria that secrete these acids as their major byproducts and conditions that secrete these acids would be beneficial for agriculture and feldspar can be used to supply potassium to agricultural lands.

Keywords: Organic acids, Feldspar, Solubilization

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

146

(139)

Evaluation of the Quality of the Groundwater used for Domestic Purposes in the Anuradhapura District of the Dry Zone and the Efficacy of Laterite Soil-based Household Water Filters as Adsorbents

Dissanayake N.U.S.*, Jayawardana D.T., Buddhima A.V.P.S., Mapatuna M.H.L., Gunathilake B.M., Hisho R.

Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*sandalidissanayake@sci.sjp.ac.lk

Abstract

High concentrations of hardness, Ca, Mg, NO_3^-, PO_4^{3-}, F^- and, heavy metals in the groundwater being consumed in Sri Lanka's North Central province are becoming a serious health concern. The current study examined the groundwater quality in the Anuradhapura district as well as the effectiveness of groundwater purification by a laterite soil-based water purification device for Domestic Purposes. Chemical parameters (hardness, Ca, Mg, NO_3^-, PO_4^{3-}, F^-, Cr, Cd and Pb) were analyzed in randomly collected 35 number of well water samples during the dry season to assess the quality. The range of hardness was (21-1730) mg/l, with an average hardness of 471 mg/l. Anuradhapura had high levels of Ca and Mg, with average concentrations of 122 mg/l, ranges of (5-429 mg/l) and 40 mg/L (2-160 mg/l), respectively. Phosphate levels ranged from (0.02-0.83 mg/l), with an average of 0.08 mg/l. Whereas nitrate concentrations ranged from (0.05-6.5) mg/l with an average of 0.59 mg/l and, fluoride levels ranged from (1.8-4.0 mg/l), with 2.3 mg/l being the average. Heavy metal concentrations that were below the WHO and Sri Lankan Standard limits had no discernible effect. The laterite soil-based water purification cylinder removed the hardness, Ca, Mg, NO_3^-, PO_4^{3-} and, F^- by adsorption. It was removed the hardness at an average rate of 89.7%, Ca at 89.32%, Mg at 86.87%, P at 100%, NO_3^- at 92.6% and F^- at 81.6%. The outcomes showed that, well water in Anuradhapura region needs to be treated beforehand so it can be consumed. The laterite soil-based water filter performed well in terms of removing high hardness, Ca, Mg, P, NO_3^-, and F^-.

Keywords: Groundwater quality, Laterite, Adsorption, Removal efficiency

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

147

(145)

Comparative Study of Soil Nutrients in Selected Paddy Lands in Wet Zone Treated with Organic and Chemical Fertilizers

Pemathilaka A.U.S.*, Munasinghe M.L.A.M.S.

Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*upekshasewvandi@gmail.com

Abstract

In Sri Lanka, paddy consumes the most significant part of chemical fertilizers and accounts for approximately 50 percent of the widespread use of chemical fertilizers. With the immediate banning of inorganic fertilizers, there was a huge argument between the government and the farmers about organic farming. Since the soil fertility change takes a long time, the impact of long-term application of the same fertilizer should be assessed. Field experiments were conducted in six selected paddy fields in wet zone considering fertilizer type and rice variety. Total 30 samples from each site were collected and soil initial nitrogen (N), phosphorus (P) potassium (K), Organic C, and composition of used fertilizers were analyzed. Nutrient status compared using critical, optimum ranges, and general management practices are discussed. This study revealed that the total N level in all the sites varies near the critical level and is inadequate to produce expected yields. Soil organic C (3.8-6.7%) and N (0.06-0.2%) levels in organic sites were higher than the chemical sites (0.09-0.19N%, 1.4-2.1C%). Phosphorus level is below the critical level (0.9-8.4 mg/kg) in organic sites, and varies from medium to high (7.5-27.0 mg/kg) in chemical sites. The sites using chemical fertilizers showed excessive K (395-480 mg/kg), and organic sites were below the optimum range (82-92 mg/kg). According to the fertilizer analysis, organic fertilizers are rich in organic C (40-90 g/kg), while organic C is absent (0%) in chemical fertilizers. All the other nutrient amounts are very low (N:0.7-19.3 g/kg, P:0.06-0.8 g/kg, K:33.2-15.4 mg/kg) in organic fertilizers, and the composition is unstable. Chemical fertilizers have an exact composition of nutrients and can easily be applied at the particular growth stage of the plant which is beneficial. An external supply of essential soil nutrient through organic or chemical fertilizer sources is required to produce expected yields. Regular and continuous monitoring of soil quality, pre-nutrient assessment of organic fertilizers, site-specific fertilization, and proper agronomic practices are highly recommended. These results will be beneficial in selecting or manufacturing suitable fertilizer type/types for paddy cultivation, including bio-fertilizers.

Keywords: Organic fertilizers, Status of soil nutrients, Soil fertility, Rice varieties

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

148

(156)

Estimation of Water Yield and Soil Erosion in Samanalawewa Watershed in Sri Lanka using GIS-based InVEST Model

Premarathna W.D.U.*, Udayakumara E.P.N., Wanniarachchi D.N.S.

Department of Natural Resources, Sabaragamuwa University, Belihuloya, Sri Lanka
*ruthpala.premarathna428@gmail.com

Abstract

Ecosystem services (ES) are a group of tasks performed by the earth's ecosystems that are required to support life and offer benefits to humanity. Thus, this study explores two of the water-related ecosystem services, water yield, and soil retention that were distributed in the Samanalawewa Watershed (SW) and its eight sub-watersheds in Sri Lanka, over 20 years (2000-2020) with five-year time intervals. Soil and water conservation and water yield play an important role in ecosystem management. Hydrological balance is a crucial component of the hydrological ecosystem services. Assessing water yield and soil erosion are pivotal for watershed management. Thus, this study estimated and mapped the water yield and soil erosion, using the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST 3.9.2) Annual Water Yield (AWY) and Sediment Delivery Ratio (SDR) model respectively. According to the obtained results, in 2000, 2005, 2010, 2015 and 2020, the estimated mean annual water yield was 2.62×10^5, 2.6×10^5, 3.5×10^5, 3.58×10^5 and 2.75×10^5 m^3 $ha^{-1}year^{-1}$, respectively. Furthermore, the estimated mean annual soil erosion rates for the above-mentioned years were 53.2, 52.9, 69.7, 87.7 and 70.2 t ha^{-1} $year^{-1}$. The estimated soil loss values of the SW are 10 to 18 times greater than the soil erosion tolerance (5 t ha^{-1} $year^{-1}$) in Sri Lanka. The results show that the years 2015 and 2005 have the highest and the lowest water yield and total soil loss values, respectively. The upper part of the watershed has relatively moderate water yield and soil loss values than the lower part. These findings would be beneficial in developing watershed management strategies and in the implementation of suitable soil and water conservation techniques within the watershed.

Keywords: Ecosystem services, InVEST, Samanalawewa watershed, Soil erosion, Water yield

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

149

(175)

Impacts of Organic and Non-organic Paddy Farming Practices on Surface Water Quality in Selected Areas

Fernando N.D.S.M., Godakumbura P.I.*, Prashantha M.A.B., Cooray A.T.

Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*pahanig@sjp.ac.lk

Abstract

Paddy (*Oryza sativa* L.) cultivation plays major role in Sri Lanka. Mainly Organic and Non-organic paddy farming methods are conducted. Organic paddy farming method only used organic fertilizers and non-organic paddy farming method used chemical fertilizers which are Urea, Triple Super Phosphates. Therefore, farming practices can be affected to the surface water quality creating various health hazards. The study was conducted from November 2021 to February 2022 (Maha season) to assess the impact of organic and non-organic paddy farming practices on surface water quality in Wallewala, Homagama, and Kottawa paddy agricultural lands by analyzing pH, EC, TDS, DO, BOD, COD, total hardness, nitrate, nitrite, phosphate, sulfate, chloride, potassium, zinc, and chromium. Wallewala is newly created environment sensitive agricultural land in less human influence. Both organic and non-organic paddy lands are in that area. Kottawa paddy lands are cultivated only chemical fertilizers and the Homagama paddy lands are cultivated by organic fertilizers. Randomly, six and nine surface water samples were collected from paddy irrigated systems in Wallewala area represent to organic and non-organic paddy lands respectively. Randomly, five and six surface water samples were collected from paddy irrigated systems in Homagama Organic, and Kottawa non-organic paddy lands respectively. The water from both paddy systems, min pH (5.25±0.04), max EC (315±1.00 μScm^{-1}), min DO (6.13±0.06 mgL^{-1}), max BOD_5 (2.82±0.06 mgL^{-1}), max sulfate (205.76 ppm), max chloride (45.91 ppm), max K (5.63 ppm), and max Zn (0.12 ppm) were found, while the study revealed that all the water quality parameters were not exceeded the reported ambient water quality standards for inland waters in Sri Lanka for irrigation purposes. Further EC, TDS, COD, total hardness, sulfates, chloride, potassium, and zinc were greater in non-organic paddy lands in both Wallewala and Kottawa areas. According to the obtained data, there was no water pollution from the paddy cultivation in respective areas. But these results indicate that water quality parameters vary with the utilized fertilizers.

Keywords: Paddy cultivation, Water quality, Organic paddy farming, Non-organic

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

150

(177)

Impacts of Organic and Non-Organic Cultivation Practices on Soil Fertility Parameters of Selected Paddy Lands Based on the Duration of Cultivation in Wet and Intermediate Climate Zones of Sri Lanka

Hemachandra J.K.D.S.H., Godakumbura P.I.*, Prashantha M.A.B., Cooray A.T.

Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*pahanig@sjp.ac.lk

Abstract

Sri Lanka has been practicing the cultivation of rice as its main staple food in two major agricultural techniques; organic and non-organic. The major aim of the present study was to analyze and compare the time duration-based impacts of the above two agricultural practices on paddy soil fertility indicators as the preliminary step of a long-term research project. Organic and non-organic paddy fields that have been cultivated for 2 seasons in Thorapitiya in the Matale district were selected as short-term cultivated lands. Land cultivated for 10 years organically in Homagama and land with a non-organic cultivation history of 20 years in Kottawa was selected as long-term cultivated lands. A total number of 35 samples were collected including the control samples from adjacent uncultivated land during the first phase of the Maha season 2021/2022. The samples were dried, sieved and then analyzed in their physical and chemical properties; color, texture, particle size distribution, pH, electrical conductivity (EC), organic carbon content (OCC), total nitrogen content (TNC), available phosphorus content (APC), exchangeable potassium content (EPC), and exchangeable magnesium content (EMC). The soil samples from Thorapitiya had a reddish-brown nature while most of the samples from Kottawa and Homagama had a grayish-brown color. Higher clay percentages were found in the soil samples from long-term organically cultivated lands in Homagama. The uniformity coefficient (C_u) values for soils from study areas except Homagama lie in the range for well-graded soil while the coefficient of gradation (C_c) values of all three areas were not in the above range. Short-term cultivation using organic and non-organic fertilizers did not show a significant difference in soil texture, pH, EC, APC, EPC, and EMC values. Most of their cultivated lands had a lower pH (~5.5–6.0) than the corresponding control plots (~5.8–6.4). The TNC levels in non-organically cultivated lands were significantly higher than in organic lands. Practicing agricultural activities for a prolonged period has resulted in significant differences in soil texture, pH, EC, OCC, TNC and APC between organic and non-organic lands. Higher OCC and lower pH, EC and APC values have been obtained for long-term organically cultivated lands than their non-organic counterparts. The TNC, APC and EPC levels were higher in most of the long-term organic and non-organic lands than in their control samples. Several amendments have to be made to bring the fertility parameters to an optimum level in long-term cultivated lands.

Keywords: Soil fertility, Paddy soil, Cultivation history, Organic cultivation, Non-organic cultivation

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

151

(184)

Spatial Variability of Selected Soil Chemical Parameters in Low-yielding Paddy Production Block in Mahaweli System H, Sri Lanka

Attanayaka A.M.S.M.[1]*, Akther M.S.R.[2], Naveendrakumar G.[1]

[1]Department of Bio-Science, University of Vavuniya, Vavuniya, Sri Lanka
[2]Damsila Exports (Pvt.) Ltd., Colombo, Sri Lanka
* sachinimadhubhashini97@gmail.com

Abstract

Although water availability for paddy production in Mahaweli System H is abundant, paddy yield is lower in Nochchiyagama (278 km^2), chosen for soil assessment. Paddy yield data were used to identify the low-yielding division using the area-weighted average. Twenty-five random locations were generated, and soil samples were collected for pH, soil conductivity (EC), salinity, and total dissolved solids (TDS) analysis. ArcGIS software was used to create spatial distribution maps and related geostatistical analyses for each parameter. Vector files were created with their associated properties, and thematic maps were generated using spatial interpolation techniques, such as universal kriging (UK), ordinary kriging (OK), and inverse distance weighted (IDW) methods of interpolation techniques to identify the best interpolation method for soil chemical parameters mapping. The entire Nochchiyagama land was observed to have a slightly acidic pH (5.6-5.9) range that may have affected rice crop growth due to nutrient mobility and uptake issues. The spatial interpolation evaluation suggests that at least two-thirds of the area observed for lower TDS levels (591-654 mg/L) is potentially unsafe paddy production. Elevated levels of EC (3.1-7.24 dS/m) along with TDS may lead to physiological drought due to interferences in ion uptake. In overall, spatial interpolation evaluation indicators suggest that the UK method was observed with a lower mean relative error (MRE) than the other two interpolations. However, EC distribution showed low MRE in both IDW and OK interpolation techniques. The IDW method was observed to have a lower RMSE (Root mean square error). The UK spatial interpolation performed better for TDS and salinity predictions than other methods. This study found consistent regional differences in low paddy yields in Mahaweli system H using the UK method for analyzing soil chemical parameters.

Keywords: Electrical conductivity, Interpolation errors, Salinity, Spatial interpolation

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

152

(70)

A Study of Households' Perception towards Solar Panel Installation Case Study: Villagers of Techno-park nearby Faculty of Technology, University of Sri Jayewardenepura

Pathirathna M.P.P.Y.*, Kuruppu R.E., Perera A.M.H., Soysa W.A.E.

Department of Civil and Environmental Technology, University of Sri Jayewardenepura, Homagama, Sri Lanka
*egt19485@fot.sjp.ac.lk

Abstract

In Sri Lanka, energy demand has been exponentially increasing with the outage of non-renewable energy sources. There is significant solar intensity in most of the areas in Sri Lanka. This study focused on the domestic solar power system since domestic solar panel usage (700 MW) is the country's highest contributor to solar energy usage. A photovoltaic (PV) system can supply electric energy to loads by directly converting solar energy through the photovoltaic effect with a flexible structure. This study aimed to analyze households' perceptions of solar panel installation. The study was conducted within a 5 km radius around the Faculty of Technology, the University of Sri Jayewardenepura, to analyze the awareness of solar-related technologies. A systematically developed questionnaire was used for the survey to collect the peoples' awareness based on environmental, social & economic beliefs. Thirty residential places (30) were interviewed. According to the results, a residential house's average monthly electricity consumption is 137.67 kWh. The mean monthly income in the area is sixty-eight thousand one hundred and sixty-six rupees and sixty-seven cents. Moreover, most people had solar energy knowledge (93.33%). Among them, 53.57% of the majority were willing to install Domestic Solar PV systems for residential places. From the consumers, 76.66% of the majority had an average level of awareness of the Environmental benefits of using renewable energy and 70.00% of the majority had an excellent awareness of government intervention in rooftop solar energy projects such as "Soorya Bala Sangramaya". From the defined awareness levels, further analysis was done on the lowest level of Awareness of Solar Energy to identify their characteristics. The majority of them were those who had lower energy consumption, were over the age of 60 and had a monthly income below twenty thousand rupees. According to the consumers, the best strategy for promoting Solar PV Systems was to lower the prices of existing Solar PV systems. Regulating the efficiency of the Solar PV system was identified by the existing Solar PV system owners.

Keywords: Solar PV system, Techno-park, Photovoltaic panels

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

153

(158)

River Gem Mining, its Impacts and Mitigation: A Case from Kumbukkan Oya, Monaragala Divisional Secretariat Area

Premawansha O.G.K.R.*, Buddhika K.M.W., Priyankara T.L.A., Dissanayaka D.M.P.T.

Monaragala District Office, Central Environmental Authority, Sri Lanka
*kumesharashini@gmail.com

Abstract

Gem mining is one of the oldest industries and a major source of income in Sri Lanka. Both traditional and recent mechanical gem mining methods are currently being practiced. However excessive, uncontrolled and illegal gem mining activities have caused many adverse impacts. This study was carried out to analyze the environmental impacts of river gem mining and to propose suitable remedial and mitigatiory measures, with more emphasis on existing legal framework. Study was conducted along a 15 km stretch of Kumbukkan Oya in Monaragala Divisional Secretariat area, where both legal and illegal gem mining activities are taking place at a high intensity. Data were collected by spatial surveys, field surveys and interviews with mine-owners, government officials and general public. All observed mining sites were within the 60m area on both sides of riverbanks. More than 80.00% of the localities from 36 observed sites were unlicensed mines. Natural vegetation had been removed and banks were collapsed due to uncontrolled mining, destructing riverine and aquatic ecosystems. Deep pits were observed in riverbeds at 12 locations. Removed trees and debris were accumulated at the middle of the river, causing flow direction changes. Washing out of damaged banks and disturbances to the riverbed had increased river turbidity and siltation. High number of unlicensed mines, negligence of miners for license conditions, poor monitoring by relevant authorities, lack of cohesion in gem mining policies and laws and the lack of awareness have triggered these issues. Immediate cancellation of condition-violated mining licenses and initiation of legal actions against illegitimate mining activities are important in preventing unregulated mining activities. Systematic rehabilitation of damaged riverine vegetation and riverbanks shall be conducted. Issuance of mining licenses in compliance with the National Environmental (Prohibition of the use of equipment for exploration, mining and extraction of sand and gem) Regulations No.01 of 2006 in Gazette Extraordinary No.1454/4 dated 17.07.2006, demarcation of the "Reservation Limit" of the river mentioned in the said Gazette Notification and obtaining Environmental Recommendations from Central Environmental Authority prior to issuing the license are important to avoid conflicts between the provisions of National Environmental Act and National Gem and Jewellary Authority Act. Issuance of licenses only subject to an acceptable rehabilitation plan submitted by the mine owners, continuous monitoring by relevant authorities and raising awareness among all the stakeholders shall be implemented. More comprehensive studies can be carried out to find the ability of implementing modern environmentally friendly mining technologies.

Keywords: River gem mining, Impacts, Mitigation, Kumbukkan Oya

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

154

(193)

Connecting the Dots; Environmental Literacy Index in Measuring Knowledge for Environmental Conservation

Dissanayake, D.M.S.B.

Institute of Development Studies, Colombo, Sri Lanka
sbdasia@gmail.com

Abstract

Conservationist Aldo Leopold noted that acts of conservation without the requisite desires and skill are futile. Systematic environmental education plays a significant role in enhancing knowledge and competencies for environmental sustainability through a scientifically informed citizenry. The environmental education spiral consists of three key elements; environmental awareness, environmental conduct, and environmental literacy. While environmental conduct that emerged with awareness contributes to the reduction of environmental degradation, scholars argue that environmental literacy contributes to conservation. With the objective of developing an environmental literacy index, this research assessed environmental knowledge, personal conduct, and the extent of application of environmental knowledge. Key informant interviews were held to develop the index with 30 criteria, and a survey was held with 160 students in schools and universities, teachers, and development officers. Environmental literacy is seen as the individual's understanding and competencies that create rational and informed decisions and contributions to conserve natural systems and associated communities that create a sustainable and environmentally friendly quality of life. Environmental education can take place in many forms and is incorporated in the school education syllabus from grade one to eleven in general, and in the science stream. Among the school students, the majority (76%) were able to identify and understand age-appropriate environmental features and significance, however, had very low (13%) personal conduct for reducing pressure on the environment, while had moderate (38%) literacy levels. The average responses of the university students were 82%, 48% and 63%. Teachers, including non-science subjects teaching, had a similar status with the university students, indicating 84%, 54%, and 61%. The development officers showed slightly different patterns, representing 73%, 41% and 51%. Among all the respondents, only 13% identified agriculture practices may contribute to water pollution, 12% stated that the transport sector contributes to greenhouse gas emissions, and 9% believed that energy practices at home contribute to global warming. The study reveals that environmental understanding has not contributed much to personal behaviours to reduce the pressure on the environment, and environmental literacy has not been in a state of environmental activism.

Keywords: Environmental conservation, Environmental education, Environmental literacy

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

155

(210)

Faunal Diversity and Biodiversity Conservation within Homagama Mahinda Rajapaksha College, Sri Lanka

**Abegunawardhana P.D.*, Aththanayake R.K.P.S., Galhenage D.T.T.M.,
Dahanayaka K.S.S.S., Amarasinghe M.A.A., Nanediri D.G.S., Pathberiya I.N.**

Mahinda Rajapaksha College, Homagama, Sri Lanka
*pasindudilshanzoologysl@gmail.com

Abstract

A faunal diversity survey was carried out to analyze the faunal diversity in Homagama Mahinda Rajapaksha College in Colombo District, Sri Lanka. The survey site is located in a suburban area that is surrounded by disturbed properties. The aim of the survey was to analyze the faunal diversity and recognize the special habitat types in the school premises for conservation purposes. It could recognize five major zones which have different types of microhabitats and rich in faunal diversity. The survey was done as a visual encounter survey, and smartphones, digital cameras and binoculars were used to collect data of the fauna species for documenting and identifying purposes. Also, pitfalls traps, light traps and beating were used as survey methods. The study was done for three days including three random sampling events during both day and night. Standard guides were used for identifying and photographs, notes on observations were sent to experts on each taxon for further confirmation. A total of 188 fauna species were recorded during the survey including 55 species of vertebrates including five classes (Aves, Amphibia, Mammalia, Reptilia, Actinopterygii) and 133 species of invertebrates including six classes (Insecta, Gastropoda, Diplopoda, Clitellata, Chilopoda, Arachnida). The study could document 30 bird, 14 reptile, 6 mammals, 4 amphibian and 1 ray-finned fish species as vertebrates and 95 insect, 5 mollusks, 3 millipede, 2 clitellate, 2 centipede, 26 arachnid species as invertebrate fauna species in the school premises. Based on the results of the survey, the fauna diversity of the studied site is stable and depends on the microhabitat types in the different zones. As a suburban area, the species richness of the site is in well conditions. To keep stable and increase the fauna diversity of the site, doing regular surveys and recording data, generating microhabitats, and conserving highly diverse habitat types are suggested. Unique species like Indian Hare (*Lepus nigricollis*), Indian Crested Porcupine (*Hystrix indica*) were observed and as the only venomous snake species, Merrem's hump-nosed viper (*Hypnale hypnale*) was recorded. The faunal diversity of the studied site helps to keep the unique surroundings there and keeping frequent records and data on the site will help to maintain the biodiversity with constructions in and around the school premises.

Keywords: Faunal diversity, Suburban, Citizen Science, Conservation, Visual encounter

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

156

(5)

A Quality Review of EIA: A Comparative Study of State-Funded and International Aid Agency-funded Development Projects in Sri Lanka

Vinasithamby R.[1]*, Vimaladhas N.[2], Vimaladhas V.[3]

[1]*Ceylon Electricy Board, Lakvijaya Power Plant, Puttalam, Sri Lanka*
[2]*Vavuniya Muthaliyarkulam RCTMS, Vavuniya, Sri Lanka*
[3]*World Vision Lanka, Mannar, Sri Lanka*
*ravinas824@gmail.com

Abstract

A development project's environmental impact assessment (EIA) is a tool for mitigating the effects on the environment and promoting sustainable development. EIA is an expensive and professionally engaged process that involves the public. Many countries around the world have long-standing laws in place connected to this topic, as well as solid knowledge and experience. One persistent argument against the efficacy of EIA in developing nations is that the procedure and quality differ from country to country. The International Aid Agencies (IAA) have their guidelines for protecting the environment while following local environmental assessment standards for any financing requirements. IAA involvement in the EIA process might significantly affect how well-written EIA reports are. To evaluate the assessment quality, six EIA reports from state-financed development projects (SL-EIAs) and another six development projects EIAs funded by the IAA (IAA-EIAs) in Sri Lanka were randomly chosen. LeeCooley review package (1990) was used to evaluate the Environmental Impact Statements (EIS) of each EIA. In this investigation, it was discovered that IAA-EIAs and SL-EIAs had a significant difference in overall quality. IAA-EIAs show values that range from highly satisfactory to satisfactory and each share 50 percent, whereas SL-EIAs indicate 83 percent satisfactory and 17 percent of borderline quality. In comparison to the SL-EIAs, all four review areas of the IAA-EIAs performed notably well. While the SL-EIA shows good to borderline quality (0.66-0.72), all evaluated IAA-EIA reports reveal highly satisfactory to satisfactory (0.81-0.93) quality. The engagement of IAA in the environmental assessment has a considerable impact to improve assessment quality in comparison to the only domestic assessment. Finding the weak area in the SL-EIA process and adhering to the IAA standards would elevate the standard of the report.

Keywords: EIA quality, Review, International Aid Agency, Development projects

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

157

(15)

Phytochemical Analysis of Some Selected Indigenous Plants in Eastern Region of Sri Lanka used for Minimizing Insect Damage on Stored Grains during Storage

Karunakaran S.*, Niranjana R.F.

Department of Agricultural Biology, Eastern University, Palacholai, Sri Lanka
*selvikaruna23311@yahoo.com

Abstract

Grains are precious food in developing countries but are tragically susceptible to attack by several stored insects. Thus, grain productions often fall below demand. As the resistance of pests against synthetic chemical pesticides and residues in foods increased, consumers' awareness turned toward food and environmental safety. The studies conducted in Sri Lanka revealed that the botanical pesticides are being used to minimize these problems and have the potential to battle against pests on stored grains during storage. Further the reference in Sri Lanka evidenced that the botanical pesticides are readily available, inexpensive, easily biodegradable and low toxic to non-target organisms. With this concept the present study has been undertaken to analyze the secondary metabolites, known as phytochemicals that possess antioxidant or anti insecticidal properties, which are much safe, eco-friendly and can combat with the man-made chemicals in controlling the storage pests. The study was carried out to find the presence of phytochemicals namely, alkaloid, flavonoid, phenol, tannin, steroids, cardiac glycosides, terpenoid, saponine and reducing sugars in an aqueous extract of some selected indigenous plants, which are available in Eastern Region of Sri Lanka namely; *Capsicum annuum* (Chilli), *Citrus aurantiifolia* (Lime) *Piper nigrum* (Pepper), *Azadiracta indica* (Neem), *Moringa oleifera* (Moringa) *Eucalyptus globules* (Eucalyptus), *Justicia adhatoda* (Adhathodai) *Annona reticulate* (Annona), *Cymbopogan citratus* (Lemon grass) *Vitex trifolia* (Nochchi), *Ocimum tenuiflorium* (Thulsi), *Lantenna camera*(Nayunni), *Eichhornia crassipes* (Water hayasinth), *Tagetes erecta* (Marigold) *piper longum* (Thipilli) and *Achyranthes aspera* (Nayuruvi), that have pesticidal properties. The leaves of selected crops were dried at room temperature for a period of one week and grounded in to fine powder to take 10 g of powder from each to prepare 200 ml of water extract using electro thermal soxhlet for 36 hours and analyses qualitatively by the standard scientific procedures. The results showed that the water extract of Neem, Moringa and Thulsi contained all the above tested phytochemicals. The flavonoid was observed in all tested crops except Thipilil, which contained only phenol and tannin. Further Pepper, Eucalyptus, Lemon grass, Annona, and Chilli did not show alkaloids where Annona had only flavonoid, phenol and tannin. Nochchi showed all the phytochemicals except cardiac glycosides and terpenoid. The study confirmed the strength of tested crops in utilizing them in the pest management programme at storage because of the presence of one or more groups of the major insecticidal components like, alkaloids and flavonoids. The study also exposes the way for further studies related to the impact of individual plant insecticidal components against storage pests.

Keywords: Aalkaloids, Aqueous, Extract, Grains and phytochemical

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

158

(24)

Role of Street trees in Urban Landscape: A Resource Audit

Seenapatabendige K.B*, De Silva D.A.M.

Department of Architecture, General Sir John Kotelawala Defence University, Rathmalana, Sri Lanka
*kbseenapatabendige@gmail.com

Abstract

Street trees first considered as an ornamentation of the city landscape while brings unique identity to the city. Sri Lanka being a bio diversity hotspot large variety of trees and shrubs were available and used as part of urban landscape ornamentation. Choice of street trees based on agroclimatic zone, cultural identities, characteristics and multipurpose nature of the species. Main focus of study was to explore the role of street trees in ornamentation of cities and identify uniqueness brought to the city landscape, find out ecosystem services provided by the street trees and find out socially, culturally, economically and environmentally suitable trees species for cities located in different agroclimatic zones of Sri Lanka. Case study approach was instrumental for this study. Main data collection tools were field observations, in-depth interviews with city dwellers (45), visitors (35), officers of municipal council and urban development authority (10) and scientists (3) and policy makers (3) and maps of the cities considered for the study. Present study based on the street tree profile of 5 main cities (Colombo, Galle, Matara, Anuradhapura and Kandy), town (Bandarawela, Kaluthara, Hambantota, Rathnapura, Peradeniya and Batticaloa) and small town (Suriyawewa, Ambalongoda, Bandaragama, Mawenella, Aluthgama and Mirissa). Street trees of the main cities were ornamented by culturally imported tree species while street of the town areas was appeared with diverse mixture of trees. In Contrast economically importuned trees were common in small towns. Typology of street trees were developed using seven dimensions; social benefits, functional properties, resistant to urban environment, environmental constraints, cultural constraints and limitation constraints. 6 species were identified as the most suitable for street posadas among 15 species found in street trees. Street trees played multifunctional role in urban landscape other than its themed ornamentation role.

Keywords: Ecosystem services, Street, trees, Urban landscape

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

159

(35)

Mangrove Biodiversity Conservation and Aquaculture Practices in Sri Lanka: An Overview

Madumadhawa M.H.D.*, Manewa R.M.S.S., Palliyaguru O.G., Senaratna D.

Department of Animal Science, University of Ruhuna, Matara, Sri Lanka
*harshadilhan2@gmail.com

Abstract

The tropical island of Sri Lanka is endowed with a diverse and resourceful coastal area of 1,700 km coastline and 152,000 ha of highly productive 82 lagoons and 93,075ha of 45 estuary ecosystems. Around 33% of the population in coastal areas is engaged in fishing as the main income source, which contributes to around 1.10% of the national GDP. The objective of the review was to provide an overview of the present status of Sri Lankan coastal aquaculture, mangrove coverage, and conservation status. Mangroves are ecologically and economically important ecosystems providing the best nursery grounds for both blackish and marine species, covering only 0.24% of Sri Lanka's total land area. In addition, as the most carbon-rich forests in the tropics, mangroves provide a wide range of ecosystem services and biodiversity conservation. Currently, Sri Lankan mangroves are estimated to cover 160 km^2 and are distributed mainly in Jaffna, Kalpitiya, Batticaloa, Rekawa, and Trincomalee. Including endangered species such as *Sonneratia apetala*, *Ceriops decandra*, and *Lumnitzera littorea*, there are 21 true mangrove species, and 24 mangrove associate species can be found. However, mangrove ecosystems in Sri Lanka are progressively under threat due to coastal aquaculture practices, especially shrimp farming and development projects. Human settlements, overexploitation, and climatic variables such as coastal flooding, drought, rainfall, salinity changes, increased sea level, and sea surface temperature have significantly influenced coastal aquaculture and substantially damage the mangroves resulting in loss of mangrove biodiversity. Between 1980 and 2005, approximately 25% of mangrove habitats are estimated to have been destroyed. Recently, 1,000-1,200 hectares of mangroves have been established in 23 wetlands in Sri Lanka becoming leader of the mangrove conservation in Commonwealth countries. In conclusion, it is imperative to apply international standards for mangrove-based aquacultural practices, mangrove rehabilitation, and technical and management interventions.

Keywords: Biodiversity, Coastal aquaculture, Coastal ecosystems, Mangroves

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

160

(38)

Fungal Diversity in the Wounded Tissues of *Gyrinops walla* Trees and the Surrounding

Vidanage W.V.T.U.[1]*, Subasinghe S.M.C.U.P.[1], Manamgoda D.S.[2], Hettiarachchige R.P.[1]

[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*
*vidanagethamali96@gmail.com

Abstract

Gyrinops walla (Gaertn) of family Thymelaeaceae, is believed to be endemic to Sri Lanka and is mainly found in the lowland wet zone where the elevation is lower than 1,000 m and the annual rainfall is between 2,000 to 3,000 mm. This species is known for producing a valuable resin called agarwood in its trunk after being infected by pathogens, mainly fungi. Over 20 capable fungal species have been identified to stimulate agarwood formation in the trees of the agarwood-producing genus, *Aquilaria*. However, since such information is lacking for *G. walla*, this study aimed to determine the fungal taxa that induce agarwood formation in *G. walla* and to compare the fungal diversity between *G. walla* tissues, surrounding trees, and the soil. Samples were taken from four locations in the wet zone, Olugala, Morapitiya, Weragala, and Elpitiya, and one location in the intermediate zone, Kirimetimulla. Collected naturally wounded tissues from *G. walla* trees of those locations were surface sterilized before culturing. In addition, the stem samples were taken from the surrounding trees at 5 m radius from the sampled *G. walla* trees. Soil samples were collected at each location at 2.5 m distance along the north south directions of sampled *G. walla* trees which is from the sub-surface. A standard dilution series up to 1:10,000 was prepared for soil culturing. All the fungal colonies emerging from initial soil, stem cultures were isolated as pure cultures in separate PDA plates. Based on the colony morphology and growth parameters, all the pure cultures were categorized into 13 fungal isolates. Morphological and microscopic characteristics were used to identify the fungal isolates. Out of the 13, six isolates were identified as *Aspergillus* sp. (1, 2, 3), *Rhizopus* sp., *Trichoderma* sp., and *Mucor* sp. The unidentified isolates, due to the lack of reproductive structures, were named as morphotypes 5, 7, 8, 9, 11, 12 and 13. After identification, their presence and frequency of occurrence in different sample types i.e. resinous tissues and nonresinous tissues of *G. walla,* surrounding tree tissues and soil were evaluated in all five locations. For the comparison, diagrams were built. Thereby, predominant fungal isolates in each of the sample types were identified. Based on the occurrence of fungal isolates in each location, Olugala had the greatest fungal diversity, while Morapitiya had the lowest. Morphotype 07 was identified as the dominant isolate in resinous tissues of *G. walla* due to the presence of 15 isolates. *Rhizopus* sp. was also found as a common fungal isolate in the wounded tissues of all five locations. *Trichoderma* sp. was more abundant in the surrounding, while *Aspergillus* sp (1) was dominant in soil. Fungal isolates in resinous tissues were also present either in the non-resinous tissues of *G. walla*, surrounding tree tissues, or soil. Therefore, inocula are believed to enter the wounded tissues from nearby trees or from the soil, and spores from water, wind or carriers like insects.

Keywords: Gyrinops walla, Fungal isolates*,* Surrounding trees, Soil

---

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

161

(52)

Awareness on the Waste Management Practices and Causes for Increased Urban Waste Generation among the General Public in Western Province, Sri Lanka

Peiris P.C.*, Perera B.O.L., Jayathilake J.M.N.J.

School of Biomedical Sciences, International Institute of Health Sciences, Welisara, Sri Lanka
*pcpeiris99@gmail.com

Abstract

The upsurge in waste generation and improper management of waste possess serious issues to individuals' health and the environment. The administration of waste holds a crucial part in waste organization and proper waste management practices are essential to control the increase of urban waste and associated hazards. The present study aimed to assess the awareness on causes for increased urban waste and the practices of the general public on waste management. A descriptive cross-sectional study in Western Province, Sri Lanka was conducted among males and females within the age group of 20 to 60. 150 individuals were recruited using the quota sampling method and a self-administered questionnaire was distributed in English, Sinhala, and Tamil languages. Additionally, using SPSS software, the results were statistically analyzed. As per the data that was analyzed, 51.3% of the respondents were between the ages of 20 and 30. Most of the participants, 87.3% were aware of the increase in urban waste, and 88.6% stated the management of waste can hold a positive impact on suitable development. However, 40.6% have stated industrial waste as the major source associated with the surging urban waste indicating the unawareness of household waste as the primary source. Furthermore, though 84.6% divide inorganic and organic waste, according to 64% of participants, e-waste is not discarded using proper channels. Thus, there is an increased risk of health implications as e-waste chemical constituents could be hazardous to both human health and the environment. In the opinion of 89.3%, further training on waste management should be carried out while 52% of the respondents have declared not attaining any practices on waste management. Hence, an increase in the urban waste can be visible as the participants were inexperienced and unfamiliar with efficient waste disposal and management methods. The evidence that is currently available from this study suggests that there is a need to enhance community awareness, encourage training, and change people's attitudes regarding waste. A comprehensive infection control program combined with safe disposal of waste is recommended to achieve sustainable and economically viable waste management.

Keywords: Urban, Waste management, e-waste, Training

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

162

(56)

Awareness of the General Public within the District of Gampaha, Regarding the Biomedical Waste Disposed by Clinical Laboratories and its Consequences

Perera B.O.L.*, Peiris P.C., Jayathilake J.M.N.J.

School of Biomedical Sciences, International Institute of Health Sciences, Welisara, Sri Lanka
*oshanthiperera602@gmail.com

Abstract

The Waste management is a primary concern in a clinical laboratory for overall laboratory safety as biomedical wastes generated in medical laboratories are hazardous for humans and the environment. This study aimed to assess the awareness regarding biomedical waste and its consequences among the public in the Gampaha district and to observe the correlation between the level of education with this extent. 150 people between the ages of 18 and 55 years were considered for inclusion criteria, while current, retired, and minor healthcare workers were excluded. The convenience sampling method was used when selecting the target population, and data was collected through online surveys (google forms) with close-ended questionnaires. The age groups have been divided into four major categories: (18-25), (25-35), (35-45) and (45-55). SPSS software was used to analyze and evaluate the results. The results showed that people aged 18-25 years and 45-55 years have a low awareness of biomedical waste and its consequences, whereas people aged 25-35 years have good awareness. Individuals between the ages of 35 and 45 had the highest level of awareness. The responses obtained revealed that the highest level of awareness regarding the biomedical wastes disposed of by clinical laboratories and its consequences was given by 90% of the 35-45 age group, 60% of the 25-35 age group, 58% of the 45-55 age group, and 52% of the 18-25 age group. Except for a few exceptions, many participants in the 35-45 age groups were educated as most of them had completed their studies at least up to advanced level. Having a doctorate was the highest education level observed in the sample. According to the findings, the analyzed P value was 0.026, with a correlation coefficient of 0.6631 indicating that the results are statistically significant. Therefore, it can be concluded that there is a clear correlation between the levels of education and age regarding the awareness of biomedical waste. Therefore, strengthening the waste management systems and educating the public regarding biomedical waste would be recommended.

Keywords: Biomedical wastes, Awareness, Level of Education, General Public, Gampaha District

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

163

(68)

Effectiveness of an Awareness Program on Lunch Sheets Pollution: A Case study at Faculty of Applied Sciences, University of Sri Jayewardenepura

Gunathilake T.M.S.U., Tharindu G.A.N.*, Udayangi J.I., Weerasena O.V.D.C.J., Wanigasinghe S.P.A., Thennakoon H.G., Senarath M.V.R.P.D., Thilakarathne K.A.V., Bandara A.B.A.L., Seneviratne W.S.M.S., Sandaruwan G.L.H.

Department of Polymer Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*nadeeshtharindu001@gmail.com

Abstract

The research was based on irregular disposal practices among the FAS students and giving knowledge about alternatives instead of non-degradable lunch sheets. Among all years of students, including from 1st year to 4th year, 62 students were randomly selected from different combinations and data was collected by sharing a Google form. The collected data was based on the type of lunch sheets used (biodegradable/non-biodegradable); the way of discarding the used lunch sheets; knowledge of the decomposition period of non-biodegradable lunch sheets; awareness of alternatives and lunch sheets ban in Sri Lanka; knowledge of environmental and health impact; and their interest in biodegradable lunch sheets. A poster was shared with information on the environmental and health impacts of non-degradable lunch sheets and the alternatives that can be used to reduce the usage of lunch sheets. After the awareness program, the resurvey was conducted by sharing the Google form among the 62 students who had joined the survey to identify how their behavior had changed. Among 62 students, 93.2% of students used separate bins as a disposal method early and after the awareness program, it was upgraded to 96.7%. At the same time, 11.9% of students disposed of their lunch packaging by burning it, and it was reduced to 3.3%. Before the awareness program, only 27.1% of students knew the decomposing period (10-20 years). After the awareness program, 95% of students selected the correct answer. In the beginning, only 52.5% of students knew about the ban on non-degradable lunch sheets in Sri Lanka. According to the results of resurvey, their awareness about banning lunch sheets increased to 95%. In addition, the students were more knowledgeable than before about the impacts of lunch sheets on the environment and animals after the awareness program. As a result of the resurvey, the awareness of reusable food packaging has improved by up to 98.3%. Furthermore, results showed that 91.7% of students preferred to buy biodegradable packaging materials that are five times more expensive than currently used non-degradable lunch sheets. However, reducing the production cost of biodegradable packaging materials requires further research and investigations. In conclusion, after this study, students were made aware of lunch sheet pollution, environmental impact, and alternatives for lunch sheets. Further investigation into this research will be carried out based on other faculties belonging to the University of Sri Jayewardenepura.

Keywords: Lunch sheet, Pollution, Non-degradable, Environmental effects

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

164

(71)

Analysis of Wastewater Quality after the Reopening of the Faculty of Technology, University of Sri Jayewardenepura

Gunathilake H.M.A.V.*, Perera W.P.S.N., Malkanthi W.P.M.

Department of Civil and Environmental Technology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*egt19446@fot.sjp.ac.lk

Abstract

Wastewater is a complex matrix consists of varied pollutants namely particulate matter, microorganisms, dissolved solids, biogeochemical species at significant concentrations. Wastewater treatment brings down the concentration of pollutants to permissible levels. The Technology faculty has approximately 1,600 students and approximately 110 academic and non-academic staff members. We have observed that wastewater from the washroom systems, canteens and water used for cleaning activities are directed to the wastewater treatment plant. The study was conducted to determine the quality of generated and treated wastewater when the faculty functions in full capacity. Upon the treatment of wastewater, these are pumped for the garden water supply of the faculty. In this research, parameters like water pH, temperature, turbidity, dissolved oxygen (DO), chemical oxygen demand (COD), conductivity, total suspended solids (TSS) and temporary hardness of water were analyzed for both influent and effluent. The treatment efficiencies COD, DO, TSS and turbidity were recorded 53%, 41%, 96% and 93% respectively after the wastewater is passed through equalization anaerobic tanks, aeration tank, clarifier, chlorination tank, sand filter and carbon filters. The occurrence of an efficient treatment of wastewater can be concluded and it is recommended to be used for general water usage at the faculty gardening activities.

Keywords: COD, Dissolved Oxygen, Wastewater treatment

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

165

(76)

Relationship of Physico-chemical Properties of Water with Phytoplankton Abundance in Peraru Village Tank in Vavuniya District

Samarawickrama R.A.D.[1]*, Nanthakumaran A.[1], Sivakumar P.[2]

[1]*Department of Bio-Science, University of Vavuniya, Vavuniya, Sri Lanka*
[2]*Department of Zoology, University of Jaffna, Jaffna, Sri Lanka*
*rashmikadis1995@gmail.com

Abstract

The village tank cascade system, predominantly found in the Vavuniya district, satisfies the water demand for agriculture and domestic needs considerably. Among them, the Peraru village tank lies in a cascade line in the Vavuniya district. The water resource of Peraru village reservoir is treated by the National Water Supply and Drainage Board, Vavuniya, and distributed to the local public. As Peraru a drinking water fountain, the study of phytoplankton and water quality is important. The study's objective was to identify the phytoplankton and estimate the abundance of phytoplankton in the Peraru village tank along with the Physico-chemical characteristics of water. A phytoplankton sampling was done by using plankton net at the selected three locations of Peraru village reservoir weekly from March to April 2021. Totally, 24 samples were analyzed during the study period. Simultaneously, water samples were also collected at each site to determine dissolved oxygen, electrical conductivity, pH, turbidity, temperature, nitrate, and phosphate concentrations. Identification of phytoplankton was made based on standard guides, and the abundances of phytoplankton were estimated using Sedgewick- rafter counting cells. The results of Physico-chemical parameters were statistically tested using ANOVA and found correlations between the abundance of phytoplankton and Physico-chemical parameters. Phylum Bacillariophyta and genus *Aulacoseira* were the dominant phylum and genus in the Peraru village tank. Dissolved Oxygen (DO), Electrical Conductivity (EC), nitrate, and phosphate positively influenced the abundance of phytoplankton in the Peraru village tank, while turbidity negatively affected the same.

Keywords: Phytoplankton abundance, Correlation, Physico-chemical parameters

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

166

(85)

Temporal Variation of Water Quality in Nilwala River, Southern Province, Sri Lanka

Diwyanjalee G.R.[1]*, Premaratne W.A.P.J.[2]

[1]*Faculty of Graduate Studies, University of Kelaniya, Kelaniya, Sri Lanka*
[2]*Department of Chemistry, University of Kelaniya, Kelaniya, Sri Lanka*
*rashmitha.diwya@gmail.com

Abstract

This study intended to investigate the temporal variation of water quality of the Nilwala river in the Matara district and to determine how the changes in rainfall affect to river water quality. Water samples were collected monthly from March 2019 to October 2019 (considering the second Inter monsoon season and first inter-monsoon season) at eight locations along the main river. Water quality parameters such as chemical oxygen demand (COD), biological oxygen demand (BOD), pH, electrical conductivity, temperature, alkalinity, hardness, chloride, nitrate and phosphate were analyzed using APHA 23rd edition of standard methods for the examination of water and wastewater. Experimental results were statistically analyzed by Two-way ANOVA using Minitab 17. The pH, EC, temperature, alkalinity and nitrate concentration showed statistically significant differences among the months ($p<0.001$) and those showed statistically significant differences with monthly rainfall ($p< 0.001$). There is a statistically significant relationship between rainfall and month ($p<0.001$). There is a statistically significant relationship between rainfall and sampling location ($p<0.001$). The highest rainfall was recorded from august to November (2nd inter-monsoon season) and secondly from March to May (1st inter-monsoon season) was recorded. Conductivity, pH and temperature were decreased from March to June. This may due to 1st inter monsoon rainfall. Conductivity was increased during august-november. Flooding can increase conductivity when it washes salts and minerals from the soil into the water. Nitrate concentration in the majority of the locations was increased during march-may. Total alkalinity, pH and nitrate were increased from august to November. The temperature of river water at all locations decreased from august-November. In conclusion, the pH, EC, temperature, alkalinity and nitrate concentration showed statistically significant differences among each month. It may due to variation of rainfall. Upper part of Nilwala River had a higher rainfall than lower basin.

Keywords: Conductivity, Nilwala River, pH, temporal variation, Water quality

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

167

(101)

A Review on Pharmacological Activities of *Eclipta alba* (Keekirindiya-Bhringarāja)

Munasinghe G.M.A.L.P.*, Madushani G.W.H., Molligoda S.P.

Department of Basic Principles, Institute of Indigenous Medicine, University of Colombo, Colombo 03, Sri Lanka
*pamodi.munasinghe@gmail.com

Abstract

This review article contributes to clarifying the pharmacological properties of *Eclipta alba* (Bhringarāja) which is traditionally used in medicaments in so many countries such as Sri Lanka, India, China, Brazil, Thailand, Indonesia, Philippines, Nepal, Malaysia, Myanmar, Japan, Korea, Hong Kong, Pakistan, etc. Pharmaceutical products containing *Eclipta alba* have been used for different kinds of diseases and Bhringarāja had been mentioned in different types of prescriptions; especially in Samhitha Grantha. The main objective of this literature review is a discussion about pharmacological activities of *Eclipta alba* (Bhringarāja) and to provide an integrated, synthesized overview of the current state of knowledge on Eclipta alba (Bhringarāja) with Ayurvedic and traditional medical knowledge. The systemic literature review was carried out to gather authentic information on *Eclipta alba* (Bhringarāja). Relevant data for this study were gathered from Ayurveda textbooks, research papers, peer-reviewed indexed scientific journals, and authentic websites. *Eclipta alba* (Bhringarāja) is a small branched perennial herb, found in sandy and clay soils (waterlogged areas). Research article shows that *Eclipta alba* (Bhringarāja) has numerous medicinal properties such as Hepatoprotective, Hair growthpromoting, Antidiabetic, Analgesic, Anti-Inflammatory, Neuropharmacological, Antioxidant, Antimicrobial, Cardiovascular, Immunomodulatory, Anti-epilepsy, Anti-venom, Anticancer, Antiulcer, Anthelmintic and Anti-hyperlipedic properties. The reason for these properties is stated to be its major chemical compounds such as wedelolactone, dimethyl wedeloctone, ecliptal, etc. I found through this research that most of the therapeutic actions such as Śōthara, Vedanāsthāpana, Vraṇaśodhana, Vraṇarōpaṇa, Savarṇakaraṇa, Chakshushya, Keśavardhana, Keśaranjana, etc. have been mentioned in Samhitha Grantha and Ayurveda pharmacopeia. Those actions have been confirmed by modern laboratory tests, clinical trials, and animal trials.

Keywords: *Eclipta alba*, Bhringarāja, Ayurveda, Pharmacological activities.

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

168

(109)

Application of Participatory Concept in Minimizing Food Packaging Waste (FPW) in Manufacturing Firms

Senevirathne B.S.*, Jayasinghe M.A.

Department of Food Science and Technology, University of Sri Jayewardenepura,
Nugegoda, Sri Lanka
*sithijaneeandr@gmail.com

Abstract

All the industrialized countries lately focus on the need for the best solutions for the reduction of food waste at the various stages of the supply chain by conducting the participatory concept. It is a solution and stakeholder-oriented concept providing information on how to analyze the status quo identification of organization-specific problems and with the involvement of relevant stakeholders, develop solutions in the processes along the food value chain. The objective of this study is to present a participatory (five-phase) concept to diminish FPW in manufacturing firms. This concept is adapted to the continuous improvement (PDCA cycle) applied in Total Quality Management (TQM), which involves a participatory approach where workers and stakeholders are collaborated to detect causes for inefficiency and advance measures to counteract FPW in the Healthy Food Drink powder Manufacturing firm. The research was conducted by analyzing the data related to FPW such as Aluminum Wrappers (AlWs), Bag in Boxes (BIBs), and Plastic Bottles (PBs) using Microsoft Excel and Power BI software. Also, it paid attention to related operational and supporting processes within the organization and the behavior of the staff to get an impression of the working atmosphere and attitudes of staff. The analysis was done as a comparison with the collected FPW data for 2 months before and after developing, and implementing upgraded, targeted management practices. This analysis provided the basis for the developmental framework with the focus of increasing the effectiveness of FPW management practices by assessing the structure and selecting the best waste management methodologies for FPW. According to the analyzed data, the total wastage of AlWs, BIBs, and PBs showed 5.81%, 1.82% and 1.96% respectively. With the participatory concept, the organizational weaknesses which caused the occurrence of FPW were identified, and developmental measures were implemented to obtain significant reductions of waste of Alws, BIBs, and PBs up to 2.06%, 0% and 0.43% consequently. Counteractive measures, such as join in workforces into the developing and implementing waste reduction measures, workforce training, scheduled preventive maintenance on machines, utilization of removable ink-to-print date codes, efficient demand planning and accurate demand forecasting, enhance workforce motivation and commitment, establishing trust among all employees and proper communication flows within departments which influencing the occurrence of FPW have been proposed to avoid losses. It affirms that the participatory concept either contributes to reducing FPW or enhancing resource efficiency in the food industry, as this would enable companies to benefit economically.

Keywords: Food packaging waste, Participatory concept, Continuous improvement, Integration, Resource efficiency

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

169

(129)

Ethno Botanical Survey of Medicinal Plants at Ayurveda Base Hospital North Matale, Sri Lanka-2021

Jesintha J.*, Prasanya .M.

Department of Ayurveda, Central Province, Sri Lanka
*jesi.jebamal30@gmail.com

Abstract

Indigenous medicinal systems contribute to the preservation of the health of nations by using the resources of medicinal plants and numerous medicinal plants have many therapeutic effects and cure diseases. The study aimed to explore the therapeutic potentials of medicinal plants identified and documented indigenous uses of medicinal plants at T.B.Tennakoon Memorial Ayurveda Base Hospital and Study Center, North Matale, Sri Lanka. The study was followed over six months from March 2021 to September. Authorization was granted by the MOIC hospital and during this period the therapeutic effects of medicinal plants were classified among the plants studied. An investigation conducted through direct observation in the field, discussion, and via quessionaire. Collected plant samples and images of plants, herbarium leaves, and botanical plaques, were identified by healers in hospitals and old mounds in the region, and information gathered on medicinal plants was recorded and documented. A total of 130 medicinal plants belonging to 47 families have been identified in the region. Microsoft Excel 2013 version 15.04 was used for data analysis. The most common medicinal plant families are Fabaceae (19%), other more identified medicinal plants are Euphorbiaceae (15%), Rutaceae (10%), and Santalaceae (1%). Some rare medicinal plants have also been reported. According to this study, this area contains rich green floristic diversity, and the plants have grown well in the regional climatic conditions and the natives have used the plants for multiple purposes. Therefore, these medicinal plants are used for various diseases such as Loco-motor disorders, urinary disorders, circulatory disorders, respiratory disorders, nervous disorders, gastrointestinal disorders, skin disorders, gynecological disorders, hormonal disorders, and poisonous bites. These plants, which are used in various diseases and have different therapeutic potentials, are freely harvested in this hospitable region and some plants are also abundant. The conservation of these plant species is essential to improve traditional health practices within the hospital. However, plant breeding and conservation education are used in primary health care, conservation of their diversity, as well as clinical practice, and scientific research.

Keywords: Disease, Diversity, Medicinal plant, North Matale, Therapeutic potential

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

170

(132)

Is the Forest Fire adjacent to St. Clair's Waterfall Natural or Man-made?

Wijerathna L.P.S.D.N.[1]*, Meegahakotuwa U.S.[2]

[1]Faculty of Arts, University of Peradeniya, Peradeniya, Sri Lanka
[2]Jinaraja Girl's College, Gampola Education Zone, Central Province, Sri Lanka
*wijerathnaw1972@gmail.com

Abstract

Forest fires have been showing an increasing trend in Sri Lanka over the past few years. Previous studies proved that most of the forest fires in Sri Lanka were caused by human factors. The main objective of this study is to identify the causes of forest fires in close areas of St. Clair's fall, which is situated on the western slope of the Central Highlands and to investigate the impacts and measures to reduce forest fires. Primary data as well as secondary data were used for this study. Primary data was obtained through a questionnaire survey and focused group interviews from the study area of Hollyrood, Wattegoda, and Dewon GN Division. Twenty (20) households have been interviewed from the random sampling. Focused group interviews were held with the Nuwara Eliya Forest Conservation Department, Tea Estate companies and Thalawakele Police Station. Rainfall and temperature data were taken as secondary data for the period from 2010 to 2020 from the Department of Meteorology, Colombo. 83 respondents stated that forest fires occurs from January to April because of the high temperature and low rainfall recorded in these months. Patana grasslands are spared on the lower slopes of the left and right banks of waterfall area and plantation forest and Tea plantation have spread in the higher part of the slope. According to the Forest Department, the understory of *Patana grassland* and undergrowth for forest plantations are exposures to fire in this area. 96 respondents stated that forest fires are purposely started by the people to catch fish from the Kothmale Oya, build bonfire on the rock, and burn fish. Fires are generated through those flames. 63 stated that forest fires are done for "jungle based feedings" for cattle herds by the people in the Thalawakele plantation settlement. They expect fresh grass to boom in the rainy seasons by setting fires in the dry season. 22 respondents stated that forest fires are purposely done for hunting purposes. Most of the fires occur on the left bank of the Kothmale Oya River. In order to prevent fires in this area, the fire breaks fire belt and such as corridors without and with floras are established as buffer zones on the right bank. This fire belt is maintain by Thalawakele Plantation Company. When a forest fire occurs, the Forest Department sends the SMS message to alert the community. Planting *hana* trees as a green belt can be recommended to reduce the occurrence of fires in this area.

Keywords: Central Highlands, Random sampling, Bonfire, Hana trees

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

171

(151)

Pollen Morphological Studies on Selected Species of Family Dilleniaceae in Sri Lanka

Abeyrathne U.K.G., Munasinghe M.L.A.M.S.*

Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*mayuri@sci.sjp.ac.lk

Abstract

Dilleniaceae is an angiosperm family including 11 genera and about 500 known species with a pantropical distribution extending into Australia. In Sri Lanka, four genera and 16 species including one introduced species have been reported in the family Dilleniaceae. Most of these species are endemic or native, while *Schumacheria* is an endemic genus. Morphological characters of the pollen grains are a significant taxonomic identification tool in the systematics of higher plants. The aim of the study is to provide detailed palynological descriptions of selected pollen species and maintain pollen reference collection. Four plant species, *Dillenia retusa, Dillenia suffruticosa, Dillenia triquetra,* and *Schumacheria castaneifolia* of the family Dilleniaceae (Genus *Dillenia* and *Schumacheria*) were collected from different localities in the wet zone including Nugegoda and Baduraliya during the period from September 2022 to November 2022. The voucher specimens were authenticated using revised handbook to the flora of Ceylon and deposited in the Herbarium of the Department of Botany, University of Sri Jayewardenepura, Sri Lanka. Fresh flowers or dried flowers were taken to collect pollen. Pollen grains were acetolysed and observed under Optika microscope (BG-Italy) after mounting on a clean glass slide using glycerin jelly with Basic fuchsin. Thirty pollen grains were used to determine the pollen size for each selected species. All measurements were taken within seven days of pollen preparation using OptikalSview (3.9.0.604) software. The shape, size, and surface features of pollen grains, as well as the length and width of the pollen and apertures and Polar/Equatorial ratios, were observed. Descriptive statistical analysis was performed using Minitab 18 software for the quantitative variables related to measurements of pollen obtained with light microscope. The ranges of variation were 15-22 μm for polar axis, 16-26 μm for equatorial axis, 0.8-3.5 μm for colpus width and 5.0-12.5 μm for colpus length. The pollen grains of all the species are monad, isopolar, and radially symmetrical. Pollen grains were identified as suboblate to oblate spheroidal, small or medium-sized, tricolpate (*Dillenia spp.*) or tetra-colpate (*Schumacheria castaneifolia*), with the surface ornamentation punctate to reticulate. The longest and widest pollen grains were reported in *Dillenia suffruticosa* (22.0×26.4 μm), while the smallest were observed in *Schumacheria castaneifolia* (15.2×16.4 μm). Based on the length of the longest spore axis, except *D. suffruticosa* all other species are categorized into small-size pollen. According to the results, the distinction between species can be determined using palynological features such as shape, size, and aperture type.

Keywords: Pollen morphology, Dilleniaceae, Palynology, Reference collection

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

172

(164)

Forest and Natural Vegetation Cover Loss Over 2000 to 2020 in Sri Lanka; A Canopy Density Base Analysis

Kaushalya G. N.

Postgraduate Institute of Humanities and Social Sciences, University of Peradeniya, Peradeniya, Sri Lanka
gnnipuni011@gmail.com

Abstract

As one of the most important biodiversity hotspot, forest and natural vegetation areas play an essential role in the global ecosystem. It provides an uncountable number of ecosystem services while controlling the adverse impacts of climatic changes. With the expansion of civilization and fulfilling the infinite needs of man, forests and natural vegetation areas were destroyed, especially for agricultural purposes, development projects and timber. Due to this, the accelerated growth of deforestation and loss of natural vegetation can be observed in Sri Lanka in the past few decades. This study aimed to identify the forest and natural vegetation area loss from 2000 to 2020 with a particular focus on the Canopy Density (CD) of tree cover (>25%, >50% and >75%) in Sri Lanka. The satellite estimated data (30 mx30 m resolution) was downloaded from the 2000 to 2020 time period from the Global Forest Watch (GFW) online platform conducted by the World Resource Institute were used. Spatial and temporal changing patterns of the forest and natural vegetation areas have been identified using descriptive analysis methods (percentage) using MS Excel 2019 software. Results of the study found that in 2000, 61.38 percent of the country was covered with above 25% tree cover CD, while 53.86 percent and 39.76 percent of areas have covered with the tree cover CD above 50% and 75%, respectively. However, when it has come to 2020, these areas have decreased by 52.78 percent (>25% CD), 44.27 percent (>50% CD) and 28.65 percent (>75% CD). During this period, 8.6 percent (>25% CD), 9.59 percent (>50% CD) and 11.11 percent (>75% CD) of the forest and natural vegetation areas of Sri Lanka have lost the country. Throughout this period, 2016 can be identified as a year at risk for deforestation due to its annual deforestation rate (>8.8 percent). The total area of forest cover lost in 2016 is 17799 ha (>25% CD), 15583 ha (>50% CD) and 9865 ha (>75% CD). This is nearly 13 percent of forest cover loss for all three types of CD tree cover areas. According to the calculations of the forest areas that have >75% of CD, Anuradhapura (12.06%), Kurunegala (9.82%), and Monaragala (8.49%) districts are the areas that contributed to forest cover loss in the country during 2000 to 2020. According to the study, the annual deforestation rate is still very high. Hence should be needed to monitor and take action to stop deforestation and achieve sustainability in natural resource management in Sri Lanka.

Keywords: Deforestation, Canopy density, Tree cover, Natural resource management, Sri Lanka

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

173

(171)

Effect of Expired Yoghurt Powder as a Soil Amendment on Growth, Yield and Chlorophyll Content of Radish (*Raphanus sativus* L.)

Thushari K.L.N.A., Amarasinghe S.R., Narayana N.M.N.K.*

Faculty of Agriculture, University of Ruhuna, Matara, Sri Lanka
*nayana@ansci.ruh.ac.lk

Abstract

The disposal of expired dairy products that are rich in organic carbon and nitrogen is one of the major challenges faced by the dairy industry and causes significant economic, environmental and health issues. Recycling of expired dairy products including yoghurt is an ideal solution to protect the environment and to utilize them in a sustainable manner. Therefore, the present study was carried out to find out the performance of organic soil amendment prepared from expired yoghurt powder (EYP) on growth, yield and chlorophyll content of Radish (*Raphanus sativus* L.). A pot experiment was set up according to Completely Randomized Design with four treatments {soil without fertilizer (T1), soil with 1% EYP+157 mg K_2O/pot (T2), soil with 2% EYP+157 mg K_2O/pot (T3), soil with inorganic fertilizer (T4)} with five replicates. In T4 treatment, a mixture of inorganic fertilizers as a basal dressing (before seed sowing) and top dressing (after 3 weeks) was applied at a rate of 177 mg N, 346 mg P_2O_5 and 157 mg K_2O/pot and 177 mg N, 157 mg K_2O/pot, respectively according to the Department of Agriculture (DOA) recommendation. The root diameter (cm), root volume (cm^3), root length (cm), total leaf area (cm^2), number of leaves, shoot fresh weight (g), root fresh weight (g) and chlorophyll content (relative green index) were measured. Data were analyzed using Minitab (version 17) and SAS (version 9.1.3) software packages. One way ANOVA was conducted to examine the differences between treatments followed by mean separation using Duncan's multiple range test. Root diameter, root length, root volume, root fresh weight (48.6±0.88 g and 32.30±1.83 g in T4 and T2, respectively) were significantly higher (p<0.05) in inorganic fertilizer (T4) and 1% EYP (T2) treatments than other treatments. The leaf area and chlorophyll content were significantly higher (p<0.05) in all the treatments compared to soil without fertilizer treatment (T1). The highest fresh shoot weight (77.4±9.37 g) was obtained in inorganic fertilizer (T4) treatment showing significant difference (p<0.05) than 2% EYP (T3) and soil without fertilizer (T1) treatments. According to the results, 1% EYP (T2) treatment showed similar growth and yield performance with inorganic fertilizer (T4) and is recommended as a soil amendment for radish. However, the fungal attacks and pest attraction to EYP limit its application as a soil amendment and further studies are suggested to overcome the limitations.

Keywords: Expired yoghurt powder, Growth and yield parameters, Organic soil amendment, *Raphanus sativus* L.

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

174

(172)

Water Table Estimation in Attaragoda GN Division in Galle, Sri Lanka

Prabhashvi W.A.A., Senanayake S.A.M.A.I.K.*

Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
*indunil@sci.sjp.ac.lk

Abstract

The fluctuation of the groundwater table depends on geology, topography, climate and human consumption pattern. Long-term reduction of groundwater table caused by global climatic changes and overexploitation. However, short-term fluctuation is caused by climatic variations such as rainfall patterns and evaporation. Groundwater consumption is increasing at an alarming speed due to the increasement in the population, and it directly affects the reduction of the water table. Attaragoda GN division is considered a rural area in the wet zone of Sri Lanka. Most households utilize groundwater as their principal water source. There is no research conducted to assess the water table in the Attaragoda GN division. A preliminary study tried to determine the water table in Attaragoda GN division, Galle to fill this research gap. As a tropical country, the month of November is considered the second inter-monsoon season in Sri Lanka. Randomly selected 33 groundwater wells were considered as the sample size from 142/A Attaragoda GN division. The study was conducted in November 2021 from 8.00 am to 2.00 pm. Elevation was recorded using "My elevation mobile app," and the depth of the wells was measured using the measuring rope at the field in November 2021. The water table was calculated using the standard formula for all 33 sampling locations ($Z = h - X$; Z=depth of water table, X=elevation, h=depth measured in well). Data analysis was done using plotting the water table graph against elevation. Regarding land elevation, the water table fluctuated in the 4 m-20 m range in the Attaragoda GN area due to geographic locations. The lowest water table was recorded at a well in the highland area, and the highest was recorded at a well in the lower land. Based on the results in a plotted graph indicated that the same elevation had different groundwater table levels. Main reasons for this different water table recorded in the same elevation identified as overused groundwater for maintaining a fish farm, watering flower nurseries, and animal husbandry practices. At the same elevation, the well that recorded the low water table caused overexploitation of groundwater than the well which had a higher water table level. Water table levels can change in the same area due to their native geographic features. However, at the same elevation water table might be adjusted according to the consumption pattern of the households.

Keywords: Elevation, Geology, Ground water, Water table

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

175

(185)

Therapeutic Uses of Mee Tree *(Madhuca longifolia)*

Risla M.H.F.*, Muthalib A.M.

Department of Study in Unani, Institute of Indigenous Medicine, University of Colombo, Colombo 03, Sri Lanka
*rizla.zaki@gmail.com

Abstract

In the past, our ancestors maintained a close relationship with the environment. They knew the value of many plants. One tree that our ancestors preserved is the Mee tree. *Madhuca longifolia* belonging to the family Sapotaceae, is one of those multipurpose forest tree species that provide an answer for the food, fodder and fuel. It is widely distributed in the South Asian countries, Especially in Sri Lanka. Mee tree is a large deciduous tree growing widely under dry tropical and sub-tropical climatic conditions. The tree has religious and aesthetic value in the tribal culture. The trees with best girth in forest are often Mee trees as it is protected and cared by forest dwellers. Aim of the study is to identify the therapeutic uses of this plant in Sri Lanka. Ancient classical texts were used to collect data on Mee tree especially, Medicinal plants (Indigenous and Exotic) used in Ceylon. Articles were filtered through journals, magazines and newspapers. Databases such as Google scholar, Springer and Agroforestry were used to search journal articles. The journal articles from 2010-2022 were considered as eligible for this review. Search terms such as *Madhuca longifolia*, Mee tree, Medicinal uses were used to search journal articles. The final summary was formulated after a thorough reading of all above materials. As the results, the plant contains Vitamins, Ethylcinnamate, Amyrin acetates, Hexacosanol, Linoleic acid, Palmitic acid and many more chemical constituents. The Mee tree has analgesic, diuretic, tonic, aphrodisiac, astringent and demulcent properties with various parts of the plant. The parts are used in certain treatments in Ayurvedic medicine. The flowers, leaves, bark, roots, and seeds of the Mee tree are used to prepare medicines for rheumatism, bronchitis, headache, skin diseases, and worm infestations. The study was concluded as, this tree was so close and familiar to the lives of the people. This tree has many benefits for mankind, and many people have been interested in preserving it. However, due to the deforestation that has taken place in the country in the last few decades, the existence of Mee trees has been severely threatened. Today, Mee tree is a scarce resource in Sri Lanka. People should aware about protecting the plant for future generation.

Keywords: *Madhuca longifolia,* Mee tree, Medicinal uses, Deforestation

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

176

(191)

Preliminary Survey on Ethnomedicinal Value of Spontaneous Urban Plants

Nuwan V.G.S.I.*, Wasana R.K.R., Ediriweera E.R.H.S.S., Manori K.D.

Institute of Indigenous Medicine, University of Colombo, Colombo 03, Sri Lanka
*vgsinuwan@gmail.com

Abstract

One of the major global trends of the twenty-first century that has a big impact on our lives is urbanization. By 2050, two-thirds of the world's population, who currently make up half of the population are expected to reside in urban regions. The demands of urban environments can lead to greater poverty and environmental degradation such as poor air and water quality, shortages in water supply, waste-disposal issues, and excessive energy consumption will become worse. Additionally, urbanization encourages the invasion of non-native species by reducing the diversity of plant species, making it difficult to plant growth. Some species, however, exhibit signs of resilience to these challenges and are adaptable to the urban environment. Spontaneous Urban Plants (SUP), also known as "weeds" are frequently found in abandoned urban landscapes. They are neglected as unwelcome, unwieldy, and unkempt, but they thrive in environments where most plants cannot grow. They can grow out of cracks in the sidewalks, in the wall of a garbage ditches, or even in a tiny space inside the walls of houses. This research aims to identify the SUP species with ethnomedicinal values in urban environment. This roadside surveys were conducted to identify SUP species with ethnomedicinal values in 10 urban areas in the Galle district between January and July 2020. Open-ended and semi-structured questionnaire was used to interview a total of 37 people including Ayurveda and traditional medical practitioners, community elders and people experts in plants. The acquired data were verified using the Ayurveda authentic books and reputed journals. A total of 50 plant species of 27 families were identified as SUP. Asteraceae and Amaranthaceae and Fabaceae were reported as the most represented families. The most plant species are used to treat gastrointestinal disorders, followed by respiratory disorders and dermatological conditions. However, ethnomedicinal values of these SUP are yet to be revealed.

Keywords: Ethnomedicinal, Spontaneous urban plants, Urbanization, Weed

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

177

(196)

The Implications of Religious Practices on *Loxococcus rupicola* (Thw.) H. Wendl. and Drude, A Critically Endangered, Endemic Palm Species in Sri Lanka

Chandrathilake G.G.T.[1]*, Wickramasinghe K.H.P.D.L.[1], Rajatewa R.A.M.P.M.[2]

[1]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Education and Rehabilitation Organization (ECERO), Gampaha, Sri Lanka*
*thilakawansha@sjp.ac.lk

Abstract

Sri Lanka is rich in biodiversity and traditional, religious, and cultural practices. However, some of these traditional beliefs could lead to decline of the local biodiversity. Ran-Dotalu (*Loxococcus rupicola* (Thw.) H. Wendl. & Drude,) is one of the sacred groves among the Buddhists and Buddhism is the major religion followed in Sri Lanka. *L. rupicola* (Family Arecaceae), is a palm listed as Critically Endangered and Endangered on the global and national red lists respectively. *Loxococcus* is an endemic genus and Ran-Dotalu is also protected under the Flora and Fauna Protection Ordinance. It confines to rainforests in central highlands of Sri Lanka as small populations on shady rocky outcrops. Therefore, the objective of this study was to explore the religious beliefs, and cultural practices, and document the present state of the wild collection of Ran-Dotalu to identify the threats related to religious activities. Sociocultural data on Ran-Dotalu and its uses in the rituals were collected based on semi-structured questionnaire interviews via formal discussions, telephone conversations, and emails. Out of 114 respondents there were Buddhist priests (n=03), plant collectors (n=07), and users and or worshipers (n=104). Among them 36% were males and 64% were females. According to the results, flowers, seeds, seedlings, and saplings collections were reported from Peak Wilderness sanctuary, Erantha-Gilimale Forest reserve, and Knuckles Forest Reserve. Ran-Dotalu. Flowers were mainly collected for religious activities and rituals (42.3%), medicinal purposes (26.3%), as a substitute for Areca nut (23.6%), and to sell (7.8%). Worshiping with Ran-Dotalu flowers was common at Sri Padasthanaya, Temple of Tooth, Ruwanweliseya and Jayasrima Bhodiya, Saman Devalaya, and Katharagama Devalaya. On average 10-12 flowers were collected by a collector per month and, sold for a price ranging from Rs. 500 to Rs. 5,000. On average 10-15 flowers (per month) were brought to above-mentioned religious places. According to the legends god Sumana-Saman offered Ran-Dotalu flowers to Buddha for establishing Sri Padastanaya. Therefore, worshipers believe that offering Ran-Dotalu flowers is a great act of charity and pays off all sin. The palm recently become a popular ornamental plant (9%) despite its protected status. Around 78% of the respondents were not aware of the conservation status of *L. rupicola.* Thus, seed production and young generations in the wild populations are in danger. The study suggests that understanding of practices that may threaten local biodiversity and immediate actions are needed to conserve the *L. rupicola* wild populations.

Keywords: *Loxococcus rupicola*, Sacred groves, Ran-dotalu, Critically endangered

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

178

(198)

Importance of the Conservation of Natural Forests in Protecting Red Listed Medicinal Plant *Terminalia arjuna* in the Perspective of Indigenous System of Medicine

Shifka W.F.*, Muthalib A.M.

Department of Study in Unani, Institute of Indigenous Medicine, University of Colombo, Colombo 03, Sri Lanka
*wshifka@gmail.com

Abstract

Sri Lanka the country which is rich in natural resources has a percentage of 29.9 (1,933,000 ha) covered by forest. In present the forests are being destroyed due to various reasons. Increased population leads to increased constructions and urbanization are some reasons of forest destructions. Indigenous system of medicine explains on the importance of various natural resources which are highly effective in treating multiple ailments especially, describes on many herbal plants. The study aims on the importance of red listed plant *Terminalia arjuna* which is being an extinct plant due to forest destruction. A systematic literature review has been carried out to gather information from Unani and Ayurveda classical texts, Pharmacopeias, ethno-botanical literatures, scientific journals, and web. Unauthentic articles and articles which did not match the theme and eligibility criteria were excluded. 39 articles were finally included for the study. The key words used in searching were *T. arjuna*, forest conservation, natural resources, red list plants in Sri Lanka, Indigenous medicine and therapeutic effects. Results revealed that *T. arjuna* belongs to the family Combretacea which is widely spread in mixed dry deciduous tropical forests of Sri Lanka. Various parts of this plant (specially the stem-bark) are very effective in treating cardiovascular complications such as hypertension, dyslipidemia, anginal pain and congestive heart failure. This plant contains tannin, the cardiac glycoside possessed from the bark and fruit is known to be an excellent cardiac tonic which is potent in strengthening the cardiac muscles, in improving the blood circulation of coronary artery and prevents the heart muscle from ischemic damage. Therefore, this study focuses on the importance of the conservation of forests and natural resources which are being helpful in the system of Indigenous medicine in various ways.

Keywords: Natural resources, Forest, Indigenous medicine, *Terminalia arjuna*, Cardiac tonic

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

179

Author Index

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

180

Author Index

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

181

Author Index

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

182

Author Index

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

183

Author Index

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

184

Author Index

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

185

Author Index

Proceedings of the 27ᵗʰ International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

186

Author Index

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

187

Author Index

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

188

Author Index

Proceedings of the 27th International Forestry and Environment Symposium 2023 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

189

PROTECTING THAT WHICH PROTECTS US

MANGROVE REFORESTATION PROGRAMME
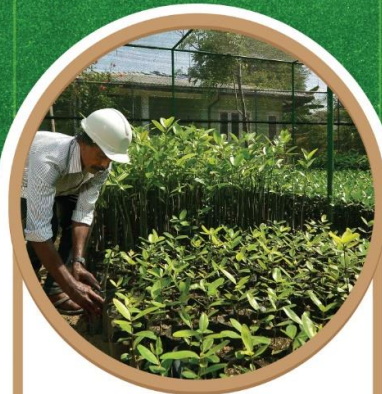
The Mangrove Nursery within our factory premises hosts 10,000 saplings belonging to 7 native species.

Since inception, we have planted over 77,000 mangrove trees in coastal areas in the North & East, together with Sri Lanka Navy.

We follow the natural composition of mangrove habitat in Cod Bay to replant.

20,900 saplings planted around 20 acres in Cod Bay, Trincomalee is now a flourishing mangrove habitat.

BIOMASS ENERGY PROGRAMME

Our biomass energy programme currently has a total capacity of 24MW/h.

We have planted Over 6 million Gliricidia trees as fuel for our power plants in Trincomalee and Mahiyangana.

We are 100% energy independent & our entire local production process is based on Renewable Biomass Energy.

This has helped reduce our carbon footprint significantly

CORAL REEF CONSERVATION

Reef Balls Deployed in

Jaffna	Seenigama
Galle	Passikudah
Trincomalee	Kalpitiya
Rumassala	Mirissa
Nilwella	

Research & Education

Established a long-term coral reef monitoring program.

Capacity building by providing training to Department of Wildlife Conservation, Sri Lanka Navy, university students and volunteers.

Community education and collaborative beach cleanups.

Support extended to conduct a study on breeding grounds of Elasmobranchs, in and around the seas of Jaffna Peninsula.

Conservation

Facilitate the declaration of the Kayankerni Marine Sanctuary as the 17th Marine Protected Area in Sri Lanka.

Mapped the Kayankerni reef system, which became one of 7 sites globally to be included in the Allen Coral Atlas
(a global initiative to map and monitor coral reefs).

TOKYO CEMENT GROUP

Co-operative Society of National Environmental Conservators

Total Waste Management Solutions

for

Better Environment

CONTROLUNION

Sustainable Certification Programs

Organic & Sustainable Agriculture

USDA ORGANIC · Control Union Certifications · GLOBALG.A.P. · RAINFOREST ALLIANCE CERTIFIED · regenagri

Sustainable Textile

GLOBAL ORGANIC TEXTILE STANDARD · GOTS · ORGANIC 100 content standard ©TextileExchange · ORGANIC BLENDED content standard ©TextileExchange · RECYCLED 100 claim standard ©TextileExchange · RECYCLED BLENDED claim standard ©TextileExchange · Global Recycled Standard ©TextileExchange

Forestry & Environmental Services

FSC www.fsc.org FSC® A000507 The mark of responsible forestry · PEFC · CONTROLUNION CERTIFIED Carbon neutralized · CONTROLUNION CERTIFIED ISO14001 · CONTROLUNION CERTIFIED ISO 14064-1:2006 · CONTROLUNION CERTIFIED ISO 50001

Food Safety & Quality Management

CONTROLUNION CERTIFIED ISO9001 · CONTROLUNION CERTIFIED ISO22000 · CONTROLUNION CERTIFIED GMP Good Manufacturing Practice · CONTROLUNION CERTIFIED HACCP · BRCGS CERTIFICATION BODY

IFS Food · FSSC 22000
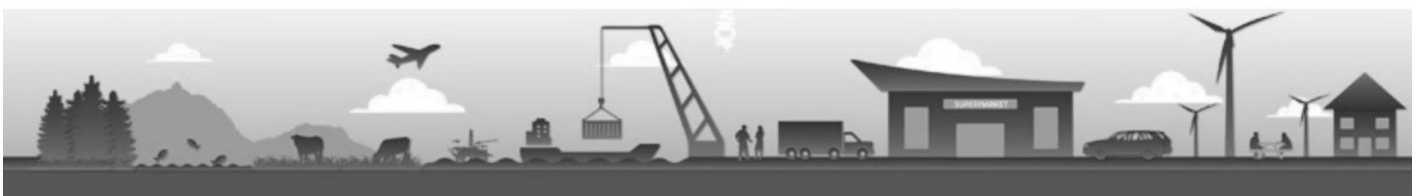
2ND FLOOR, BAM MUSEE TOWER, 52 SIR MARCUS FERNANDO MAWATHA, COLOMBO 00700, SRI LANKA

(+94) 112 678 607/8/9

HTTPS://CERTIFICATIONS.CONTROLUNION.COM/EN

CONTROL UNION SRI LANKA

CONTROL UNION SRI LANKA

NEW Rathna
GROUP OF COMPANIES.

New Rathna rice (Pvt) Ltd is the principal revenue generator for the Rathna group. It has established itself as one of the most renowned and respected Sri Lankan Rice Manufacturing and distributing brands.

NEW RATHNA RICE (PVT) LTD.

Rathna Agro Plantation (Pvt) Ltd is an eco-friendly business that was established under the concept of the "Green Business". We have selected TOMJC Mango the world's largest and juiciest mango to cultivate in a separate area in the industrial zone which is totally supervised by our company

Rathna AGRO PLANTATION (PVT) LTD.

Rathna Engineering specializes in producing interlock designs and solutions in the B2B market space

Rathna ENGINEERING (PVT) LTD.

Rathna Polysacks (Pvt) Ltd we took a dynamic approach to the polysacks industry

Rathna POLYSACKS (PVT) LTD.

Rathna Aviation Lanka (Pvt) Ltd is our imprint on the local air transportation industry

Pearl Grand by Rathna is the "Best Nest in The City" to all our much-valued business & leisure travellers. Our thoughtfully designed rooms, exotic dining options, recreation facilities, meeting facilities, & personalized services, give an unforgettable experience of an amazing homely stay.

PEARL GRAND BY RATHNA

New Royal Rice (Pvt) Ltd represents a strategic point for the group as a highly qualitative rice producer and distributor that spreads the excellence of the mother company

ROYAL

Located in the heart of the legendary ancient city of Polonnaruwa, Ruins Chaaya Hotel is ready to welcome all our guests with genuine island hospitality and authentic culture.

RUINS CHAAYA

Organisers

First University in South Asia to Report its Carbon Footprint According to ISO 14064-1 Standards

University of Sri Jayewardenepura

Department of Forestry and Environmental Science

Platinum Sponsor

TOKYO CEMENT GROUP

Gold Sponsors

CDB

Co-operative Society of
National Environmental
Conservators

Silver Sponsors

STATE TIMBER CORPORATION

CONTROLUNION

EnCare

NEW Rathna
GROUP OF COMPANIES.

For more info visit
fesympo.sjp.ac.lk

International Forestry and Environment Symposium - 27th - 28th January 2023 University of Sri Jayewardenepura, Sri Lanka