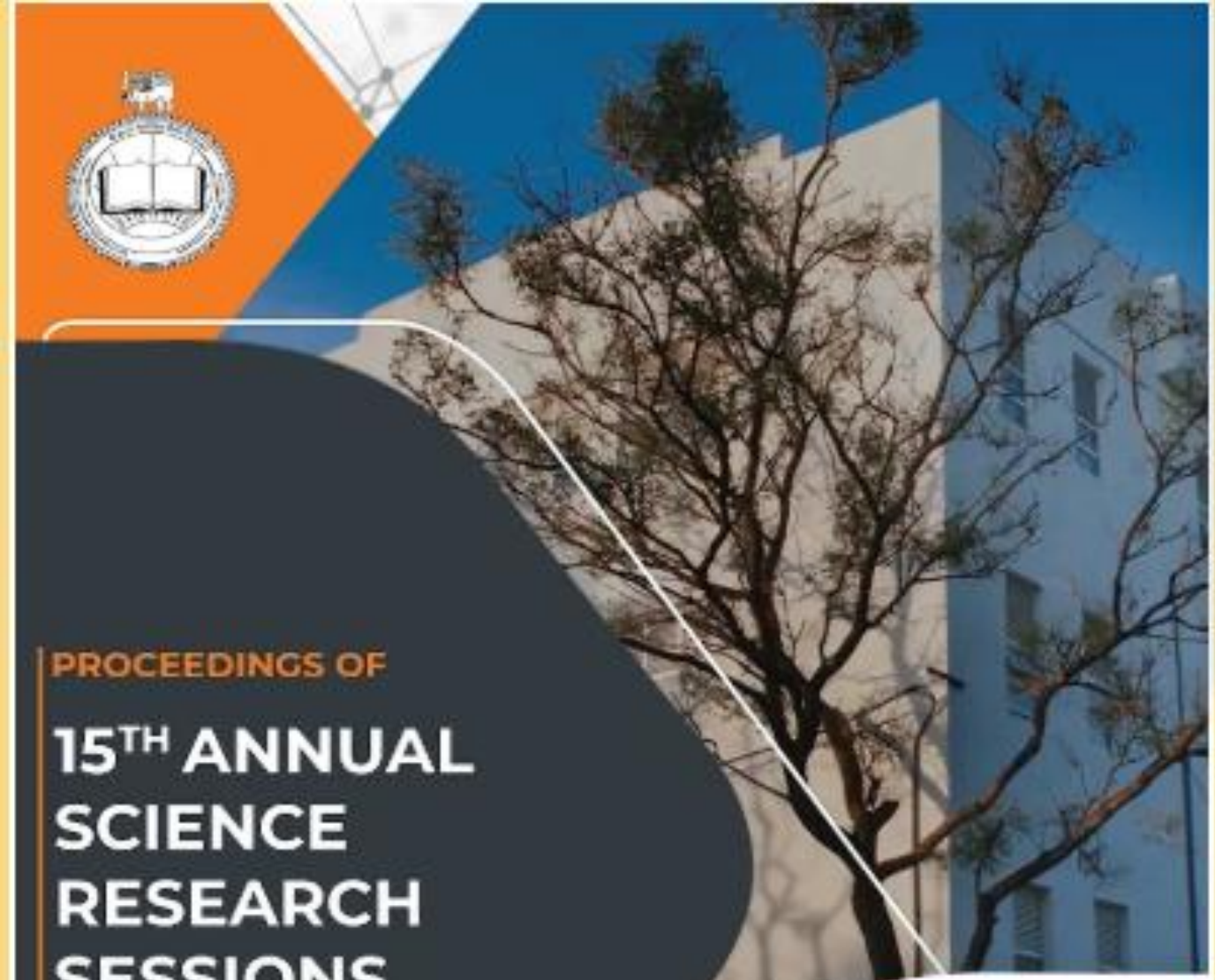


PROCEEDINGS OF

15TH ANNUAL SCIENCE RESEARCH SESSIONS 2026

"INTELLIGENCE INTEGRATED SCIENCE: SYNERGIZING INNOVATIONS FOR A SUSTAINABLE FUTURE"

Faculty of Applied Sciences
South Eastern University
Of Sri Lanka

08th September 2026

FACULTY OF APPLIED SCIENCES

SOUTH EASTERN UNIVERSITY OF SRI LANKA

PROCEEDINGS OF

15th ANNUAL SCIENCE RESEARCH SESSIONS - 2026

"*Intelligence Integrated Science: Synergizing Innovations for a Sustainable Future*"

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ISBN 978-955-627-517-9

Published by:
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Sammanthurai
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MESSAGE FROM THE VICE CHANCELLOR



It gives me great pleasure to convey my best wishes to the Annual Science Research Sessions 2026 (ASRS 2026), organized by the Faculty of Applied Sciences, South Eastern University of Sri Lanka (SEUSL). The ASRS has evolved into a hallmark event of SEUSL, providing a platform for researchers, academics, and students to present their findings and foster collaboration.

This year's theme, *"Intelligence Integrated Science: Synergizing Innovations for a Sustainable Future,"* is timely. Science and technology are advancing rapidly, and intelligent approaches are becoming increasingly important for addressing the complex challenges society faces. At the same time, our innovations must contribute to a future that is sustainable, inclusive, and beneficial to all. It is encouraging to note that ASRS 2026 received a strong response. A total of 91 abstracts, including extended abstracts, were submitted, of which 71 papers were accepted following the review process. This reflects the growing interest among researchers in sharing their findings and engaging in meaningful academic discussion at the ASRS.

The wide range of conference tracks, covering Biological Sciences, Chemical Sciences, Computer Science, Data Science and IT, Environmental Sciences, Mathematics and Statistics, Physical Sciences, Agricultural Sciences, and Science Education, demonstrates the multidisciplinary nature of modern scientific research.

I sincerely appreciate the Dean of the Faculty of Applied Sciences, the Conference Chair, Coordinator, Secretary, members of the organizing committees, reviewers, and all others who have contributed their time and effort towards making ASRS 2026 a success. I also congratulate all authors whose papers have been accepted for presentation and wish them fruitful discussions and valuable academic engagement.

I wish the event every success.

Prof. S. M. Junaideen
Vice Chancellor,
South Eastern University of Sri Lanka, Oluvil.

MESSAGE FROM THE CONFERENCE CHAIRPERSON



It is with great pleasure and pride that I extend my warmest greetings to all participants of the 15th Annual Science Research Sessions (ASRS 2026) organized by the Faculty of Applied Sciences, South Eastern University of Sri Lanka. This year's theme, *"Intelligence Integrated Science: Synergizing Innovations for a Sustainable Future,"* reflects the growing importance of integrating scientific knowledge, emerging technologies, and innovative thinking to address the complex challenges facing our society and the world.

ASRS 2026 provides a valuable platform for researchers, academics, and students to share their research findings, exchange knowledge, and establish meaningful academic collaborations. The publication of this proceedings volume represents the dedication and scholarly contributions of researchers from diverse fields of science. I am confident that the research presented in this volume will contribute to the advancement of knowledge and inspire further research and innovation towards a sustainable future.

I sincerely appreciate the valuable contributions of all authors, reviewers, members of the editorial team, organizing committee, academic staff, and supporting staff whose commitment and dedication have made ASRS 2026 possible. I also extend my sincere gratitude to the keynote speakers and all participants for their valuable presence and contribution.

I warmly congratulate all researchers and presenters and wish ASRS 2026 every success. May this research session strengthen our research culture, foster new collaborations, and inspire the next generation of scientists and innovators.

Prof. H. M. M. Naleer
Dean,
Faculty of Applied Sciences,
South Eastern University of Sri Lanka,
Conference Chair – ASRS 2026.

MESSAGE FROM THE CONFERENCE COORDINATOR



It is with great pleasure that I convey this message in the proceedings of the 15th Annual Science Research Sessions (ASRS 2026), organized by the Faculty of Applied Sciences, South Eastern University of Sri Lanka, under the theme "*Intelligence Integrated Science: Synergizing Innovations for a Sustainable Future*".

The breadth of disciplines represented at ASRS 2026 reflects the diverse, multidisciplinary, and integrative nature of contemporary scientific research. This year's research sessions received 91 extended abstracts from higher education and research institutions across Sri Lanka. Following a comprehensive review by an expert panel comprising internal and external reviewers, 71 abstracts have been selected for publication in the proceedings. The event features two keynote addresses delivered by eminent professors, followed by 15 parallel technical sessions comprising 71 oral presentations. These sessions provide a valuable platform for researchers, academics, and scholars to disseminate their findings, exchange ideas, and engage in meaningful academic dialogue across diverse fields of science.

The success of ASRS 2026 is a reflection of the collective effort and collaborative spirit of numerous individuals and teams. I wish to express my profound gratitude to the Vice Chancellor and the Dean of the Faculty of Applied Sciences for their invaluable guidance and unwavering support. I also extend my sincere appreciation to the keynote speakers, secretary, editorial team, reviewers, organizing committee, sub-committees, and all the panelists for their commitment, professionalism, and dedicated efforts throughout the planning and execution of the event.

Finally, I extend my warmest congratulations to all authors and presenters for their valuable scholarly contributions to ASRS 2026. I am confident that the knowledge shared and the collaborations fostered through this research session will inspire further innovation, strengthen research partnerships, and contribute meaningfully to building a more innovative, sustainable, and knowledge-driven future.

Dr. M. A. C. Akmal Jahan
Coordinator/ASRS-2026,
Faculty of Applied Sciences,
South Eastern University of Sri Lanka.

A BRIEF BIOGRAPHY OF THE KEYNOTE SPEAKER



Prof. Gihan Dias
Department of Computer Science and Engineering,
Faculty of Engineering,
University of Moratuwa,
Sri Lanka

Prof. Gihan Dias is a distinguished academic and computer engineering professional with extensive experience in computer networking, Internet technologies, e-learning, natural language processing, identity systems and cybersecurity. He holds a B.Sc. Engineering from the University of Moratuwa, an M.Sc. from the University of California, Santa Barbara, and a Ph.D. from the University of California, Davis. He was a Senior Professor in the Department of Computer Science and Engineering at the University of Moratuwa and the director of the National Languages Processing Centre.

Prof. Dias was instrumental in establishing and operating the Lanka Education and Research Network (LEARN). He also played a pioneering role in the establishment and development of Sri Lanka's ".lk" country-code top-level domain and is the Domain Registrar of the LK Domain Registry.

Throughout his academic career, Prof. Dias has contributed extensively to teaching, research, postgraduate education, and professional activities in the fields of computer communications and Natural Language Processing.

In addition to his academic contributions, Prof. Dias has held several important professional and national-level positions. He served as a Programme Director at the Information and Communication Technology Agency (ICTA) of Sri Lanka and has been involved in developing Internet services and networking initiatives in the country. His contributions to the growth of Sri Lanka's Internet infrastructure and academic networking have earned him international recognition, including induction into the Internet Hall of Fame in 2013.

Prof. Gihan Dias continues to advance computer science, networking, and digital technologies through his academic leadership, research, professional activities, and engagement in national and international initiatives.

Artificial Intelligence and Language Models

Prof. Gihan Dias
University of Moratuwa

Abstract

Will Artificial Intelligence take over the world? Large Language Models and Generative AI such as ChatGPT have become very popular, but many people still don't understand what they are, how they work, and how to properly make use of them. This presentation will demystify language models, show how they work, and how we may use them in our own work.

What is a Large Language Model? It is a system that has been *trained* using a large amount of data. A model may be trained with not billions, but trillions of words of text, not just in English, but also Tamil, Sinhala and all other languages. Modern models contain not only text, but also voice, images, and other media.

However, the model does not contain text, images, etc. directly. Instead, the training data is *encoded* into several parameters – billions of parameters. The model may then be queried to provide answers to your questions. For example, we may give it some text in Tamil and ask it to translate the text to English. How does it do this? It first encodes your query into an internal form. Then it generates text, images, sounds, etc., which its parameters tell it are the best matching answer to your query. This is why it is called *generative* AI.

There are many large language models available, including GPT, Claude and DeepSeek. Most of them work similarly. They have a free tier where the model can be queried free of charge. However, many serious applications require payment, which can become expensive. Another issue is that all your queries and data are exposed to the model.
Open models may be run on our own system and don't require exposing our data or payment to the provider. We can also keep our data on internal systems and only use the LLM for non-confidential work.

A BRIEF BIOGRAPHY OF THE KEYNOTE SPEAKER



Prof. R. M. Kapila Tharanga Rathnayaka
Dean,
Faculty of Applied Sciences,
Sabaragamuwa University of Sri Lanka

Prof. R. M. Kapila Tharanga Rathnayaka is a distinguished academic and researcher in the fields of Statistics, Applied Mathematics, statistical modelling, and data-driven research. He currently serves as the Dean of the Faculty of Applied Sciences at Sabaragamuwa University of Sri Lanka. His academic journey includes a B.Sc. Special Degree in Mathematics and Statistics from the University of Ruhuna, an M.Sc. in Industrial Mathematics from the University of Sri Jayewardenepura, and an M.Sc. in Statistics and Ph.D. in Applied Statistics from Wuhan University of Technology, China.

His research interests encompass statistical modelling, time-series analysis and forecasting, data mining, clustering, classification, artificial intelligence, artificial neural networks, and computational statistics. He has made significant contributions to the development of hybrid statistical and computational approaches for forecasting and data analysis, with applications spanning financial time-series and stock-market forecasting, electricity-demand forecasting, economic modelling, customer analytics, and healthcare-related classification. His research includes the integration of traditional statistical techniques with artificial neural networks, ARIMA models, Grey System approaches, and machine-learning methods, resulting in innovative approaches to stock-market forecasting, electricity-demand prediction, energy consumption and economic growth modelling, and customer classification and prediction.

Prof. Rathnayaka has an extensive record of research publications and international conference contributions, alongside significant experience in teaching, postgraduate supervision, academic administration, and the development of applied statistical and mathematical research. His continuing research focuses on integrating statistical modelling, artificial intelligence, machine learning, and forecasting to develop data-driven solutions to contemporary scientific and societal challenges, reflecting his commitment to advancing quantitative research and strengthening the role of Statistics in science and technology.

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Biological Sciences

Abstract ID: 026

ADULTICIDAL ACTIVITY OF SELECTED UNDERUTILIZED SRI LANKAN MEDICINAL PLANTS AGAINST ADULT *Aedes aegypti* (DIPTERA: CULICIDAE)

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Abstract

The escalating resistance of insects to insecticides and growing environmental concerns over synthetic insecticides have necessitated safer plant-based alternatives. One of the most studied vectors is *Aedes aegypti*. This study evaluated the adulticidal activity of methanolic extracts of three selected underutilized Sri Lankan medicinal plants: *Abutilon indicum* L. (T1; Country mallow/Indian mallow; Sinhala: Beth Anoda; Tamil: Peruntulli/Peruntutti), *Acalypha indica* L. (T2; Indian Acalypha; Sinhala: Kuppameniya; Tamil: Kuppameni), and *Cissus quadrangularis* L. (T3; Adamant Creeper; Sinhala: Heeressa; Tamil: Pirandai) against adult female *A. aegypti*. Leaves of *Abutilon indicum* and *Acalypha indica* and stems of *Cissus quadrangularis* were collected, washed, shade-dried, and powdered. Extract type and concentration were arranged factorially using a Completely Randomized Design. Five different concentrations, which were 2, 4, 6, 8, and 10% w/v, were tested in a laboratory against 20-25 mosquitoes (3-5 days). Mosquitoes were exposed to the treated paper for 120 min, with the recording of the KD reaction recorded at 0, 30, 60, 90, and 120 min, followed by a 24 h recovery period. Methanol-treated papers served as the negative control, and mortality was corrected using Abbott's formula. Two-way ANOVA and probit analysis were performed to determine the effects of extract type and concentration and calculate LC_{50} and LC_{90} values, respectively. All three extracts showed adulticidal activity against *Aedes aegypti*, with mortality increasing significantly with concentration, while the control showed no significant mortality. *Abutilon indicum* exhibited the highest adulticidal activity and was the most toxic extract, with LC_{50} and LC_{90} values of 4.976% and 9.140% (w/v), respectively. The study demonstrates the concentration-dependent adulticidal potential of these selected Sri Lankan medicinal plants against mosquitoes.

Keywords: *Aedes aegypti*, *Acalypha indica*, *Abutilon indicum, Cissus quadrangularis*, *Medicinal plants, Spatial repellency, Mosquito repellents, Vector control*

Abstract ID: 037

EFFECTS OF EXOGENOUS FOLIAR APPLICATION OF GIBBERELLIC ACID AND ASCORBIC ACID ON SALINITY TOLERANCE IN SELECTED RICE (*Oryza sativa* L.) CULTIVARS

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Abstract

Salinity is one of the major abiotic constraints limiting rice productivity by inducing ionic imbalance, osmotic stress, and oxidative damage. This study evaluated the potential of individual and combined foliar applications of gibberellic acid (GA_3) and ascorbic acid (ASA) in enhancing salinity tolerance in three rice cultivars, AT 353, AT 354, and Pokkali at the early vegetative (seedling) stage. They were cultivated under hydroponic conditions at their respective cultivar-specific threshold salinity levels of 4,6 and 10 dS m^{-1}. Salinity stress significantly influenced ($p<0.001$) growth, physiological and biochemical characteristics, resulting in a reduction of shoot length, fresh weight, leaf area and chlorophyll content, while increasing the accumulation of proline, soluble sugars, 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity, and lipid peroxidation as indicated by malondialdehyde (MDA) content. Significant cultivar-specific variation in response to the salinity stress was observed. Proline content increased by 19.0%, 22.0%, and 10.7%, and DPPH radical scavenging activity increased by 25.5%, 12.2%, and 3.3% in salt-sensitive AT 353, moderately tolerant AT 354, and tolerant Pokkali, respectively, compared with their non-saline control. Despite the small relative increases, Pokkali maintained higher proline (6.243 mg g^{-1} FW) and DPPH activity (71.38%) under salinity, indicating greater salinity tolerance. Foliar application of GA_3 and ASA significantly improved plant performance and salinity tolerance and mitigated the adverse effects of salinity stress. The combined foliar treatment consistently showed greater effectiveness than the individual applications. Among all treatment combinations, GA_3 (150 µM) + ASA (300 ppm) and GA_3 (100 µM) + ASA (200 ppm) produced the most favourable response, and they were the most effective in alleviating salinity-induced damage. GA_3 (150 µM) + ASA (300 ppm) improved total chlorophyll content by 61.4%, 83.2%, and 228.3% in AT 353, AT 354, and Pokkali, respectively; increased proline accumulation by up to 99.0%; and reduced lipid peroxidation by up to 63.4% compared with untreated controls. Likewise, GA_3 (100 µM) + ASA (200 ppm) increased total soluble sugar accumulation by 82.7% in AT 353 and 79.3% in Pokkali. Overall, the combined foliar application of GA_3 and ASA enhanced defence mechanisms such as osmotic regulation, strengthened antioxidant activity, maintained chlorophyll content, and enhanced membrane stability, thereby increasing salinity tolerance of all three selected rice cultivars.

Keywords: *Rice, Salinity stress, Salinity tolerance, Gibberellic acid (GA_3), Ascorbic acid (ASA), Antioxidant activity*

Abstract ID: 039

LARVAL GROWTH RESPONSE OF AEDES MOSQUITOES TO DIFFERENT PLANT LEAF INFUSION CONCENTRATIONS

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Abstract

Aedes mosquitoes act as major vectors of several mosquito-borne diseases, including dengue, Zika, and chikungunya, creating significant public health concerns in tropical regions. This study evaluated the influence of three different plant leaf infusions and four different concentrations on the larval growth and development of *Aedes* mosquitoes under laboratory conditions. Mosquito eggs were collected from ovitraps containing standardized concentrations of leaf infusions and incubated under controlled conditions. Newly hatched first-instar larvae were identified, and *Aedes* larvae were selected for the experiment. Leaf infusions were prepared from *Tectona grandis*, *Artocarpus heterophyllus*, and *Terminalia catappa* using air-dried leaves soaked in distilled water for 14 days. The prepared infusions were tested at concentrations of 100%, 75%, 50%, and 25%, with distilled water as the control. Ten first-instar larvae were introduced into each treatment group with five replicates and maintained under controlled environmental conditions. Larval growth was recorded daily and expressed as micrometres per day (µm/day). The results demonstrated that larval development varied depending on plant species and infusion concentration. *Artocarpus heterophyllus* produced the highest larval growth at 100% concentration, with mean growth measurements of 3900±19.58 µm/day in the second instar, 2111.2±61.79 µm/day in the third instar, and 1900±64.55 µm/day in the fourth instar. In *Tectona grandis*, complete inhibition of growth was observed at 100% concentration, whereas the highest growth occurred at 50% concentration, recording 4100±91.29 µm/day, 2500±91.29 µm/day, and 1900±91.29 µm/day in the second, third, and fourth instar, respectively. *Terminalia catappa* showed maximum growth at 75% concentration, with rates of 3179±17.4 µm/day, 2762.5±62.5 µm/day, and 782.5±38.4 µm/day across the three larval stages. Overall, the findings indicate that plant-derived leaf infusions significantly influence *Aedes* larval growth and development, and their effects vary according to plant species and concentration.

Keywords: *Aedes, Mosquito larvae, Leaf infusion, Tectona grandis, Artocarpus heterophyllus, Terminalia catappa, Larval development, Plant extract*

Abstract ID: 041

DIVERSITY AND DISTRIBUTION OF TETRAPONERA RUFONIGRA AND OTHER TETRAPONERA-ASSOCIATED ANT SPECIES IN AMPARA DISTRICT SRI LANKA

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Abstract

Ants of the genus *Tetraponera* are ecologically important arboreal insects that contribute to ecosystem functioning and may have medical significance because of their painful defensive stings. However, information on the diversity, distribution, host plant associations, and sting-related health effects of *Tetraponera* species in Sri Lanka, particularly in Ampara district, remains limited. Therefore, this study aimed to investigate the distribution, host tree associations, and sting incidents involving *Tetraponera rufonigra* in selected areas of Ampara district and to assess the diversity of *Tetraponera* species in the selected localities in Ampara district. A total of 60 baited tree traps were placed on selected large trees in chena cultivation areas at Walagambura and Buddangala Sanctuary. Traps were exposed for one hour before collection. In addition, tree trunks up to eye level of 100 trees at each locality were examined, and ants observed on the trunks were collected and preserved in 70% ethanol. Specimens were identified using a stereomicroscope and standard taxonomic keys. In Sammanthurai, trees along an 800 m roadside stretch were examined for the presence of *T. rufonigra*, and associated tree species were recorded. Ant sting incidents were assessed through questionnaire surveys among students from selected schools in Sammanthurai, using images and preserved specimens of T. *rufonigra* to facilitate species recognition. Three Tetraponera species, namely *T. rufonigra*, *T. nigra*, and *T. allaborans*, were recorded from Walagambura, whereas no *Tetraponera* species were recorded from Buddangala during the survey period. *T. rufonigra* was associated with several tree species, with teak (*Tectona grandis*) showing the highest association. Questionnaire surveys indicated that ant sting incidents occurred among students in all selected schools. This study provides baseline ecological, taxonomic, and medically relevant information on *Tetraponera* in Ampara district and contributes to biodiversity research, environmental management, and public health awareness in Sri Lanka.

Keywords: *Tetraponera rufonigra, Ant diversity, Host plant association, Ant stings, Ampara district*

Financial assistance from the South Eastern University Research Grant of Sri Lanka (*Grant No: SEU/ASA/RG/2023/03) is acknowledged.*

Abstract ID: 048

FEEDING ACTIVITY OF HOUSE CROWS (*Corvus splendens*): EFFECTS OF FOOD TYPE AND TIME OF DAY

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Abstract

House crows (*Corvus splendens*) are highly adaptable omnivorous birds, usually observed in human habitations, exploiting a range of natural and anthropogenic food sources. This study evaluated the food preferences and time of day of house crow feeding behaviour in Oddamavadi, Sri Lanka. Observations were conducted from November 20, 2025, to December 10, 2025. Four food types, namely rice, fish, bread, and vegetables, were chosen because they are common food items in environments dominated by humans. In each of the three observation periods- morning (7.00–8.00 am.), afternoon (1.00–2.00 pm.), and evening (5.00–6.00 pm.)-equal amounts of each type of food were fed daily for 20 days. The number of crows that visited and ate each type of food was counted from video recordings. Data were analysed using ANOVA, with statistical significance considered at $p < 0.05$. Both food type and time of day significantly influenced the number of crows observed. Food type had a highly significant effect ($p < 0.001$), while time of day also had a highly significant effect ($p < 0.001$). Fish attracted the highest average number of crows, followed by bread, rice, and vegetables, while feeding activity was highest during the morning compared with the afternoon and evening. These findings draw attention to the distinct food preferences of house crows and temporal variation in feeding activity, with a greater preference for animal-based food and increased foraging activity during morning hours. The study highlights opportunistic feeding habits of house crows and their ability to efficiently exploit food resources in human-dominated habitats.

Keywords: *Corvus splendens, Human habitations, Food preference, Foraging behaviour, Opportunistic feeding*

Abstract ID: 052

PRELIMINARY ASSESSMENT OF FOOD PREFERENCE IN ADULT THREE-STRIPED PALM SQUIRRELS (*Funambulus palmarum*) USING DIFFERENT FOOD TYPES UNDER CONTROLLED FEEDING CONDITIONS

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Abstract

The choice of foods is a key feature in the feeding process of animals, affecting nutrient consumption, survival, use of habitat, and food availability. This study was conducted to investigate the food preference of adult squirrels of the same species when given food in controlled conditions. Squirrels were given a choice of five foods that were readily available: rice (*Oryza sativa*), Banana (*Musa* spp.), Chickpea (*Cicer arietinum*), Peanut (*Arachis hypogaea*), and sweet commercial biscuit. Food preference was evaluated by daily intake counts of feedings for each of the food types offered during a period of three months. The study was based on the hypothesis that squirrels will not eat the foods indiscriminately and will show preference for the type of foods that have greater palatability and energy benefits. Daily observation was done for twice a day for three months to assess variations in food choices and feeding frequencies during the experimental period. The total count of feedings was used as a criterion for preference among the foods. According to Friedman test results, there was a highly significant effect of food type on intake in the experimental condition (DF = 4, $X_2 = 20$, $p < 0.001$), which means that adult squirrels had an obvious preference among different foods offered to them. Also, according to the Poisson regression analysis, food type was a significant factor influencing intake ($X_2 = 3770.0$, $p < 0.001$), meaning that squirrels used different types of food selectively. Moreover, according to the results of the trend analysis, there was a slight reduction in food intake over time. The box plot shows high variability in the amount of food consumed and reveals the presence of several extreme food intake values. The results confirm the idea that food selection by squirrels depends on a variety of factors, including flavour, texture, nutrition, and energy content of food. This information helps to get a better understanding of foraging ecology and food consumption behaviour of squirrels and can be useful in developing management strategies for conservation and feeding of squirrels.

Keywords: *Food preference, Squirrel, Foraging behaviour, Cafeteria experiment, Feeding ecology, Dietary selection, Food intake, Wildlife biology*

Abstract ID: 054

INTEGRATED ANALYSIS OF CAROTENOID CONTENT, ANTIOXIDANT ACTIVITY, AND CONSUMER PERCEPTION OF SEVEN SRI LANKAN PUMPKIN CULTIVARS

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Abstract

Pumpkin is an economically important vegetable crop that does not have a single scientific name. Among different pumpkin cultivars, *Cucurbita maxima* and *Cucurbita moschata* are commonly cultivated in Sri Lanka, especially in dry and intermediate zones. In the present study, seven pumpkin cultivars, including Deshiya Hen Wattakka, Pathma, Raja, Bingo, ANK Ruhunu, Batana, and Lucky 7 Hybrid, were utilized to evaluate and compare the carotenoid content and antioxidant activity. Different fruit parts, namely pulp, pulp with peel, and seeds, were used for analysis. In addition, a mini survey was conducted to evaluate the consumer perception of the nutritional value of different pumpkin cultivars. Results obtained from three independent replicates were analysed using General Linear Model (GLM), Two-way analysis of variance (ANOVA), and Tukey's pairwise comparisons at a significance level of $p < 0.05$. Results indicated significant differences between cultivars, part of the fruits and interaction between them for carotenoid content ($p < 0.001$) as well as for antioxidant activity assays such as 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay ($p < 0.001$), total phenolic content ($p < 0.001$), and total flavonoid content ($p < 0.001$) while ferric reducing antioxidant power assay did not show significant difference between cultivars ($p = 0.065$) and cultivar-part of the fruit interaction ($p = 0.026$). However, a significant difference was recorded ($p < 0.001$) among parts of the fruit. The highest carotenoid concentration was recorded in ANK Ruhunu pulp with peel (25.70 mg/ml), and the lowest value (0.94 mg/ml) was recorded in Bingo seeds. The highest DPPH radical scavenging activity was recorded in Lucky 7 Hybrid seeds (0.506 mg/ml), while the lowest value was observed in Raja pulp and Bingo pulp with peel (0.072 mg/ml). The lowest phenolic content was observed in Raja pulp with peel (0.083 mg/ml), and the highest phenolic content was found in ANK Ruhunu seeds (3.06 mg/ml). The total flavonoid content showed minimal variation among different cultivars and remained approximately 0.001 mg/ml throughout the study. Consumer survey results indicated that pumpkin is widely consumed in Sri Lanka. However, the awareness regarding carotenoids, antioxidant compounds, and pumpkin seed consumption remained relatively limited. The findings, together with further investigations, will provide valuable information for cultivar selection, breeding programmes, value-added product development and improving food and nutritional security of Sri Lanka.

Keywords: *Carotenoid, Antioxidant Activity, 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, Ferric reducing antioxidant power assay, Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Consumer Perception*

Abstract ID: 055

INFLUENCE OF α-TOCOPHEROL IN BIO-ENHANCING THE EFFECT OF AMPICILLIN AND TETRACYCLINE AGAINST HUMAN PATHOGENS (*Staphylococcus aureus* & *Escherichia coli*)

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Abstract

The rapid development of multidrug-resistant human pathogens necessitates the investigation of novel synergistic approaches in order to increase the effectiveness of existing antibiotics. This research focuses on bio-enhancing ampicillin and tetracycline in synergy with α-tocopherol (Vitamin E) for two clinically important human pathogens, *Staphylococcus aureus* and *Escherichia coli*. The experimental investigation was conducted in three distinct phases. First, the baseline Minimum Inhibitory Concentration (MIC) and the highest concentrations were determined for each strain. Notably, *E. coli* demonstrated significant baseline resistance to ampicillin, exhibiting a remarkably high MIC of 16 mg/ml, showing 8.33±0.33 mm of mean inhibition zone diameter ($p < 0.001$). Second, the therapeutic agents were combined with α-tocopherol to study the change in susceptibility of microbes by using agar well diffusion assays. The combination of α-tocopherol significantly increased the inhibition zone diameters for both antibiotics against the tested strains, confirming a statistically significant antibacterial enhancement ($P < 0.05$) relative to the antibiotics administered in isolation. Third, optimization analysis was performed to isolate peak synergistic matrix formulations. The best possible synergy between the antibiotics and α-tocopherol, showing high antibacterial activity against the bacterium *S. aureus*, was 80% tetracycline + 20% α-tocopherol (41.66±0.33 mm) and 50% ampicillin + 50% α-tocopherol (41.66±0.33 mm). Besides, the optimal overall antibacterial activity against *E. coli* was found to be 90% tetracycline + 10% α-tocopherol (39±0.57 mm) and 50% ampicillin + 50% α-tocopherol (20.33±0.88 mm). Importantly, the presence of α-tocopherol maintained and increased bactericidal activity even in the lesser amount of standalone antibiotics. This study indicates the possibility that α-tocopherol may act as an efficient agent for reducing the dose of antibiotic required for treatment.

Keywords: *α-Tocopherol, Synergism, Staphylococcus aureus, Escherichia coli, Minimum Inhibitory Concentration, Antibiotic Resistance*

Abstract ID: 056

α-TOCOPHEROL HELPS TO MITIGATE DROUGHT STRESS IN SELECTED DROUGHT-SENSITIVE RICE VARIETIES

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Abstract

Drought stress is a major problem for rice production and significantly affects seedling establishment, growth, and physiological performance through oxidative damage. The present study investigated the potential of α-tocopherol (Vitamin E) seed priming to enhance drought tolerance in selected rice varieties with contrasting drought responses. A greenhouse experiment was conducted using three rice varieties: BG 251 (drought-tolerant), BG 300 (moderately tolerant), and BG 94/1 (drought-sensitive). Seeds of each rice variety were primed with different concentrations of α-Tocopherol (30 ppm, 40 ppm for BG 251; 45 ppm, 55 ppm for BG 300; and 60 ppm, 70 ppm for BG 94/1) for 16 hours, and the primed seeds were compared directly against their respective variety's own hydro- primed and non-primed control groups under drought stress conditions (25-40% soil moisture for BG 251, 40-60% soil moisture for BG 300, 60-80% soil moisture for BG 94/1) was imposed by maintaining variety specific soil moisture levels throughout the experimental period, while a well-watered controls (80-100% soil moisture content) was maintained for all varieties. The experiment was arranged in a Completely Randomized Design with three replications. Germination percentage, plant height, root length, leaf area, biomass accumulation, chlorophyll content, proline content, DPPH radical scavenging activity, and malondialdehyde (MDA) content were assessed at 45 days after transplanting. Results showed significant varietal responses to α-Tocopherol treatments. Seed priming significantly improved germination percentages under drought stress, reaching 65% in BG 94/1, 70% in BG 300, and 35% in BG 251 compared to their respective variety's own hydro-primed and non-primed control groups ($P < 0.05$). In BG 94/1, 60 ppm α-Tocopherol increased root length (5.52 cm vs. 3.72 cm hydro-primed; 3.10 cm non-primed) and fresh biomass (1.09 g vs. 0.35 g hydro-primed), while maintaining 42% higher chlorophyll content and reducing malondialdehyde (MDA) accumulation by 35%. In BG 300, 45 ppm produced maximum root length (9.58 cm) and elevated proline levels. For BG 251, 30 ppm yielded the highest leaf area (48.06 cm^2) alongside enhanced DPPH radical scavenging activity. These multigenetic physiological adaptations demonstrate that α-Tocopherol seed priming effectively mitigates oxidative damage, presenting a suitable approach for drought stress management.

Keywords: *α-Tocopherol, Seed Priming, Drought Stress, Rice (*Oryza sativa *L.), Antioxidant Activity*

Abstract ID: 063

GASTROINTESTINAL HELMINTHS OF BACKYARD CHICKENS IN SELECTED SITES OF KANDY AND KEGALLE DISTRICTS, SRI LANKA: PREVALENCE, SOIL ASSOCIATED FACTORS, AND DIAGNOSTIC COMPARISON

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Abstract

Backyard chickens are an important source of nutrition and income in rural Sri Lanka. However, their free-range management increases exposure to gastrointestinal (GI) helminths, which can negatively affect health and growth. Despite the importance of backyard poultry farming, information on helminth occurrence and the environmental factors influencing their transmission remains limited. Therefore, this study focused on the prevalence and infection intensity of major GI helminths in backyard chickens from selected sites in the Kandy and Kegalle and examined the influence of soil characteristics and diagnostic techniques on parasite detection. Fecal samples from 150 backyard chickens and corresponding soil samples were collected from 28 household sites in the Kandy and Kegalle. Parasite eggs were identified and quantified using direct smear, simple salt flotation, modified salt flotation, direct egg count, and McMaster techniques. Helminth infections were detected in 81.3% of the sampled chickens. Prevalence was 76.0% in Kandy and 86.7% in Kegalle, although the difference between districts was not statistically significant. *Raillietina* sp. (34.0%) and *Capillaria* sp. (32.7%) were the most frequently recorded parasites, while *Ascaridia* sp. (8.7%) and *Strongyloides* sp. (6.0%) occurred at lower prevalence levels. These infections are known to reduce growth, damage the intestinal tract, and reduce overall growth in chickens. Soil samples obtained from 28 locations revealed several environmental associations with parasite occurrence. Higher soil moisture levels were linked to increased egg counts of *Raillietina* sp., whereas lower soil pH values were associated with greater *Capillaria* sp. egg counts. In contrast, sandy-loam soils were associated with lower egg densities. Comparison of diagnostic methods showed that modified salt flotation provided the highest qualitative detection efficiency, while the McMaster technique was the most suitable approach for quantitative estimation of parasite egg counts. The results showed that soil characteristics may contribute to the survival and spread of GI helminths in backyard chicken populations. The relatively high infection rates recorded in both districts emphasize the importance of effective parasite control measures to protect chickens' health and reduce productivity losses.

Keywords: *Backyard chickens, Capillaria sp, Diagnostic techniques, Raillietina sp*

Abstract ID: 068

HEMOPARASITES IN SERVICE DOGS IN THE NAVY, ARMY AND POLICE UNITS IN SRI LANKA: OCCURRENCE AND PHYLOGENETIC CHARACTERIZATION

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Abstract

Hemoparasitic infections pose a risk to the health and operational performance of military and police working dogs due to frequent exposure to diverse environments and vector populations. This cross-sectional study investigated the occurrence and phylogenetic relationships of hemoparasites in working dogs across multiple service units in Sri Lanka. Blood samples were collected from 112 dogs (Police: 40, Army: 53, Navy: 19) between May and November 2024 and examined by microscopy, polymerase chain reaction, sequencing, and phylogenetic analysis. Overall, 11 dogs (9.8%) were positive: 10 with *Babesia gibsoni* across all three units and one police dog with *Brugia malayi*. *Babesia gibsoni* infection rates were higher in Police dogs (6/40; 15.0%) than Army dogs (3/53; 5.6%; $\chi^2 = 7.09$, $p = 0.01$), with no significant difference between Police and Navy dogs (1/19; 5.2%), though the low case numbers limit robust comparative inference. Sequencing confirmed all *Babesia*-positive amplicons as *B. gibsoni* (≥99% identity), with Neighbour-Joining phylogenetic analysis placing isolates within a well-defined *B. gibsoni* clade, clustering closely with a previously reported Sri Lankan sequence (MN988979). The detection of *B. malayi* in a police working dog at Kandy kennels is notable; while canine filarial infections in Kandy are more commonly attributed to *Dirofilaria repens*, *B. malayi* has been predominantly reported from the Western Province. Its detection here may reflect an expansion in host range or overlooked transmission dynamics, warranting further investigation, as does the striking contrast in parasitemia levels between Police, Navy and Army dog units and Sri Lanka Air Force dogs reported previously.

Keywords: *Babesia gibsoni, Brugia malayi, Hemoparasites, Molecular surveillance, Working dogs*

Abstract ID: 069

FEED PREFERENCE EVALUATION OF RABBITS USING A CAFETERIA FEEDING TRIAL

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Abstract

Fattening rabbits is a livestock enterprise that requires proper nutrition to maximize productivity and efficiency. Identifying preferred feeds helps select cost-effective, local options, yet research in this area remains limited. This experiment used a cafeteria-style repeated measures design to assess the feeding preferences of five healthy rabbits (n=5). The five tested feeds were cattle feed, CO-3 grass, water spinach (*Ipomoea aquatica*), three-flowered beggarweed (*Desmodium triflorum*), and carrot. A Friedman non-parametric test showed a significant difference in consumption levels among the feeds ($\chi^2 = 19.64$), df = 4, p=0.001). Cattle feed had the highest mean rank (SPSS: 4.93, Minitab: 24.5), followed by CO-3 grass (4.07, 20.5), water spinach (2.98, 15.0), and three-flower beggarweed (2.02, 10.0). Carrots had the lowest preference (1.00, 5.0). Time trend analysis showed minimal change in consumption over time (Yt = 35.98 - 0.038xt) with high prediction error (MAPE = 217.57%), (R^2= 0.46%). Multivariate regression also indicated that temporal trends (beta = 1.14), (p=0.741) and individual animal differences (p > 0.05) did not significantly affect intake behavior (F=0.06), (p=0.997). Rabbits display a rigid and uniform preference hierarchy that prioritizes commercial cattle feed and CO-3 grass over other tested forages and carrots. Because these feeding habits are highly stable and unaffected by time or individual animal traits, local producers can confidently use these baseline preferences to formulate consistent, cost-effective, and highly palatable daily rations.

Keywords: *Rabbit, Feed preference, Forage quality, Selective feeding, Nutrition, Cafeteria Feeding system*

Abstract ID: 070

VISUAL SENSITIVITY AND COLOR PREFERENCES OF THE HOUSE FLY (*Musca domestica*)

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Abstract

House flies (*Musca domestica*) are significant mechanical vectors that act as carriers of infectious diseases among humans and animals. The role of attraction to particular colours is a key reason for the efficiency of visual traps. To determine colours that attract large numbers of these pests or repel them, an experiment was conducted with the use of yoghurt containers which were covered with different polythene colours. These results can be useful when determining better techniques of safe food storage as well as the production of pest-resistant packaging to implement intelligent pest management. While at first the preferences of these pests may shock the researchers, their response changes according to the change in light during the course of a day. Even small changes in colours can affect the results of a trap greatly. In this experiment, yoghurt containers covered with polythene of different colours such as blue, black, red, green, purple, brown, pink, yellow, and white were used. Bait was equally placed in all cups, and traps were placed in a certain manner on the test area. The number of house flies that landed on each colour during more than 15 trials was counted to find out the preference of flies for each colour. The response of flies depended on the colour of the trap. The most attractive colour turned out to be blue, with (4.40±2.47) flies being captured during each trial. The second one was red with (4.13±1.86), and white was third, with (3.80±1.70) flies. The number of flies caught in pink traps was moderate (2.93±1.75), after which came purple (2.80±1.57), brown (2.33±1.05), and green traps (2.20±1.21). The black traps attracted almost no flies (1.67±0.90). Although the variance in yellow traps was much greater, their attractiveness was also quite low (2.33±1.99). One-way ANOVA showed that there are statistically significant differences in attraction between colours used for traps ($F=4.17$, $p < 0.05$).

Keywords: *Musca domestica, Color preference, House fly attraction, Colored traps, Pest management*

Abstract ID: 076

SEED DORMANCY, GERMINATION AND STORAGE BEHAVIOUR OF FIVE SELECTED MEDICINAL PLANTS IN SRI LANKA

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Abstract

Seed biological traits play a fundamental role in seed germination, storage behaviour, and the conservation potential of plant species. Understanding these traits is particularly important for medicinal plants, many of which are increasingly threatened by habitat loss, overexploitation, and poor natural regeneration. This study examined the seed biological traits of five selected medicinal plant species in Sri Lanka: *Cassia fistula* L.*, Codariocalyx motorius* (Houtt.) H. Ohashi*, Crotalaria verrucosa* L.*, Vitex altissima* L., and *Polyalthia suberosa* (Roxb.) Thwaites. Seed morphology, moisture content, germination behaviour, dormancy mechanisms, and storage behaviour were studied under controlled laboratory conditions. Significant interspecific variation was observed in seed size, shape, colour, and moisture content. *P. suberosa* showed the highest moisture content 37.9 ± 0.6% ($p < 0.05$), while *C. fistula* showed the lowest (7.9±0.6%, $p < .05$). Germination studies revealed distinct dormancy patterns among species. Untreated *C. verrucosa* showed the highest initial germination (73.3±4.7%) with a low T_{50} value (14 days), indicating the absence of dormancy. All other species had T_{50} values >30 days, indicating the presence of dormancy. Scarification significantly enhanced germination in *C. fistula* from 0-100% ($p < 0.05$) and *C. motorius* from 6.7 - 96.7% ($p < 0.05$), confirming the presence of physical dormancy. Gibberellic acid treatment induced germination in *P. suberosa* from 0.00 - 63.3±5.8% ($p < 0.05$), indicating the presence of physiological dormancy. Furthermore, these species exhibited contrasting differences in their seed storage behaviour. *C. fistula, C. motorius,* and *P. suberosa* retained viability after dry storage, demonstrating orthodox storage behaviour, while *C. verrucosa* lost viability following desiccation, suggesting recalcitrant storage behaviour. *V. altissima* exhibited an initial germination of 16.7±5.8%, which increased to 53.8%±7.8% ($p < 0.05$) following dry storage, indicating desiccation tolerance and the alleviation of dormancy during storage. The results revealed substantial variation in seed biological traits among the studied medicinal plant species, providing valuable insights for propagation, conservation and species-specific management strategies.

Keywords: *Medicinal plants, Seed biology, Seed dormancy, Germination, Seed storage behaviour, Conservation*

Abstract ID: 080

LARVICIDAL EFFICACY OF SELECTED MEDICINAL PLANT EXTRACTS AGAINST FOURTH-INSTAR *Aedes albopictus* (DIPTERA: CULICIDAE) LARVAE

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Abstract

Dengue fever is a leading public health problem spreading through the world via mosquitoes, especially in tropical and subtropical areas, and therefore in need of environmentally safe alternatives to synthetic insecticides. The present study investigated the larvicidal activity of aqueous leaf extracts of six medicinal plants, namely *Cinnamomum zeylanicum, Passiflora foetida, Azadirachta indica, Carica papaya, Andrographis paniculata* and *Caesalpinia bonduc,* against fourth-instar larvae of *Aedes albopictus*. An experimental design using laboratory-reared mosquitoes was used, and the eggs were collected from the Dummalasuriya, Kurunegala District, Sri Lanka area and reared under controlled conditions. The concentration series was generated from a 160 mg mL^{-1} stock solution prepared by mixing 160 g of fresh leaves in 1000 mL of distilled water and then serially diluted two-fold to 80, 40 and 20 mg mL^{-1}. Fourth-instar larvae were exposed to the four concentrations for 12 and 24 h according to the World Health Organization standard larvicidal bioassay protocol. Larval mortality was documented, and median lethal concentration (LC_{50}) and 90% lethal concentration (LC_{90}) were determined by probit regression analysis. The results revealed a concentration- and time-dependent increase in larval mortality for all tested extracts. At 12 h, *Cinnamomum zeylanicum* caused 62.50%, 84.16%, 100% and 100% mortality at 20, 40, 80 and 160 mg mL^{-1}, respectively, while *Passiflora foetida* caused 81.66%, 88.33%, 90.83% and 100% mortality at the corresponding concentrations. At 160 mg mL^{-1}, *Caesalpinia bonduc, Azadirachta indica, Carica papaya* and *Andrographis paniculata* showed maximum mortalities of 95.00%, 51.66%, 52.50% and 36.66%, respectively. At 24 h, *Passiflora foetida* and *Cinnamomum zeylanicum* achieved 100% mortality at the highest concentration. The lowest LC_{50} (5.716 mg mL^{-1}) and LC_{90} (20.760 mg mL^{-1}) were recorded for *Passiflora foetida*, followed by *Cinnamomum zeylanicum* (LC_{50} = 13.756 mg mL^{-1}; LC_{90} = 34.080 mg mL^{-1}), whereas *Carica papaya* had the highest LC_{50} value (119.702 mg mL^{-1}). The 24-h probit regression slopes were statistically significant for *Caesalpinia bonduc* (p=0.007) and *Azadirachta indica* (p=0.022), whereas the LC_{50} and LC_{90} estimates for the remaining extracts were not statistically significant and should therefore be regarded as indicative estimates. These findings identify *Passiflora foetida* and *Cinnamomum zeylanicum* as the most promising botanical larvicides among the six tested plants.

Keywords: *Aedes albopictus, Botanical larvicides, Medicinal plants, Larval mortality, Vector management*

Abstract ID: 081

ALPHA TOCOPHEROL SEED PRIMING ENHANCES SALT TOLERANCE OF SALT SENSITIVE RICE VARIETIES

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Abstract

Salinity stress is a major constraint to rice production, particularly during early plant establishment. This study evaluated the effectiveness of α-tocopherol seed priming in enhancing salinity tolerance in three rice varieties differing in salt tolerance: Pokkali (salt tolerant), At 354 (moderately salt tolerant), and At 362 (salt sensitive). Seeds were primed with different concentrations of α-tocopherol for 16 hours and exposed to threshold salinity levels of 10 dS m^{-1}, 6 dS m^{-1} and 4 dS m^{-1} for Pokkali, At 354 and At 362, respectively, under controlled laboratory conditions. Germination was assessed within 7–10 days, while growth, physiological, and biochemical parameters were evaluated 45 days after treatment initiation. Salinity stress significantly reduced shoot length (shoot length reduced from 36.20 to 31.50 cm in Pokkali, from 28.63 to 23.10 cm in at 354, and from 28.79 to 19.86 cm in At 362), leaf area, biomass accumulation, and chlorophyll content while increasing antioxidant activity and oxidative damage (MDA content increased from 1.84 to 3.42 nmol g^{-1}, 1.90 to 2.95 nmol g^{-1}, and 2.34 to 2.95 nmol g^{-1}, in Pokkali, At 354 and At 362 respectively). However, α-tocopherol priming alleviated these adverse effects in a genotype-dependent manner, with optimal concentrations of 20 ppm for Pokkali, 40 ppm for At 354, and 100 ppm for At 362. In the salt-sensitive variety at 362, optimal priming increased shoot length from 19.86 to 25.50 cm ($p < 0.001$), leaf area from 3.25 to 4.70 cm^2 ($p < 0.001$), total chlorophyll content from 1.2 to 2.30 mg g^{-1} FW ($p < 0.001$), and proline accumulation from 51.20 to 88.98 µg g^{-1} FW ($p < 0.001$), while enhancing DPPH radical scavenging activity from 16.13% to 50.62% ($p < 0.001$). Furthermore, α-tocopherol priming significantly reduced malondialdehyde accumulation (decreased from 2.95 to 1.75 nmol g^{-1}, representing a 40.7% reduction), indicating lower lipid peroxidation and oxidative stress. Overall, α-tocopherol seed priming effectively mitigated salinity-induced damage by preserving photosynthetic pigments, improving osmotic adjustment, and strengthening antioxidant defence systems. The findings highlight the potential of α-tocopherol priming as a simple and cost-effective strategy for improving salinity tolerance in rice, although genotype-specific optimization of priming concentration is essential to maximize its benefits.

Keywords: *α-tocopherol, Seed priming, Salinity stress, Antioxidant activity, Osmotic adjustment, Oxidative stress*

Abstract ID: 084

SEED DORMANCY AND DORMANCY-BREAKING MECHANISMS OF SELECTED MEDICINAL PLANTS

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Abstract

Medicinal plants play a vital role in both traditional and modern medicine. Knowledge of seed dormancy and germination of medicinal plants is essential for propagation and conservation. However, information on dormancy types and dormancy-breaking methods remains limited for several species. Therefore, this study determined seed dormancy, dormancy type, and suitable dormancy-breaking methods in *Ocimum tenuiflorum*, *Senna tora, Cardiospermum halicacabum, Ricinus communis, Senna alata, Opuntia ficus-indica,* and *Aegle marmelos*. Fully mature seeds were collected and subjected to standard germination and dormancy-breaking treatments. Data are presented as mean±standard deviation (SD), with n=4 representing the number of replicates. Standard germination showed high germination in *A. marmelos* (98±5%) and *O. tenuiflorum* (91.25±11.09%) without pre-treatment, indicating no seed dormancy. Low germination percentages were observed in *S. tora* (36.25±4.79%), *S. alata* (16±4.79%), *C. halicacabum* (3±0.96%), *R. communis* (1.25±2.5%), and *O. ficus-indica* (0%), indicating seed dormancy. Imbibition studies showed the presence of a permeable seed coat and absence of a physical barrier in all species. Mechanical scarification increased germination in *S. tora* (36.25±4.79% to 71.67± 7.64%, $p < 0.001$), *C. halicacabum* (3±0.96% to 33.75±7.5%, $p= 0.002$), *S. alata* (16 ± 4.79% to 68.75±11.09%, $p < 0.001$), *R. communis* (1.25±2.5% to 75±4.08%, $p < 0.001$) and *Opuntia. Ficus indica*. (0% to 47.5±5%, $p < 0.001$). Heat treatment at 40 ºC significantly increased germination in *S. tora* (36.25±4.79% to 77.5±6.45%, $p < 0.001$) and *S. alata* (16± 4.79% to 75±9.13%, $p < 0.001$) while at 80 ºC in *O. ficus-indica* (0% to 31.25 ± 6.29%, $p < 0.001$). Chemical scarification with 0.5% H_2SO_4 significantly increased germination in *S. alata* (16±4.79% to 82.5±2.89%, $p < 0.001$), while 1% HCl increased germination in *O. ficus-indica* (0% to 67.5 ± 10.4%, $p < 0.001$). GA_3 treatment at 500ppm significantly increased germination in *R. communis* (1.25±2.5% to 98.75±2.5%, $p < 0.001$), *C. halicacabum* (3± 0.96% to 71.25±8.54%, $p < 0.001$), and *S. alata* (16% to 52.5±5%, $p < 0.001$). Overall, this study provides insights into dormancy characteristics and species-specific dormancy-breaking requirements, supporting propagation, conservation, and sustainable utilization of these medicinal plant species.

Keywords: *Conservation, Germination, Gibberellic acid, Medicinal plants, Scarification, Seed dormancy*

Abstract ID: 087

INSECTICIDAL EFFECT OF CERTAIN MEDICINAL PLANTS SOLVENT EXTRACTS AGAINST EARLY-STAGE OF *Leucinodes orbonalis* Guenée LARVAE IN EGGPLANT

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Abstract

Brinjal, *Solanum melongena L*. is one of the most important vegetable crops grown in Sri Lanka and other tropical countries. Its production, however, is seriously impeded by the brinjal fruit and shoot borer, *Leucinodes orbonalis,* which is regarded as the most devastating insect pest and causes significant yield and economic losses. Synthetic insecticides are frequently used to control this pest, but the frequent use of certain ones has led to pollution of the environment, insecticide resistance, residue build-up, and negative impacts on beneficial organisms and human health. The objective of this study was to assess the insecticidal properties of the five plant extracts, namely *Swietenia macrophylla* (leaf), *Ocimum tenuiflorum* (leaf), *Cassia auriculata* (flower), *Alpinia officinarum* (rhizome), and *Citrus aurantiifolia* (peel), against early-stage *Leucinodes orbonalis* Larvae under controlled conditions in the laboratory. The plant materials were extracted with methanol, and the insecticidal activity was evaluated at two concentrations (1000 ppm and 3000 ppm). Mortality Assays were performed for 72 hrs and recorded every 2 hrs. Each treatment consisted of 40 Larvae, with a total of 1200 larvae used across all treatments. The reatments were arranged in a completely randomized design. The treatments were replicated four times to guarantee the reliability of the experiment. In order to compare the insecticidal effectiveness of the different plant extracts, survival analysis was carried out using Minitab statistical software. Survival analysis and Kaplan-Meier curves were used for analysis of the mortality data. From the results, it was observed that the flower extract of *Cassia auriculata* showed the maximum insecticidal activity at 1000 ppm and 3000 ppm after 72 hours, with mortality rates of 87.50±5.23% and 90.0±4.74%, respectively. *Ocimum tenuiflorum* leaf extract was the least effective, with 30.0±7.45%and 42.5±7.81% mortality at the respective concentrations. The effectiveness of the insecticides was found to be in the following order: *Cassia auriculata> Swietenia macrophylla> Alpinia officinarum> Citrus aurantiifolia> Ocimum tenuiflorum*. The log-rank test analysis showed that there were significant differences among the mortality curves of the plant extracts (1000ppm: χ^2=35.9241, df=4, $p < 0.001$; 3000ppm: χ^2=1.8685, df=4, $p < 0.001$). The alkaloids, flavonoids, phenols, tannins, saponins, steroids, and terpenoids were identified by phytochemical screening, and they were found in different concentration levels in the extracts. The study offers insights into the development of eco-friendly botanical pesticides as an alternative to synthetic pesticides for controlling *L. orbonalis* infestation.

Keywords: *Brinjal, Botanical insecticides, Biopesticides, Insecticidal activity, Leucinodes orbonalis, Plant extracts in methanol, Survival analysis, Sustainable pest management*

Abstract ID: 091

ISOLATION & IDENTIFICATION OF BACTERIA PRESENT IN DESICCATED COCONUT AFTER THE DRYING PROCESS

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Abstract

Desiccated coconut is a low-moisture, ready-to-eat food product manufactured from fresh coconut kernel by cutting or shredding it and subsequently subjecting it to thermal processing and drying to reduce microbial loads and extend the shelf life. However, certain microorganisms may survive processing or may be introduced through subsequent handling. This study aimed to isolate and identify bacteria surviving after the drying process in two desiccated coconut manufacturing factories, representing organic and conventional desiccated coconut processing. Samples were collected from an organic desiccated coconut factory located in Negombo and a conventional desiccated coconut factory located in Kurunegala. Bacterial colonies were isolated on nutrient agar, and ten distinct colonies were selected for further identification. The isolates were identified based on their morphological characteristics such as colony morphology, Gram-staining, cell morphology, arrangement, spore formation, and growth under aerobic and anaerobic conditions. Further identification was performed using biochemical tests, including the catalase test, Oxidase test, Oxidation-fermentation test, Voges-Proskauer test, Nitrate reduction test, Arginine decarboxylase test, Urease test, Triple-sugar iron test, Indole test, and sugar fermentation tests. Based on the combined morphological and biochemical characteristics, the ten isolates were assigned to three bacterial genera: *Bacillus, Micrococcus*, and *Staphylococcus.* The detection of bacterial isolates after drying indicates that thermal processing does not necessarily eliminate the entire bacterial population and underscores the importance of maintaining strict hygienic practices during subsequent processing and handling. The findings provide preliminary information on bacterial populations surviving after drying and can support further investigations on microbial survival and contamination control in desiccated coconut production.

Keywords: *Desiccated coconut, Drying process, Food hygiene, Food microbiology, Microbial contamination*

Chemical Sciences

Abstract ID: 035

EXPLORING THE IMPACT OF SUBSTITUENTS ON AROMATIC PYRROLE BORANE IN THE DEHYDROGENATION PROCESS: A COMPREHENSIVE INVESTIGATION OF ELECTRON-DONATING GROUPS FOR ENHANCED EFFICIENCY

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Abstract

A detailed theoretical analysis of pyrrole borane and its dehydrogenated counterpart has been performed to explore its capabilities towards hydrogen storage. The dehydrogenation pathway was substituted by electron-donating groups such as –OH, $–NH_2$, $–SCH_3$, and $–OCH_3$ in single alpha(C2) or single beta (C3), or both alpha and beta positions. The optimized geometries of reactant complexes, transition states, and product complexes have been obtained using the CBS-QB3 composite method; initial screening of molecular geometries and properties was carried out at the Hartree-Fock (HF) theory level. A comparative structural analysis revealed that pyrrole borane has a longer dative B-N bond distance, and consequently a lower bond dissociation energy, compared to pyrrolidine borane. The predicted enthalpies of dehydrogenation with various electron-donating groups, in hydrogen elimination, are more exothermic and not much closer to thermoneutrality than related substituted systems. The free energy barrier falls significantly in α-OCH_3, α-NH_2, β-NH_2, α-OH, 2,5-OH, and 3,4-NH_2. This study endorses the fact that pyrrole borane-α-OH is identified as the optimal Compound compared to other compounds. Moreover, it achieves the lowest catalyzed activation energy of 39.15 kJ/mol while satisfying E_a(cat.) < BDE margin by 1.27 kJ/mol in dehydrogenation at a pressure of 1 atm and 298 K temperature.

Keywords: *Hydrogen storage, Pyrrole borane, Dehydrogenation, CBS-QB3, Dative Bond Activation, Electron-Donating Groups*

Abstract ID: 043

COMPUTATIONAL STUDIES OF CHEMICAL HYDROGEN STORAGE POTENTIAL OF AROMATIC THIOMORPHOLINE BORANE ADDUCT

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Abstract

Efficient and safe hydrogen storage remains a primary challenge for the practical usage of hydrogen as a dominant fuel source. In response, material-based chemical storage using amine-borane adducts has attracted significant interest. Cyclic amine-boranes emerge as particularly promising due to their structural stability and highly favorable dehydrogenation properties. In this work, a detailed theoretical evaluation of Aromatic Thiomorpholine Borane (ATMB), a cyclic amine-borane, was conducted at an elevated temperature of 450 K to assess its viability as a solid-state hydrogen storage material under practical fuel cell conditions. Using the Complete Basis Set-Quadratic Becke 3 (CBS-QB3) composite method, thermochemical parameters, B-N bond dissociation energies (BDE), and potential energy surfaces associated with the dehydrogenation pathways were precisely calculated. The computed standard Gibbs free energy change of -107.9 kJ/mol indicates the thermodynamic spontaneity of hydrogen release from ATMB at 450 K. Furthermore, the standard enthalpy of dehydrogenation was found to be -48.5 kJ/mol, confirming that the elimination process is exergonic and energetically feasible. Transition state structures for both uncatalyzed and borane (BH_3)-catalyzed pathways were successfully isolated. The theoretical analysis reveals that the BH_3 catalyst significantly lowers the activation energy barrier to 63.7 kJ/mol. Because this barrier falls below the calculated B-N bond dissociation energy of 94.0 kJ/mol, the catalyst plays a vital role in facilitating efficient hydrogen release while actively avoiding undesired structural decomposition. This study confirms that ATMB can release hydrogen selectively and rapidly when catalyzed, establishing a strong theoretical foundation for its integration into advanced hydrogen fuel cell technologies.

Keywords: *Aromatic Thiomorpholine Borane, Hydrogen Storage, CBS-QB3, Elevated Temperature, Catalytic Dehydrogenation, B-N bond dissociation energy*

Abstract ID: 058

COMPARATIVE EVALUATION OF SPRAY-DRYING AND FREEZE-DRYING ON THE ANTIOXIDANT STABILITY AND DPPH RADICAL SCAVENGING ACTIVITY OF MALTODEXTRIN–ENCAPSULATED *Psidium guajava* LEAF POWDER

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Abstract

Plant-derived antioxidants represent a promising strategy for combating oxidative stress and chronic inflammation. *Psidium guava* (guava) leaves have been extensively studied for their phenolic-rich extracts and antioxidant activity, yet there is a lack of comparative data on how microencapsulation with maltodextrin during spray-drying and freeze-drying impacts of their antioxidant stability over time. The present study is therefore designed to compare the effects of spray-drying and freeze-drying on the stability of total phenolic content (TPC), total flavonoid content (TFC), DPPH scavenging activity, FRAP (Ferric Reducing Antioxidant Power), and ABTS radical scavenging activity of *Psidium guajava L.* leaf powder encapsulated with 10% and 20% maltodextrin during 30 days of storage. Guava leaf extracts were prepared using four extraction methods: (1) ethanol extraction (70% ethanol), (2) methanol extraction (80% methanol), (3) aqueous extraction (distilled water), and (4) hydroethanolic extraction (50% ethanol: water). Powders were formulated through both drying methods and assessed for multiple antioxidant assays. TPC (expressed as gallic acid equivalents), TFC (expressed as quercetin equivalents), DPPH (% inhibition), FRAP (μM Fe^{2+}/g), and ABTS (% inhibition) were measured at Day 0, Day 15, and Day 30. The 30-day storage period was selected based on standard nutraceutical stability guidelines (ISO 15652:2019) for short-term powder formulation assessment, representing the typical shelf-life window before commercial packaging and providing sufficient data points to calculate degradation kinetics. The study is expected to identify differences in stability between the two drying methods and determine the effect of maltodextrin concentration on antioxidant retention. TAC, catalase, and SOD-mimetic assays will provide further insight into the bioactive potential of guava leaf powder. The findings may support the development of stable, scalable guava-based nutraceutical ingredients for functional foods and dietary supplements, contributing to Sri Lanka's growing natural products industry.

Keywords: *Psidium guava, Maltodextrin, spray drying, Freeze drying, Antioxidant stability, Total phenolic content, Total flavonoid content, DPPH scavenging activity*

Abstract ID: 065

SYNTHESIS OF CuNi INTERMETALLIC NANOPARTICLES VIA REDUCTION METHOD FOR CATALYTIC APPLICATIONS

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Abstract

In the present study, CuNi intermetallic nanoparticles (IMNPs) were synthesized with 1:1 and 2:1 molar ratios via the seed-mediated growth method. In this approach, one metal first forms seed nanoparticles that subsequently incorporate the second metal to produce an ordered intermetallic phase. This seed-mediated process provides better control over particle size, shape, and atomic arrangement by regulating the local chemical environment. Ascorbic acid acts as the reducing agent, while iron (III) chloride promotes oxidative etching and defect removal, resulting in uniform, well-structured nanoparticles. Unlike conventional methods that require very high synthesis temperatures, the CuNi IMNPs were successfully synthesized at a relatively low temperature of 200 °C using a simple and cost-effective approach. The synthesized nanoparticles were characterized using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), and UV-Visible spectroscopy. The XRD results confirmed that the synthesized IMNPs have a face-centered cubic crystal lattice structure. The average crystal size of the nanoparticles was calculated to be approximately 9 nm using the Debye-Scherrer equation. The catalytic activities of the synthesized CuNi nanoparticles were evaluated through the reduction of methyl orange in the presence of ascorbic acid. The reaction followed pseudo-first-order reaction kinetics. The Cu-Ni (1:1) NPs required 42 min for the reduction process with a rate constant of 0.038 min^{-1}. The Cu-Ni 2:1 molar ratio NPs completed the reduction within 17 min with a higher rate constant of 0.064 min^{-1}. The results suggest that CuNi IMNPs possess significant potential as an efficient catalyst for dye reduction. This study demonstrates that CuNi IMNPs can be synthesized via the seed-mediated growth method under relatively low temperatures, and the synthesized nanoparticles have significant potential as efficient catalysts for dye reduction.

Keywords: *CuNi intermetallic nanoparticles, Seed-mediated growth, Dye reduction, Methyl orange dye*

Abstract ID: 073

COMPARATIVE EVALUATION AND SPECTROSCOPIC CHARACTERIZATION OF LYCOPENE EXTRACTED FROM TOMATO USING DIFFERENT SOLVENT SYSTEMS.

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Abstract

This study investigated the presence of lycopene, a pigment responsible for the red color of ripe tomatoes (*Solanum lycopersicum* L.) and recognized for its potent antioxidant activity and numerous health-promoting properties. The extraction efficiency of lycopene is strongly influenced by the choice of extraction solvent; therefore, identifying an optimum solvent system is essential for maximizing quality. This study aimed to optimize the extraction of lycopene from tomato using three different solvent mixtures, hexane: acetone (HA), hexane: ethanol (HE), and hexane:acetone:ethanol (HAE), and characterize the extracted pigment using UV–Visible spectroscopy, Thin Layer Chromatography (TLC), and Fourier Transform Infrared (FTIR) spectroscopy. UV–Visible spectroscopic analysis revealed a characteristic absorption maximum at 470 nm, confirming the presence of lycopene in all extracts. Among the solvent systems investigated, the HAE mixture exhibited the highest absorbance of 0.98 and extraction yield of 0.71 g, followed by HA with an absorbance of 0.89 and yield of 0.645 g, while HE showed the lowest absorbance of 0.81 and yield of 0.587 g. TLC analysis showed an orange-red spot with a retardation factor (Rf) ranging from 0.79 to 0.86, confirming the presence of lycopene. Among the extracts, HAE produced the most intense spot. FTIR spectra displayed characteristic bands near 3011, 2915, 2854, 1650, 1461, and 1375 cm^{-1}, corresponding to olefinic and aliphatic C–H stretching, conjugated C=C stretching, and CH_2/CH_3 bending vibrations. A weak absorption band near 1746 cm^{-1} was attributed to minor carbonyl-containing compounds or slight oxidative degradation products rather than to lycopene. Overall, HAE was the most effective solvent system, providing the highest lycopene yield and concentration while maintaining its structural integrity. This method may support the production of high-quality natural lycopene for food, nutraceutical, pharmaceutical, and cosmetic applications. These results demonstrate the importance of solvent polarity for improving pigment recovery.

Keywords: *Lycopene; Tomato* (*Solanum lycopersicum* L.*), Solvent extraction, Solvent optimization, UV–Visible spectroscopy, FTIR spectroscopy, Thin-layer chromatography*

Abstract ID: 074

COMPARATIVE ASSESSMENT OF COASTAL WATER QUALITY AT THREE RECREATIONAL BEACHES IN EASTERN SRI LANKA

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Abstract

This study assessed the seawater quality of three recreational beaches, Arugam Bay, Pasikudah, and Karaitivu, in Eastern Sri Lanka during the rainy season from December to January. Seawater samples were analysed following standard APHA procedures for physicochemical and microbiological parameters, including water temperature, turbidity, salinity, electrical conductivity (EC), pH, dissolved oxygen (DO), biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total suspended solids (TSS), phosphate, nitrite, oil and grease, *Escherichia coli*, and total coliforms. The measured parameters were compared with recreational water quality reference values adopted from WHO and USEPA guidelines. Distinct spatial differences were observed among the three beaches ($p < 0.05$). Arugam Bay recorded the highest salinity (30.32±0.60 PSU), EC (49.93±1.81 mS/cm), COD (128.00±24.44 mg/L), and TSS (811.40±70.10 mg/L), indicating comparatively high dissolved ionic content and suspended and organic loads. Pasikudah recorded the highest *E. coli* concentration (199.10± 96.90 CFU/100 mL) and oil and grease content (239.30±126.70 mg/L), while the mean *E. coli* concentration remained below the stated recreational guideline value of 200 CFU/100 mL. Karaitivu exhibited the highest turbidity (16.09±11.39 NTU) and the lowest DO concentration (2.96±0.39 mg/L), indicating poorer water clarity and lower oxygen availability compared with the other two beaches. The pH, BOD_5, phosphate, nitrite, *E. coli*, and total coliform levels remained within the stated reference limits at all three beaches. In contrast, TSS and COD exceeded the respective recommended values, while DO remained below the recommended value at all sites, and turbidity exceeded the recommended value at Karaitivu. These results demonstrate clear spatial variability in seawater characteristics among the studied beaches and indicate that recreational water quality and suitability vary by location. Continued site-specific monitoring is recommended to assess temporal changes and support appropriate coastal water quality management.

Keywords: *Coastal seawater quality, Recreational beaches, Physicochemical parameters, Microbiological indicators, Escherichia coli*

Abstract ID: 075

DEVELOPMENT OF A pH-RESPONSIVE SELF-HEALING BIOPOLYMER FILM USING CHITOSAN EXTRACTED FROM PRAWN SHELL WASTE

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Abstract

Biopolymer films represent a sustainable alternative to conventional plastics, particularly in the development of active and smart packaging systems. Chitosan, an abundant natural polysaccharide, is an excellent candidate for this application due to its biocompatibility, non-toxicity, and strong film-forming properties. In this study, chitosan was successfully extracted from prawn shells via a controlled acetylation process. To develop pH-responsive smart packaging capabilities and enhance functional properties, Biopolymer films were synthesized using extracted chitosan. A specific self-healing formulation was developed utilizing urea as an activator to improve the structural integrity of the matrix. Surface morphological and physicochemical characterizations of the synthesized biopolymer film were conducted. The pH-responsive behaviour and mechanical stability of the films were optimized for advanced packaging applications. Among the synthesized formulations, the Biopolymer film activated via urea demonstrated superior mechanical properties and a distinct pH-responsive visual response, operating optimally within a pH range of 5 to 6. Furthermore, the optimized film exhibited notable improvements in structural stability alongside a rapid and reversible colorimetric response to environmental pH variations, confirming its viability for advanced smart packaging applications.

Keywords: *Biopolymer films, Chitosan, Prawn shell waste, pH-responsive, Self-healing*

Abstract ID: 082

TRANSITION METAL-DOPED Fe-BASED PRUSSIAN BLUE ANALOGUE NANOPARTICLES AS EMERGING ELECTROCHROMIC MATERIALS FOR ENERGY-EFFICIENT SMART WINDOWS

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Abstract

Electrochromic smart window technology is an emerging solution for energy-efficient buildings by enabling dynamic control of solar radiation and visible light transmission while operating at low power. In this study, undoped and doped PBAs were systematically investigated as aqueous nanoparticle inks for solid-state ECSW applications. Transition metals Co, Ni, Cu, Zn, Mn and Cr were introduced into the Prussian Blue Analogue (PBA) framework while maintaining a fixed Fe^{3+}: dopant ratio of 1:4 to provide a controlled and systematic comparison of the influence of different transition metal dopants on the structural and electrochemical properties of the PBA framework. UV-Visible spectroscopy revealed characteristic absorption extending from 800 to 1100 nm, covering a significant portion of the near-infrared region and demonstrating the potential of the synthesized materials for solar-radiation modulation in smart-window applications. Powder X-ray diffraction data clearly confirmed the formation of PBA phases, while the Zn-Fe PBA exhibited a distinctly different diffraction pattern with sharper and additional reflections compared with the other doped PBAs, indicating dopant-dependent changes in nucleation, crystal growth and structural ordering due to the weak Jahn-Teller active d^{10} electron configuration of Zn^{2+}. The Electrochemical properties of the PBA films were evaluated by cyclic voltammetry using a three-electrode configuration. Zn-Fe PBA exhibited different redox features at approximately 0.25 V and 0.88 V versus Ag/AgCl, compared with approximately 0.24 V and 0.91 V for undoped PB, confirming the retention of the characteristic Fe^{2+}/Fe^{3+} redox process following Zn incorporation. Finally, synthesized PBA NP inks were applied to fabricate solid-state electrochromic smart window devices with a configuration of FTO/TiO_2; P25/Chitosan polymer-based KCl gel electrolyte/PBA NPs/FTO, and EIS analysis and electrochromic performance analysis. These findings identified Zn-Fe PBA as a promising low-cost, energy-efficient, and environmentally sustainable material for next-generation solid-state ECSW technologies.

Keywords: *Prussian Blue Analogue (PBA), Electrochromic Smart Window (ECSW)*

Financial assistance from South Eastern University of Sri Lanka (Grant No: SEU/ASA/RG/2021/11) is acknowledged.

Abstract ID: 086

ASSESSMENT OF MICROBIAL WATER QUALITY AT ARUGAM BAY, PASIKUDA AND KARAITIVU BEACHES: CORRELATIONS WITH SOME SELECTED ENVIRONMENTAL FACTORS

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Abstract

This study assessed the microbial water quality of coastal waters at three selected beaches on the eastern coast of Sri Lanka: Arugam Bay, Pasikuda and Karaitivu. The study focused on identifying and quantifying selected microbial indicators, including Escherichia coli (E. coli), total coliforms, and enterococci, to provide preliminary information on microbial contamination in these areas. Further, algal concentration was assessed at Karaitivu Beach. The influence of selected environmental parameters, including temperature, turbidity, electrical conductivity (EC), pH, dissolved oxygen (DO), and salinity, on the distribution of microbial indicators was also investigated in February 2026 and examined using standard microbiological and physicochemical methods. Karaitivu Beach, geographically located between Arugam Bay and Pasikuda, was used as a comparative reference site. The results suggested that the water quality characteristics of Karaitivu Beach were intermediate relative to the other two study sites. Two-sample *t*-tests at a 95% confidence level were conducted. A significant difference in *E. coli* counts was observed between Arugam Bay and Karaitivu (p=0.049), whereas no significant difference was detected between Pasikuda and Karaitivu (p=0.069). Total coliform counts showed no significant differences between Arugam Bay and Karaitivu (p=0.067) or between Pasikuda and Karaitivu (p=0.065). Similarly, enterococci count did not differ significantly between Arugam Bay and Karaitivu (p = 0.151) or between Pasikuda and Karaitivu (p=0.076). Arugam Bay, a significant negative correlation was observed between *E. coli* counts and EC (r = −0.774, p=0.041), 1 while at Pasikuda, *E. coli* counts showed a significant positive correlation with turbidity (r = 0.811, p=0.027). At Karaitivu, *E. coli* counts were positively correlated with temperature (r = 0.617, p = 0.014), whereas enterococci counts exhibited a significant negative correlation with pH (r = −0.773, p=0.041). Furthermore, significant negative correlations were observed between *E. coli* and DO (p = 0.001), and between enterococci and DO (p = 0.047). Overall, relatively high microbial counts were recorded at Pasikuda Beach, suggesting the possible presence of contamination sources and indicating a potential health risk for recreational users during the study period. However, as the study was based on a single sampling campaign, continuous monitoring and environmental surveillance are recommended to assess long-term water quality and ensure public health and coastal water safety.

Keywords: *Coastal water quality, Microbial contamination, Recreational beaches, Escherichia coli (E. coli), Total coliforms, Enterococci, Environmental parameters*

Abstract ID: 089

IN SILICO EVALUATION OF *OSBECKIA ASPERA* PHYTOCHEMICALS AS POTENTIAL NPC1L1 INHIBITORS FOR REGULATING CHOLESTEROL ABSORPTION

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Abstract

Niemann–Pick C1-Like 1 (NPC1L1) is an important intestinal cholesterol transporter involved in cholesterol uptake and a proven clinical target for hypercholesterolemia. Ezetimibe is a clinically approved NPC1L1 inhibitor; however, its side effects encourage the search for safer and more effective alternatives. In this computational study, six phytochemicals previously reported from *Osbeckia aspera*, including ellagic acid, quercetin, kaempferol, kaempferol-3-O-β-glucopyranoside, quercetin-3-O-β-galactopyranoside, and tiliroside, were evaluated as potential NPC1L1 inhibitors, with ezetimibe included as the reference compound. The ligand structures were retrieved from the PubChem database, while the crystal structure of NPC1L1 (PDB ID: 7DFW) was obtained from the Protein Data Bank (PDB). Ligand structures were geometry-optimized using density functional theory (DFT) with the B3LYP / 6-31++G (d, p) basis set. Potential protein-ligand binding-site residues were identified using the PrankWeb server, and molecular docking was carried out with AutoDock Vina via Chimera. The complexes showing the most favorable docking structures were selected for 100 ns molecular dynamics (MD) simulations using GROMACS to analyse and compare the conformational stability and dynamics of both the apo-protein and the protein–ligand systems. Structural stability was determined using RMSD, RMSF, SASA, Rg, and hydrogen-bond analysis. Binding free energies were calculated using the molecular mechanics Poisson-Boltzmann surface area (MM-PBSA) method. The ADMET analysis compared the drug-likeness, pharmacokinetic behaviour, and toxicity properties of ezetimibe and tiliroside. Docking results revealed that tiliroside showed the highest docking affinity toward NPC1L1(−10.8 kcal/mol) compared with ezetimibe (−10.0 kcal/mol). The MD trajectory analysis indicated that binding of both tiliroside and ezetimibe enhanced the structural stability of NPC1L1, as evidenced by lower overall structural deviations and reduced residue-level fluctuations compared with the apo-protein throughout the simulation. MM-PBSA calculations suggested a more favourable predicted binding energy for tiliroside (−34.90 kcal/mol) relative to ezetimibe (−22.40 kcal/mol). Although tiliroside showed promising interactions with NPC1L1 to regulate intestinal cholesterol absorption, its violations of Lipinski's rule of five and other ADMET limitations indicate the necessity for structural modification and experimental validation. Overall, these findings highlight tiliroside as a potential lead candidate for future development of novel NPC1L1 inhibitors.

Keywords: *AutoDock Vina, Density functional theory, Ezetimibe, MM-PBSA, Tiliroside*

Abstract ID: 093

PHYTOCHEMICAL CHARACTERIZATION AND LARVICIDAL EFFICACY OF SOLVENT EXTRACTS OF SIX MEDICINAL PLANTS AGAINST *Tribolium castaneum* IN STORED RED RICE FLOUR

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Abstract

The red flour beetle (*Tribolium castaneum*) is a significant pest of stored grains and grain products, causing considerable qualitative and quantitative losses in stored red rice flour. As the world moves towards environmentally friendly agricultural practices, synthetic pesticides that pose risks to human health and the environment are gradually being replaced by plant-based pesticides. Plant-derived pesticides are preferred as they are biodegradable, eco-friendly, cost-effective, and generally less hazardous to humans and non-target organisms. This study aimed to evaluate the larvicidal activity of six medicinal plant species, such as *Pongamia pinnata* (stem bark), *Lantana camara* (leaves), *Vitex negundo* (leaves), *Moringa oleifera* (leaves), *Psidium guajava* (leaves), and *Syzygium cumini* (seed), for larvicidal activity against *T. castaneum* under controlled laboratory conditions (30±2 °C) and 65±5% RH) with 3 replicates. The experimental data were analyzed using IBM SPSS Statistics Version 26 to determine the effects of plant species, extract concentration, and their interaction on larval survival at statistical significance ($p < 0.05$). Among the tested extracts, *P. pinnata* (stem bark) exhibited the highest activity, resulting in the highest larvicidal activity (mean larval survival = 9.16±0.88) against *T. castaneum*. To identify the bioactive constituents, 30 g of crude *P. pinnata* stem bark extract was fractionated by silica gel column chromatography. Elutions with hexane, ethyl acetate, and methanol yielded thirteen fractions, which were pooled according to their thin-layer chromatography profiles. The antioxidant activity of *P. pinnata* bark extract was evaluated using the DPPH free radical scavenging assay. The EC50 value of the extract was 19.9 ppm, compared with 4.94 ppm for ascorbic acid. Preliminary phytochemical screening revealed the presence of phenols, flavonoids, alkaloids, tannins, saponins, terpenes, steroids and glycosides. Flavonoids and Chalcones are believed to contribute to larvicidal activity through feeding toxicity and disruption of physiological processes. The findings suggest that *P. pinnata* stem bark possesses promising larvicidal properties and has potential for development as a plant-based bioinsecticide against *T. castaneum*.

Keywords: *Antioxidant activity, Column chromatography, Larvicidal efficacy, Phytochemical screening, Pongamia pinnata, Tribolium castaneum*

Computer Science

Abstract ID: 009

MIXED-METHODS ANALYSIS OF EMOTIONS AND THINKING PATTERNS IN AGILE IT TEAMS: INSIGHTS FROM SRI LANKAN SOFTWARE DEVELOPMENT CONTEXT

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Abstract
Agile software development has become the dominant approach in Sri Lanka's rapidly growing IT industry. While it enables faster delivery, it also creates significant emotional and cognitive challenges for developers due to tight deadlines, frequent changes in requirements, and high pressure during short sprints. This mixed-methods study examined how emotions and thinking patterns vary among agile IT professionals based on gender, age, designation, work setup, team size, and frequency of face-to-face interactions. Quantitative data were collected via a structured survey of 190 Sri Lankan IT professionals working in agile environments. Qualitative data were gathered through interviews, voice recordings, WhatsApp messages, and sticky notes. Reliability analysis showed good internal consistency (Cronbach's $\alpha > 0.84$). Statistical analyses including Kruskal-Wallis tests, regression, and mediation analysis were conducted, along with Braun and Clarke's (2006) thematic analysis. Results showed that workplace stress and negative thinking patterns are significant predictors of emotional exhaustion ($R^2=0.611$). Negative thinking patterns partially mediated the relationship between stress triggers and emotional exhaustion (indirect effect $=0.182$, $p < 0.001$). Years of experience and frequency of face-to-face interactions significantly influenced both emotions and thinking patterns. Three major qualitative themes emerged: the Agile Execution Paradox, experience-mediated cognitive blame loops, and ritualistic versus psychologically safe structures. This study contributes to the understanding of human factors in agile teams within a developing country context and provides practical recommendations for project managers and organizations to reduce burnout, enhance psychological safety, and improve sprint retrospectives in Sri Lankan agile IT teams.

Keywords: *Agile Software Development, Emotions, Thinking Patterns, Negative Thinking, Emotional Exhaustion, Psychological Safety*

Abstract ID: 019

DETECTING AI-GENERATED VERSUS HUMAN-WRITTEN REVIEWS IN E-COMMERCE PLATFORMS USING HYBRID DEEP LEARNING MODELS

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Abstract

Online consumer reviews are a primary decision cue in e-commerce. Yet, large language models such as ChatGPT, Claude, and Gemini can now mass-produce fluent, product-specific reviews that closely mimic authentic feedback. Because such text exhibits high lexical diversity and strong internal coherence, filters designed for manually written spam detect it poorly. Prior linguistic work is confined largely to long-form genres, fake-review research targets human-written spam, and no study has exploited review text, contextual metadata, and imagery for authorship detection. This study addresses those gaps through a hybrid transformer-ensemble framework. A balanced corpus of 12,576 clothing-product reviews combined 6,288 authentic reviews from a public Amazon dataset with 6,288 synthetic reviews generated in near-equal proportions by ChatGPT, Claude, and Gemini, each inheriting the star rating, verified-purchase status, and media configuration of a human counterpart. This matched-pair control forces any learned signal to originate in the text rather than in exploitable metadata correlations. Six linguistic, stylistic, and semantic markers validated by the Mann-Whitney U test all differed significantly, confirming that AI reviews are shorter (49.41 against 63.45 words), emotionally suppressed (0.000 against 0.481 exclamation marks), and semantically more rigid. Text was encoded as 384-dimensional all-MiniLM-L6-v2 embeddings and visual content as 2,048-dimensional ResNet50 descriptors, with ten scaled contextual and stylistic features appended, giving a 2,442-dimensional late-fusion representation classified by an XGBoost algorithm (800 trees, maximum depth 7, learning rate 0.03) under a stratified 70/15/15 split. Because initial training yielded a conservative classifier with precision near 95% but recall of only 46-56%, class weighting and a validation-set threshold scan were applied, converging on a boundary of 0.20 and raising text-stream recall to 88.14%. On the held-out partition, the fused model achieved 82.50% accuracy, an F1-score of 82.51%, and a ROC-AUC of 0.914, with symmetric errors across classes. Gain-based feature importance attributed 91.0% of the decision to textual semantics, 5.2% to visual features, and 3.8% to contextual metadata, showing that fusion supplies robustness rather than headline accuracy once metadata is controlled. The detector is accurate and lightweight, offering emerging digital marketplaces a deployable safeguard for review integrity.

Keywords: *AI-generated review detection, E-commerce, Transformer embeddings, XGBoost, Multimodal late fusion*

Abstract ID: 040

HCPVP: A HYBRID CONTEXT-AWARE PRIVACY VULNERABILITY PREVENTION FRAMEWORK FOR REAL-TIME SOFTWARE DEVELOPMENT ENVIRONMENTS

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Abstract

The rapid growth of data-driven applications has increased the risk of privacy violations due to improper sensitive data handling. Privacy by Design (PbD) and Privacy as Code (PaC) embed privacy principles into development, but current solutions rely on post-development auditing or manual verification. These methods, however, have limitations in proactively handling privacy aspects. In this research, we propose a Hybrid Context-Aware Privacy Vulnerability Prevention (HCPVP) framework to detect and prevent privacy vulnerabilities in a software development process in real time. The proposed framework integrates static source code analysis through Abstract Syntax Trees (ASTs), dynamic runtime behavior monitoring, and machine learning-based privacy policy understanding to detect and prevent privacy vulnerabilities. The implemented components were evaluated, with the rule-based static analysis engine achieving 93.9% precision and 92.0% recall across five privacy vulnerability categories, the dynamic runtime monitoring module achieving 100% precision and recall, and the policy understanding module achieving 92.9% accuracy on held-out privacy policy text. Using the heterogeneous sources mentioned above, the Privacy Risk Fusion Engine is designed to derive contextual privacy risk scores and provide immediate developer feedback through an Integrated Development Environment (IDE). These results demonstrate the feasibility of operationalizing regulatory privacy requirements as testable detection mechanisms and provide an empirical foundation for integrating static, runtime, and policy-level privacy analysis. The proposed framework establishes a unified and proactive privacy engineering approach that continuously aligns implementation with privacy requirements throughout the software development process, unlike existing Privacy as Code solutions that focus on isolated analysis techniques. The proposed framework aims to improve privacy vulnerability prevention, reduce developer effort, minimize compliance risks, and support the development of privacy-robust software systems through continuous, context-aware privacy analysis.

Keywords: *Privacy as Code, Privacy Engineering, Static Analysis, Dynamic Analysis, Software Privacy, Machine Learning*

Abstract ID: 062

CHARACTERIZING ULTRAVIOLET INDEX DYNAMICS ACROSS WET, INTERMEDIATE, AND DRY REGIONS OF SRI LANKA THROUGH ADVANCED PREDICTIVE MODELING

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Abstract

Ultraviolet (UV) radiation reaching Earth's surface poses significant public health risks, including skin cancer, cataracts, and immune system suppression. The Ultraviolet Index (UVI), a standardized measure of UV radiation intensity, supports public health communication and climate adaptation planning. Despite its importance, systematic hourly UVI forecasting studies across tropical climatic zones remain limited. This study identified robust temporal lag structures and evaluated traditional time-series (TTS), machine learning (ML), and deep learning (DL) models across representative locations in Sri Lanka's wet, intermediate, and dry zones. Hourly UVI data from NASA POWER for Colombo, Badulla, and Jaffna (2018–2023) were analysed after excluding night-time observations. Autocorrelation Function, Mutual Information, and progressive Random Forest analysis identified common lags of 1, 11, 12, 13, 24, and 36 hours. Models were evaluated using chronological 80:20 training-testing splits under two feature-engineering strategies: a fixed-lag approach using selected ACF-MI lags and a varying-lag approach using 12, 24, and 36 lag terms. ARIMA, Random Forest, XGBoost, Feedforward Neural Network (FNN), Long Short-Term Memory (LSTM), and one-dimensional Convolutional Neural Network (CNN) models were optimized using Optuna and five-fold time-series cross-validation. ARIMA showed substantially higher errors, whereas ML and DL models achieved superior performance. The 36-lag strategy performed best, with CNN achieving RMSE = 0.4107 and R^2=0.9872 in Colombo, while FNN achieved RMSE=0.4386 and R^2 = 0.9838 in Badulla and RMSE=0.4387 and R^2= 0.9822 in Jaffna. ML and DL hyperparameter optimization required approximately 156 s and 727 s, respectively, using CPU-only computing. UVI values showed an upward pattern during 2023, with Badulla recording the highest proportion of High, Very High, and Extreme UVI observations (25.4%). Limitations include the use of three representative stations, a univariate framework excluding atmospheric predictors, and the absence of persistence and seasonal-naïve benchmarks, which should be addressed in future research.

Keywords: *Ultraviolet Index, Machine Learning, Deep Learning, Climatic Zones*

Abstract ID: 094

HYBRID FEATURE SELECTION WITH OPTIMIZATION AND FUSION TECHNIQUES FOR BREAST CANCER CLASSIFICATION USING MICROARRAY DATA

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Abstract
Breast cancer is fatal and kills a lot of women globally. Earlier detection and getting an appropriate diagnosis are crucial for better treatment and prevention. There's simply too much data from genes, composed of enormous cancer-related information; some of them are redundant, and they need a huge amount of computational power and time. In this research, breast cancer microarray data containing 97 samples and 24,481 features were used. This study investigates a hybrid way for classifying breast cancer using microarray data, incorporating optimisation and fusion techniques. Cancer classifications were experimented with various approaches. The initial approach is gene selection, where we selected the most important gene information and investigated various methods, including ReliefF, CFS, Information Gain, Gain Ratio, Mutual Information, and Recursive Feature Elimination (RFE), where RFE comparatively signalled higher performance. To make sure the best feature selection, we investigated optimisation techniques, such as Genetic Algorithm, Particle Swarm Optimisation, Arithmetic Optimisation, and Sandpiper Optimisation, where the Arithmetic Optimisation algorithm comparatively performed better than the baseline performance. Various machine learning techniques were used for classification, where Support Vector Machine and Multi-Layer Perceptron comparatively performed better. A fused approach with both classifiers also provides better accuracy. Overall, the hybrid approach of feature selection, optimisation, and fusion techniques shows potential to improve the classification performance of breast cancer using microarray data.

Keywords: *Breast Cancer, Microarray Gene Expression, Feature Selection, Arithmetic Optimization Algorithm, Machine Learning, Fusion, Hybrid models*

Abstract ID: 095

EVIDENCE-AUGMENTED FAKE NEWS DETECTION USING DENSE RETRIEVAL AND ROBERTA: AN EXPLAINABLE DEEP LEARNING FRAMEWORK

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Abstract

Detection of fake news has become increasingly difficult owing to the fast spread of misinformation via online news portals and social media networks, affecting public opinion and decisions. Even though there have been numerous advances in the field of automatic detection of fake news using transformer-based language models, most existing methods focus on the textual part of news articles without considering external evidence to assess their authenticity. Due to this shortcoming, these systems cannot make reliable classification decisions for ambiguous news. To overcome this problem, this research proposes an Evidence-Augmented Fake News Detection Framework that integrates dense evidence retrieval with a RoBERTa-based classification model. In this method, we use Sentence-BERT to get semantic embeddings for the news articles and the ISOT dataset, which serves as the evidence corpus, while Facebook's AI Similarity Search (FAISS) is used for finding semantically similar evidence. Later, the retrieved evidence is reranked by the CrossEncoder reranking and is combined with the original news to form an evidence-augmented input. To enhance transparency and explainability, LIME (Local Interpretable Model-Agnostic Explanations) is used to interpret individual predictions made by the model. To verify the proposed method, experiments were carried out on the WELFake dataset with the ISOT dataset serving as the external evidence corpus for retrieval and further validated on the LIAR and FakeNewsNet benchmark datasets for generalization performance. From the experimental results, the proposed method achieved approximately 98.9% accuracy on the WELFake dataset with high precision, recall, and F1-score. The ablation study was performed to compare the proposed framework with an FAISS-only retrieval strategy without CrossEncoder reranking, which reveals the role of the CrossEncoder reranking module. The results demonstrate that integrating external evidence retrieval with RoBERTa provides an effective approach for fake news detection, while LIME enhances the transparency and explainability of the model's predictions.

Keywords: *CrossEncoder, Evidence augmentation, Fake news detection, FAISS, RoBERTa, Sentence-BERT, LIME*

Abstract ID: 057

SENTIMENT ANALYSIS OF GOOGLE REVIEWS TO DETERMINE ATTRACTION FAVORABILITY OF A PLACE

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Abstract

This study presents a sentiment analysis approach for classifying Google Reviews of tourist destinations in Sri Lanka as positive or negative using machine learning techniques. With the growing influence of online platforms on travel decision-making, the study addresses the challenges of analyzing large numbers of reviews manually. A custom dataset comprising 1,000 Google Reviews was collected from over 70 tourist attractions in Sri Lanka, including beaches, temples, national parks, waterfalls, and cultural sites. The objective was to develop and evaluate multiple sentiment classification models and identify the highest-performing model. Experimental results demonstrated strong classification performance, with Support Vector Machine (SVM) achieving the highest accuracy of 97.0%, followed by Logistic Regression (96.5%), Naïve Bayes (96.0%), Random Forest (94.0%), and Decision Tree (87.0%). In addition, a web application was developed for real-time sentiment classification using the best-performing model. This study contributes to tourism analysis, text classification, and opinion mining by providing an effective method for analyzing tourist feedback and supporting data-driven decision-making for tourism management, service improvement, and enhancement of the tourist experience in Sri Lanka.

Keywords: *Sentiment Analysis, Google Reviews, Machine Learning, Text Classification, Supervised Learning, Web Application, Support Vector Machines*

Environmental Science

Abstract ID: 010

USE OF POLLEN MORPHOMETRICS FOR SPECIES DELIMITATION IN THE FAMILY CUCURBITACEAE

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Abstract

Members of the family Cucurbitaceae have been historically utilized in Sri Lanka as important resources with edible and medicinal value. Taxonomic differentiation of Cucurbitaceae pollen in pollen spectra is essential in environmental archaeology, archaeobotany, and paleoethnobotany. The present study aims to characterize the morphometric features of pollen from 19 taxa of the family Cucurbitaceae in Sri Lanka, comprising 18 were represented as individual species and one species was represented by two varieties, including *Benincasa hispida, Citrullus lanatus, Coccinia grandis, Cucurbita maxima, Cucurbita moschata, Cucurbita pepo, Cucumis melo, Cucumis sativus, Diplocyclos palmatus, Lagenaria siceraria, Luffa acutangular, Luffa cylindrica, Momordica charantia, Momordica denudata, Momordica dioica, Mukia leiosperma, Mukia maderaspatana, Trichosanthes cucumerina var. anguina,* and *Trichosanthes cucumerina var. cucumerina* to evaluate the applicability of these characteristics for taxonomic differentiation within the family. Pollen samples (three replicates per species of pollen samples) were prepared using the acetolysis method and examined under an Olympus BX53 light microscope. Morphological characteristics were assessed in polar and equatorial views, including shape, number of pores and colpi, exine ornamentation, and size [polar width (P), equatorial height (E), and P/E ratio]. Pollen descriptions were described in accordance with the Glossary of Pollen and Spore Terminology. Results revealed that the average P, E, and P/E of pollen of the examined taxa showed a significant variation among species ($p < 0.001$). Principal Component Analysis of the examined pollen morphometrics, together with pollen shape and surface ornamentation, supported the taxonomic delimitation of several genera, including *Cucurbita, Luffa, Mukia,* and *Trichosanthes*. *C. lanatus* formed a distinct group due to its low P/E ratio. The study emphasizes the value of pollen morphology as a reliable tool for identifying and classifying several Cucurbitaceae genera and some species.

Keywords: *Acetolysis method, Number of pores and colpi, P/E ratio, Pollen shape*

Abstract ID: 020

GROWTH DYNAMICS AND MORPHOMETRIC RELATIONSHIPS OF BLACK SOLDIER FLY LARVAE (*Hermetia illucens* L.; DIPTERA: STRATIOMYIDAE) REARED ON DIFFERENT ORGANIC WASTE SUBSTRATES

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Abstract

The black soldier fly (*Hermetia illucens* L.; BSFL) is a biologically significant dipteran insect whose larval stage can convert organic waste into nutrient-rich by-products. Therefore, it has gained significant attention for sustainable organic waste management. Although BSFL performance has been widely studied for bioconversion efficiency, limited research has examined larval growth using morphometric traits with sigmoid growth models across different organic waste substrates, particularly across repeated rearing batches. This study investigated the growth dynamics and morphometric relationships of BSFL reared on eight different organic waste substrates under laboratory conditions (28±2 °C; 65±5% relative humidity) at Eastern University, Sri Lanka. Experiments were conducted using a completely randomized design (CRD) with three replicates. Larval body weight, length and width were recorded on days 3, 7, 10 and 14 across two consecutive batches (Batch 1: days 1-14; Batch 2: days 15-28). Growth parameters including specific growth rate (SGR), relative growth rate (RGR) and absolute growth rate (AGR) were calculated to determine larval growth performance. Gompertz and logistic growth models were fitted to larval weight data, while allometric analyses were applied to evaluate the morphometric relationships between larval body weight, length and width. One-way ANOVA showed a highly significant difference in larval growth performance among different organic waste substrates ($F_{7,16} = 478.74$, $p < 0.001$). Cooked food waste recorded the highest final larval weight (0.341 g) and SGR (30.16 % day^{-1}) in Batch 1; however, its performance declined sharply in Batch 2 (0.072 g). This reduction may be associated with progressive depletion of readily available nutrients during successive rearing, although changes in substrate nutritional composition were not directly measured. Tea bag waste consistently showed the lowest growth performance in both batches. Significant positive morphometric relationships were observed between body weight and length in both batches (Batch 1: $r = 0.856$, $p = 0.007$; Batch 2: $r=0.777$, $p = 0.023$). The logistic growth model provided the best fit for larvae reared on food waste (Batch 1: $R^2 = 0.997$), while the Gompertz model better described the growth pattern of larvae reared on mixed organic waste substrate ($R^2=0.975$). These findings demonstrate that organic waste substrate type strongly influences the growth and development of BSFL and highlight their potential for optimizing BSFL production under tropical conditions.

Keywords: *Allometric, Black soldier fly, Growth dynamics, Morphometric relationship, Organic waste*

Abstract ID: 031

A COMPARATIVE STUDY OF GOAT GROWTH PERFORMANCE UNDER SEMI-INTENSIVE AND EXTENSIVE REARING SYSTEMS

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Abstract

Goat farming plays a significant role in livestock production by contributing to meat production, household income, and food security in rural communities. The study aimed to evaluate the growth performance of goats under semi-intensive and extensive production systems in the Batticaloa and Trincomalee districts of the Eastern Province of Sri Lanka. Ten healthy goats of the same age were selected from each production system and monitored for five weeks. The goats in the semi-intensive system comprised mixed breeds, including Saanen × Jamnapari, Kottukachchiya × Saanen, Jamnapari cross, Saanen cross, and Kottukachchiya cross, whereas the goats in the extensive system were indigenous breeds. The initial mean body weight was 28.27±7.94 kg in the semi-intensive group and 29.38±5.69 kg in the extensive group. Body weights were measured every 7 days, and growth performance was determined using total weight gain and average daily gain (ADG) to assess overall and daily growth, respectively. Descriptive statistics, independent-samples t-tests, and repeated-measures ANOVA were used to analyse the data. It was found that goats raised in the semi-intensive system had greater weight gain than those raised in the extensive system. The semi-intensive group recorded a significantly higher total weight gain (1.91±0.28 kg) than the extensive group (0.75±0.42 kg) ($t = 7.266$, $p < 0.001$). Similarly, the average daily gain was significantly greater in the semi-intensive system (0.0616±0.0091 kg day^{-1}) than in the extensive system (0.0250±0.0140 kg day^{-1}) ($t=6.948$, $p < 0.001$). Repeated-measures ANOVA showed a significant effect of time ($F=223.315$, $p < 0.001$) and a significant Time × System interaction ($F=46.988$, $p < 0.001$), indicating that body weight increased differently over time between the two production systems. Overall, goats under the semi-intensive system showed greater total weight gain and average daily gain. These findings suggest an association between rearing system and growth performance under the study conditions.

Keywords: *Average daily gain, Body weight gain, Extensive system, Goat production, Growth performance, Semi-intensive system*

Mathematics and Statistics

Abstract ID: 006

OPTIMIZATION OF PETROLEUM BLENDING OPERATIONS USING MIXED-INTEGER PROGRAMMING WITH DEMAND EXPANSION AND PROCESSING COST CONSIDERATIONS

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Abstract

Crude oil blending is a key optimization problem in petroleum refining because refinery profitability depends on selecting suitable crude oil mixtures while meeting product quality specifications and operational constraints. This study develops a parametric mixed-integer linear programming (MILP) model for crude oil blending that simultaneously determines production quantities and incorporates advertising and processing costs into the optimization framework. Unlike conventional blending models that assume fixed product demand, the proposed formulation treats advertising expenditure as a decision variable that influences market demand, allowing production and marketing decisions to be optimized together. The model considers m types of crude oils and n finished petroleum products. Each crude oil is characterized by its purchase cost, availability, octane rating, and impurity level, whereas each finished product is defined by its selling price, quality specifications, and market demand. Product quality is maintained by enforcing minimum octane rating requirements and maximum allowable lead content, ensuring compliance with industry fuel standards and environmental regulations. Processing costs associated with refining crude oil into finished products are also incorporated to represent refinery operations better. A parametric formulation is adopted so that demand, production capacity, quality limits, and cost coefficients can be analyzed under different operating conditions without reformulating the optimization model. To demonstrate the applicability of the proposed approach, a numerical example involving three crude oil types, Type 1, Type 2, and Type 3, and three petroleum products, namely premium, ordinary, and economy, is presented, subject to 12 variables with 13 constraints. The developed MILP model was fed to OBM ILOG Optimization Studio and obtained the optimum solution. The results show how advertising investment, processing costs, and quality constraints jointly influence production planning, blending decisions, and overall profitability. The proposed MILP model provides an integrated decision support framework that links operational and marketing decisions, making it suitable for strategic planning in petroleum refining.

Keywords: *Blending problem, Petroleum refining, Mixed-integer programming, Advertising, Processing cost*

Abstract ID: 008

FUZZY β-SEPARATION AXIOMS IN FUZZY TOPOLOGICAL SPACES

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Abstract

This study explores fuzzy β-separation axioms in fuzzy topological spaces, extending classical separation ideas to the fuzzy β-open concept. It builds on Chang's foundational work on fuzzy topological spaces and Zadeh's fuzzy sets and follows Balasubramanian's approach of defining separation axioms in terms of fuzzy sets rather than fuzzy points. The paper formally defines and thoroughly examines five classes of spaces: fuzzy β-T_0, fuzzy β-T_1, fuzzy β-T_2 (fuzzy β-Hausdorff), fuzzy β-normal, and fuzzy β-regular spaces. A clear hierarchy is shown: every fuzzy β-T_2 space is also a fuzzy β-T_1 space, and every fuzzy β-T_1 space is also a fuzzy β-T_0 space. For each axiom, it is proven that the class is hereditary, meaning every subspace inherits the property, and closed under finite products. Furthermore, for the T-type axioms, it is shown that the property is preserved under bijective fuzzy β-open maps from the corresponding classical T-space and under injective fuzzy β-continuous maps into the corresponding classical T-space. These results extend the classical separation theory to the fuzzy β-open framework and provide groundwork for further investigation of fuzzy β-compactness, fuzzy β-connectedness, and related covering properties in fuzzy topological spaces.

Keywords: *Fuzzy topological spaces, Fuzzy β-open sets, Fuzzy β-separation axioms, Fuzzy β-Hausdorff spaces, Fuzzy β-continuity*

Abstract ID: 011

A LINEAR PROGRAMMING FRAMEWORK FOR THE OPTIMAL ALLOCATION OF DENGUE PATIENTS AND IDENTIFICATION OF UNTREATED CASES: A CASE STUDY IN A SRI LANKAN HEALTHCARE SYSTEM

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Abstract

Dengue is a high-risk vector-borne disease that poses a significant public health burden and places considerable pressure on healthcare systems. During peak transmission periods, such as the rainy season, the number of dengue patients rapidly increases beyond the available healthcare resources, such as limited hospital capacity and treatment capacity. For this reason, the number of untreated patients significantly increases. Therefore, some patients need to move to the private sector if they have enough financial resources, while others rely on self-treatment. This situation indicates that it is necessary to identify how many patients can be fully treated by considering the available resources in healthcare units such as hospitals. This research mainly targets the proposed Linear Programming modeling framework to identify the optimal allocation of patients to general ward units and intensive care units (ICUs). Additionally, this proposed framework can be used to identify disease risk by identifying the number of untreated patients. This model includes key constraints such as staff capacity, bed availability, budget limitations, and patient demand. The model is not limited to these constraints and can be adjusted by incorporating additional necessary constraints. Baseline model parameters and resource availability were identified using community-level information and literature, and sensitivity analysis was conducted to identify how variations in these parameters and available resources can improve the model target. The results highlighted that this modeling approach effectively captures how to manage patient admissions to hospitals by considering existing resources. The model results indicated that, under the considered situation, it is not suitable to admit all patients into all available beds because there are not enough resources to fully treat them, and no ICU admissions can be accepted. The sensitivity analysis further highlighted that the number of admitted patients can be increased by changing the available resources. Policymakers can use this approach to allocate resources to hospitals to reduce the number of untreated patients during sudden disease transmission periods. This approach can also be used to determine how resources should be allocated to ensure that more patients can be fully treated.

Keywords: *Dengue, Linear programming, Optimization, Patient allocation, Resource allocation, Untreated patients*

Abstract ID: 015

AN OPERATIONS RESEARCH APPROACH FOR DENGUE PREVENTION ACTIVITY PLANNING AND CASE FORECASTING USING TIME SERIES ANALYSIS

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Abstract

Dengue remains a major public health concern in Sri Lanka, with frequent outbreaks placing significant pressure on healthcare systems, particularly in high-risk districts. The increasing burden of dengue highlights the need for effective dengue control activity planning and an understanding of future dengue trends. This study develops a Binary Integer Linear Programming model to support dengue prevention activity planning. The intervention framework includes surveillance and inspection activities, community clean-up campaigns, fogging operations, public awareness programs, volunteer mobilization, logistics and transportation support, and health facility preparedness. The model also incorporates real-world constraints such as total available budget, limited manpower and volunteer capacity, availability of equipment, logistics and transport capacity, and minimum required effectiveness levels. The results indicate that surveillance and inspection activities, community clean-up campaigns, fogging operations, and logistics and transportation support constitute the optimal intervention plan under the considered resource and cost allocation. These interventions are selected based on cost-effectiveness and resource availability while satisfying all constraints. In addition, time series forecasting was applied to historical weekly dengue case data to analyze disease behaviors and short-term trends. It provides insights into changes in disease transmission and supports early warning and timely decision-making by indicating expected variations in dengue incidence. The modelling approach considers five high-dengue-risk districts in Sri Lanka, Colombo, Gampaha, Kalutara, Kandy, and Jaffna, to enhance the realism of the model. The study demonstrates that the proposed modelling framework can effectively support cost-efficient dengue prevention planning under limited resources.

Keywords: *Activity planning, Binary integer linear programming, Dengue, Optimization, Time series forecasting*

Abstract ID: 016

COMPARISON OF NUMERICAL METHODS FOR SOLVING NONLINEAR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

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Abstract

Most nonlinear ordinary differential equations (ODEs) lack closed-form solutions, making robust numerical methods essential for their analysis. This study compares Euler's method, the classical fourth-order Runge-Kutta method (RK4), and the adaptive Runge-Kutta Fehlberg method (RK45, MATLAB ode45) for solving the Lorenz system and Duffing oscillator as benchmark nonlinear ODE problems. Simulations were performed using the MATLAB software. We evaluated the methods in terms of computational time, global error, and stability of the results. The accuracy was quantified using the relative L^2 error against a reference solution obtained using ode45 with tight tolerances. RK45 uses adaptive step-size control with relative and absolute tolerances of 10^{-6}. The results show that Euler's method has the lowest per-iteration cost but the largest accumulated relative error ($\approx 10^{-1}$) and becomes unstable for step sizes of $h > 0.01$, making it unsuitable for long-term simulations. RK4 reduced the relative error to $\approx 10^{-5}$ with a moderate CPU time, offering a good balance between simplicity and precision. RK45 achieved the smallest error ($\approx 10^{-7}$) and the shortest total CPU time despite a higher per-step cost because adaptive step-sizing reduced the total number of function evaluations by approximately 40% compared with fixed-step RK4. The findings indicate that RK45 provides the best overall trade-off between accuracy and efficiency for the tested nonlinear systems, whereas RK4 remains a reliable fixed-step solution.

Keywords: *Adaptive step size, Computational efficiency, Euler's method, Global error, Non-linear ODEs, Runge-Kutta methods*

Abstract ID: 017

A HYBRID VIKOR AND BI-OBJECTIVE INTEGER LINEAR PROGRAMMING APPROACH FOR ELECTRIFICATION PLANNING IN POST-CYCLONE DITWAH DISASTER RELIEF CAMPS IN SRI LANKA

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Abstract
In the aftermath of Cyclone Ditwah, temporary relief camps across Sri Lanka faced severe disruptions to electricity supply. Reliable power is critical in these settings for healthcare, clean water, communication, and basic camp operations, yet rebuilding the grid takes time and resources are limited. To address this, we propose a hybrid decision framework that combines two methods. First, we use the VIKOR multi-criteria decision-making method to rank candidate energy technologies - solar PV, wind, battery storage, and diesel generators - against criteria such as cost, reliability, environmental impact, and efficiency. Second, we feed those VIKOR rankings into a bi-objective integer linear programming model in LINGO to select the optimal mix and sizing that minimizes both total cost and unmet demand. We define the approach as "hybrid" because VIKOR handles the trade-offs between criteria, while BOILP handles the quantitative optimization of system design. Demand profiles, solar irradiance, and component costs were obtained from [Department of Disaster Management Sri Lanka reports, NASA POWER database, and field surveys conducted in 3 camps in District X, 2024]. System performance was simulated in MATLAB and Python, and the optimization was solved using LINGO. Results indicate that a combination of solar PV, battery storage, and backup diesel generators provides the most reliable and cost-effective supply for the camps studied. Wind energy was found to be less viable due to high seasonal variability at the sites. The proposed framework provides disaster management authorities with a practical, data-driven tool to deploy resilient power solutions in emergencies.

Keywords: *Bi-Objective Integer Linear Programming (BOILP), Cyclone Ditwah, Disaster relief camps, Hybrid energy systems, LINGO optimization, Multi-criteria decision-making (MCDM), VIKOR method*

Abstract ID: 021

IMPLEMENTATION OF GRAPH THEORY WITH OPTIMIZATION ON THE SETTING OF TRAFFIC LIGHTS AT AN ARTERIAL INTERSECTION

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Abstract

Traffic congestion is a major challenge in urban areas, requiring efficient traffic signal control to improve traffic flow, reduce delays, and minimize fuel wastage. This study aims to optimize traffic signal settings at an arterial intersection by integrating graph theory and optimization techniques. A four-leg intersection with 24 traffic movements was considered using hypothetical traffic data. In this study, the traffic movements were modelled as a graph, where vertices represent traffic movements and edges represent conflicts between movements. The Welch-Powell algorithm and graph colouring technique were applied to identify non-conflicting traffic movements and group them into signal phases. By using graph colouring, the chromatic number obtained for the graph was four, resulting in four signal phases. The optimum cycle time calculated using Webster's method was 129.63 seconds. The green time allocated based on traffic flow proportions was 25.03, 29.03, 28.53, and 27.03 seconds for the four phases, respectively. To achieve better signal efficiency, an optimization model was developed and solved using MATLAB to allocate green time according to traffic demand, where phases with higher traffic demand received more green time; phases that are 64.63 second with lower traffic demand received the minimum green time, which is 15 seconds. The results demonstrate that the integration of graph theory and optimization techniques can improve traffic signal performance by reducing inefficiencies in green time allocation. Further, it offers a practical approach for managing arterial intersections. The proposed approach can be extended to larger traffic networks and multiple interconnected junctions in future studies.

Keywords: *Graph theory, Graph colouring, Welch-Powell algorithm, Traffic signal optimization, Webster's method, MATLAB*

Abstract ID: 023

DERIVATIVE-FREE ITERATIONS OF HALLEY'S METHOD USING HYPERCOMPLEX STEPS

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Abstract

The Bisection Method (BM), Regula-Falsi Method (RFM), Secant Method (SM), Newton-Raphson Method (NRM), and Halley's Method (HM) are some examples of classical iterative methods for superlinear equations. The BM and RFM have linear convergence ($c = 1$), SM has superlinear convergence $c = (1 + \sqrt{5})/2$, NRM is quadratically convergent ($c = 2$) and HM is cubically convergent($c = 3$). HM requires the exact first and second derivatives and may fail when they are unavailable or difficult to compute, or when the function is not sufficiently smooth. To address these issues, finite-difference (FD) methods are often used, but they provide limited accuracy and are affected by rounding errors. Recently, the Hypercomplex-Step (HCS) differentiation technique has been developed to approximate derivatives with higher-order accuracy than standard complex-step methods, enabling derivatives of sufficiently smooth functions to be computed to any desired order of accuracy. This study proposes a derivative-free variant of HM by employing the HCS differentiation technique, where the derivatives in HM are approximated using the same order of accuracy $p = 16$. The derived formula requires no derivative evaluations. The proposed method was tested on nonlinear functions and compared with classical and FD methods, and its roots were further validated against MATLAB-generated High Precision Reference Roots (HPRR). The numerical results demonstrate that HM with HCS (DFHM) consistently produces root approximations very close to the HPRR and generally achieves higher accuracy than HM with FD (HM-FD) and other classical iterative methods. The proposed HCS-based method reduces derivative approximation errors and improves the reliability of HM. These results demonstrate improved numerical performance over HM-FD and standard methods.

Keywords: *Hypercomplex-step differentiation, Halley's Method, Numerical accuracy, Root finding algorithms, Derivative approximation*

Abstract ID: 025

A LINEAR PROGRAMMING APPROACH FOR MAXIMIZING SRI LANKA'S TEA EXPORT REVENUE WITH SENSITIVITY ANALYSIS

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Abstract

Sri Lanka's tea industry is a major contributor to the national economy through foreign exchange earnings and employment generation. However, tea export allocation decisions are often based on historical trade patterns rather than optimization-based approaches, which may limit revenue potential. This study develops a Linear Programming (LP) model to determine the optimal allocation of four tea grades-bulk tea, packed tea, tea bags, and green tea-across five key export markets: Iraq, Russia, Turkey, the United Arab Emirates, and Iran. The data used in this study cover the period from 2011 to 2024 and were obtained from Forbes and Walker tea brokers, Sri Lanka tea export statistics, and the Sri Lanka Tea Board. The selected tea grades represent some of the well-known and profitable tea products exported from Sri Lanka, while the selected markets comprise several leading countries that import Sri Lankan tea. The objective is to maximize total export revenue while satisfying constraints related to tea-grade supply, market demand, packaging and processing capacities, and overall port export capacity. The constructed model was solved using the simplex algorithm. Results indicate an optimal export revenue of USD 28.65 million, with packed tea contributing 61.4% of total earnings, emphasizing the importance of value-added tea products. Sensitivity analysis using shadow prices, reduced costs, and allowable ranges were performed to evaluate the effects of parameter changes. The results show that market demand constraints are binding across all selected markets, with the Russian market having the greatest impact on revenue. Price changes were identified as the most influential factor affecting export revenue (55.5%), followed by market demand (34.9%), tea-grade supply (6.3%), and packaging capacity (3.3%), while export capacity had no significant impact within the analyzed range. Scenario analyses further revealed that strategies combining price improvements with increased market demand generate greater revenue gains than capacity expansion alone. The proposed optimization framework provides valuable insights for exporters and policymakers to improve revenue generation, resource allocation, and the competitiveness of Sri Lanka's tea export sector. Future studies could incorporate transportation costs, exchange rate uncertainty, and multi-objective optimization techniques.

Keywords: *Linear programming, Tea export revenue, Sensitivity analysis, Shadow price*

Abstract ID: 028

CLASSES OF REALISTIC CHARGED STELLAR MODELS WITH PRESSURE ISOTROPY

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Abstract

In this study, the exact solutions of the system of Einstein–Maxwell equations in spherical polar coordinates for static, spherically charged perfect fluid distributions in spheroidal geometry are studied. Such solutions are important in the modelling of relativistic dense matter, including neutron and quark stellar stars. We choose a gravitational potential compatible with the spheroidal geometry and satisfying the required regularity conditions at the stellar centre, and an electric field intensity that vanishes at the Centre and remains well-behaved throughout the stellar interior. By applying the Tikekar transformation, the pressure isotropy condition is reduced to a second-order linear differential equation that facilitates the derivation of exact solutions. Two distinct cases are considered based on the model parameters involved, namely the spheroidal parameters $K, M,$ and the electric field intensity parameter α. For the special case $K + \alpha = M,$ exact solutions are obtained in terms of elementary functions, which is a much simpler form and can be used to model a relativistic spherical star with charge. In the general case $K + \alpha \neq M,$ the Frobenius method is employed to derive a general series solution. Under specific restrictions on the model parameters, the series terminates to generate two classes of solutions in terms of even and odd polynomials, together with two further classes expressed as products of polynomials with algebraic functions. Several previously known stellar models can be recovered as special cases by assigning particular values to the model parameters, demonstrating the generality of the obtained solutions. Furthermore, the uncharged configurations can be obtained by setting $\alpha = 0$. The regular behaviour of the gravitational potential and matter variables, together with the vanishing and well-behaved nature of the electric field intensity, support the physical acceptability of the obtained models. These results provide useful exact models for studying charged relativistic compact objects within the framework of general relativity.

Keywords: *Einstein-Maxwell field equations, Charged dense stars, Exact solutions, Spheroidal geometry*

Abstract ID: 030

CHARGED ANISOTROPIC MODELS FOR RELATIVISTIC FLUID SPHERES WITH GENERALIZED POTENTIAL

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Abstract
We investigate exact models for the Einstein-Maxwell system of equations in spherically symmetric relativistic stars with pressure anisotropy and electric field intensity. The existence of an electric field with anisotropy significantly influences the internal structure and stable condition of dense cosmological objects such as relativistic stars. The Einstein-Maxwell field equation is transformed into an equivalent system with the assistance of a well-known transformation. With the physically reasonable choices for the gravitational potential together with the matter contents, a master second-order ordinary differential equation is obtained. This is the linear equation of the entire system of equations which governs the behaviour of the structure of the solution and has to be solved to obtain the closed-form solution. The resulting equation is solved using different analytical techniques. Exact solutions are obtained as hypergeometric series, and, for specific parameter values involved in the system, the series terminates to produce elementary solutions comprising polynomials and algebraic functions, which are more crucial to investigate the physical behaviour. These elementary solutions provide mathematically simple and physically meaningful models of charged anisotropic stellar configurations. It is also shown that previously known isotropic and uncharged models can be recovered as special limiting cases of the solutions obtained. The models developed in this study contribute to the understanding of relativistic charged anisotropic fluid spheres and may be useful in the modelling of dense cosmological objects.

Keywords: *Anisotropic factor, Einstein-Maxwell field equation, Electric field intensity*

Abstract ID: 042

SOLVING NON-SQUARE LINEAR SYSTEMS OVER POLYNOMIAL RINGS

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Abstract
We present a fast algorithm for solving non-square linear systems over polynomial rings over finite fields. By employing rational function reconstruction, the algorithm computes polynomial solutions efficiently and substantially outperforms the classical Gaussian elimination approach. The proposed method is particularly suitable for solving large polynomial systems arising in computational algebra. Here we use a modified version of Dixon's algorithm to solve a non-square linear system. Dixon's algorithm is a modular algorithm that employs p −adic lifting. This approach makes it computationally more efficient than methods based on the Chinese Remainder Theorem or elementary row operations. We rigorously assess its complexity as $O^{\sim}(m^{\omega-1}nd + n^2d)$ operations over $\mathbb{Q}$, whereas the Gaussian method takes $O^{\sim}(m^3nd^2)$ operations to solve a linear $m \times n$ system $Ax = b$ over a polynomial ring over a finite field. Here, d is the maximum degree of the entries of the original input matrix.

Keywords: *Dixon's algorithm, Kernel, Non-square linear system, Polynomial rings over finite fields, Rational reconstruction*

Abstract ID: 051

DIFFERENCE EQUATION APPROXIMATIONS OF SECOND-ORDER HOMOGENEOUS LINEAR SPRING-MASS DIFFERENTIAL EQUATION WITH CONSTANT COEFFICIENT USING TAYLOR'S SERIES

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Abstract
Spring–mass systems are a staple for modelling vibrations in engineering and physics, so getting accurate numerical approximations is crucial. In this study, we apply the Taylor series method to solve the differential equation for a damped spring–mass system. We used MATLAB to generate both analytical and numerical solutions, comparing these two and evaluating how well the numerical approach holds up. We also tested two ways of setting the initial conditions: the standard initial displacement and velocity pair, versus using two displacement values and estimating the initial velocity numerically. Our relative error analysis showed that the displacement–velocity setup is noticeably more accurate, as estimating the initial velocity in the two-displacement approach adds extra error. Ultimately, the results highlight both the strength of the Taylor series method for damped dynamic systems and the major role initial conditions play in solution accuracy.

Keywords: *Damped spring–mass system, Initial conditions, MATLAB, Numerical simulation, Taylor series method, Vibration analysis*

Abstract ID: 064

A DYNAMICAL SYSTEM MODEL FOR EARLY CHILDHOOD GROWTH UNDER INTERRUPTED CLINICAL OBSERVATION

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Abstract

Tracking the growth of young children is essential for assessing their health and nutritional status. However, clinical growth records are often incomplete because measurements are taken at irregular intervals and many observations are missing. Instead of relying on data imputation methods, this study uses a continuous-time dynamical systems approach to represent growth as a continuous biological process. Three nonlinear growth models, namely the Logistic, Gompertz, and von Bertalanffy models, were applied to describe changes in height and weight. The models were fitted to a five-year dataset of seven children using nonlinear least squares estimation. Their performance was evaluated using the Sum of Squared Errors (SSE), the coefficient of determination (R^2), and visual comparisons between observed and predicted values. The findings indicate that the Logistic model provided the most accurate representation of height growth, while the Gompertz model showed superior performance in modelling weight development. In contrast, the von Bertalanffy model demonstrated comparatively lower accuracy for both variables. These results suggest that continuous-time dynamical system models provide a practical and reliable framework for analysing irregular childhood growth data and may support more effective monitoring of child development in clinical settings.

Keywords: *Early childhood growth, Dynamical systems, Nonlinear growth models, Logistic model, Gompertz model, Interrupted clinical observation, Irregular clinical data, Nonlinear least squares*

Abstract ID: 071

STRUCTURAL PROPERTIES OF α -TOPOLOGICAL SUBRINGS

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Abstract

The study of algebraic structures equipped with generalized topological concepts has attracted increasing attention in recent years. Among these structures, topological rings provide a natural framework in which the algebraic operations of addition and multiplication are compatible with the underlying topology through continuity conditions. Motivated by the concept of α-open sets, this paper introduces the notion of an α-topological ring by replacing the classical continuity requirements with conditions involving α-open neighbourhoods. Based on this framework, we define α-topological subrings and α-topological ring homomorphisms and investigate their fundamental structural properties. It is shown that the intersection of two α-topological subrings is again an α-topological subring, whereas the union of two such subrings need not be an α-topological subring. Furthermore, every open subring of an α-topological ring is proved to inherit an α-topological ring structure under the subspace topology. In addition, the inverse image of an α-topological subring under an α-topological ring homomorphism is established to be an α -topological subring. These results demonstrate the stability of α-topological structures under subring operations and homomorphisms, thereby extending the theory of topological rings within the framework of α-open sets and providing a foundation for future research on α-topological ideals, α-isomorphisms, and other generalized continuity concepts.

Keywords: *α-topological rings, α-open sets, α-continuity, α–topological subrings, α-topological ring homomorphisms*

Abstract ID: 092

MARGINAL COST AND PROFIT OPTIMIZATION IN SRI LANKAN TEA PRODUCTION: A COMPARATIVE STUDY BETWEEN NUWARAELIYA DISTRICT AND NATIONAL OUTPUT

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Abstract

This dissertation provides a rigorous mathematical-economic analysis of profit optimization in the Sri Lankan tea industry, specifically contrasting the Nuwara Eliya district with national production benchmarks. Amidst rising production costs, economic uncertainties, and shifting climate patterns, the industry requires a move from qualitative management toward data-driven optimization. This study utilizes secondary data from the Tea Research Institute (TRI) (2020-2023) to formulate quadratic cost and revenue functions for six distinct production categories across Low, Medium, and High Grown elevations. By applying differential calculus, the research determines the optimal production level (x^*) where marginal revenue balances marginal cost, identifying critical thresholds for maximum profit. Key findings reveal a structural divergence: regional production in Nuwara Eliya exhibits a "Profit Valley" behaviour with increasing returns to scale, while the national output generally follows a "Profit Peak" model characterized by diminishing returns. Furthermore, the study incorporates a detailed break-even analysis for each sector, identifying the minimum production threshold required to cover total costs. This analysis maps the "survival corridors" for estates, providing a clear quantitative guide for managers to determine when production scales are economically viable versus when they fall below the cost-recovery threshold. The study employs sensitivity analysis to stress-test these models against auction price fluctuations and input cost inflation, identifying the High Grown sector as the most price-resilient, while the Medium Grown sector proves highly cost-sensitive. The resulting framework provides a precise analytical tool for policymakers to implement elevation-specific production targets, optimize resource allocation, and enhance the financial sustainability of the Sri Lankan tea sector.

Keywords: *Profit optimization, Marginal cost, Marginal revenue, Differential calculus, Break-even analysis, Sensitivity analysis, Quadratic cost function, Economic optimization*

Abstract ID: 013

ANALYSIS OF NATIONAL INCOME AND PUBLIC EXPENDITURE TRENDS IN SRI LANKA

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Abstract

This study explores the intricate relationship between national income and government spending in Sri Lanka, employing statistical modelling to examine how various income sources impact public expenditure. The research models government spending as dependent on revenue components, including direct and indirect taxes, grants, rupee loans, and treasury bills, utilizing yearly fiscal data from the Central Bank of Sri Lanka. The initial phase of analysis applied Multiple Linear Regression, which revealed strong links between tax revenue and government expenditure. However, it also uncovered significant multicollinearity among the independent variables, as indicated by elevated Variance Inflation Factor values. In response to this issue, this study utilized Principal Component Analysis (PCA), a dimensionality reduction technique that converts correlated variables into a smaller set of uncorrelated principal components. Subsequently, Principal Component Regression was carried out using the first three principal components, which captured over 95% of the variance in the dataset. This refined model yielded a high R-squared value of 0.9975, demonstrating the strong explanatory power of national income components in predicting government expenditure. Model diagnostics further confirmed the absence of autocorrelation. Additionally, forecasts based on the PCA model projected a consistent upward trend in government spending through the year 2030. The research highlights the importance of data-driven fiscal policy in Sri Lanka, stressing the role of robust statistical methods and dimensionality reduction in enhancing public finance analyses. The insights gained from this study provide valuable guidance for policymakers seeking to develop more accurate and sustainable budgeting strategies.

Keywords: *Government Expenditure, Multicollinearity, National Income, Principal Component, Regression Analysis*

Abstract ID: 032

FORECASTING LP95 PETROL PRICES IN SRI LANKA USING TIME SERIES MODELS

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Abstract

Accurate forecasting of petrol prices is important because fuel price fluctuations significantly affect transportation costs, inflation, and overall economic activity. This study analyses and forecasts monthly LP95 petrol prices in Sri Lanka using classical time series techniques. Monthly LP95 petrol price data from March 1990 to November 2025 were obtained from the Ceylon Petroleum Corporation and analysed using R. Exploratory data analysis was conducted to examine the characteristics and temporal patterns of the series. A logarithmic transformation was applied to stabilize the variance, and stationarity was assessed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. First-order differencing was subsequently applied to obtain a stationary series. Candidate ARIMA models were identified using the autocorrelation function (ACF) and partial autocorrelation function (PACF), with model selection based on the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). Multiple structural-break analysis was conducted to identify changes in the level of the LP95 price series, with breakpoints detected in August 1996, March 2007, and July 2020. ARIMA (3,1,0) and Holt's Linear Trend models were evaluated using a 12-month holdout sample, while a post-break ARIMA (1,1,0) model was additionally assessed using data from the most recent pricing regime. Forecasting performance was evaluated using Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), and Root Mean Squared Error (RMSE). Although ARIMA (3,1,0) outperformed Holt's Linear Trend, the post-break ARIMA (1,1,0) model achieved the best out-of-sample forecasting performance, with an MAE of 19.48, RMSE of 22.69, and MAPE of 5.71%. Residual diagnostics indicated no significant autocorrelation, with the Ljung - Box test yielding a p-value of 0.924. These findings indicate that accounting for structural changes can improve the forecasting of LP95 petrol prices and provide useful information for policymakers, businesses, and consumers in planning and decision-making related to fuel price movements in Sri Lanka.

Keywords: *ARIMA model, Forecasting, LP95 petrol price, Structural breaks, Time series analysis*

Abstract ID: 045

IMPACT OF MULTICOLLINEARITY PROBLEMS IN MODEL FITTING AND REMEDIAL MEASURES

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Abstract
Multicollinearity is a major problem in multiple linear regression model fitting using the ordinary least squares method, because it increases the variance and covariance of regression coefficients and reduces the reliability of statistical inference. This study evaluates the performance of ridge regression as an alternative to the ordinary least squares estimation method under multicollinearity conditions. Simulated data sets with high correlation structures ($\rho = 0.9$, 0.95 and $\rho = 0.99$) were generated using the Monte Carlo simulation method with MINITAB software for five independent variables and one dependent variable with different sample sizes. The study focuses on comparing the stability and accuracy of parameter estimation methods by using statistical indicators such as the confidence interval width of the parameter, the mean squared error of the model, and the mean squared error of the parameter. The results indicate that ordinary least squares estimation becomes unstable when explanatory variables are highly correlated, whereas ridge regression provides more stable and reliable estimates. The findings confirm that ridge regression is an effective method for overcoming multicollinearity and improving predictive accuracy in regression analysis.

Keywords: *Mean Squared Error, Multicollinearity, Multicollinearity Diagnostic Method, Ordinary Least Squares, Ridge Regression*

Abstract ID: 059

STATISTICAL ANALYSIS OF NEONATAL OUTCOMES AND ASSOCIATED RISK FACTORS AT ASHRAFF MEMORIAL HOSPITAL KALMUNAI – 2025

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Abstract

Neonatal outcomes such as low birth weight and preterm birth remain a major concern in hospital settings, particularly in regional hospitals where statistical investigation of clinical data is still limited. This study was conducted at Ashraff Memorial Hospital, Kalmunai, using neonatal examination records from the year 2025, and the aim of the study was to identify factors associated with adverse neonatal outcomes. A total of 1,542 neonates were included in the analysis. Data on birth weight, gestational age, neonatal length, occipitofrontal circumference (OFC), Neonatal Intensive Care Unit (NICU) admission status, and maternal characteristics, including age, gravida, parity and mode of delivery, were collected from secondary hospital records and analysed using statistical software SPSS & MINITAB and Microsoft Excel. Descriptive analysis showed that 16.2% of neonates were low birth weight (LBW), 18.4% were preterm and 60.1% of deliveries were performed by caesarean section. Among preterm neonates, emergency Lower Segment Caesarean Section (LSCS) was the most common mode of delivery. Chi-square tests revealed that preterm birth was significantly associated with mode of delivery ($p < 0.001$), and LBW neonates were significantly more likely to be admitted to the NICU ($p < 0.001$). Maternal age showed a significant association with both LBW and mode of delivery, with teenage mothers and mothers above 35 years having a higher proportion of LBW neonates compared to mothers aged 21-35 years. However, no significant association was found between maternal age and NICU admission. Multiple linear regression analysis identified gestational age, mode of delivery, and gender of the baby as significant predictors of birth weight, together explaining around 36% of the variation in birth weight. Further, Binary logistic regression showed that lower birth weight, lower gestational age, mode of delivery, and presence of birth defects significantly increased the likelihood of NICU admission. Furthermore, the logistic model found that higher maternal age and higher birth weight were associated with increased odds of caesarean delivery, while higher gestational age and higher gravida reduced the odds. With total comprehensive, the results of this research suggest that gestational age, birth weight, and mode of delivery are key factors influencing neonatal outcomes at Ashraff Memorial Hospital. Regular monitoring of high-risk pregnancies and strengthening of NICU facilities are recommended to improve neonatal care in the Kalmunai region.

Keywords: *ANOVA, Binary Logistic Regression, Chi-Square Test, Multiple Regression, Neonatal Outcomes*

Abstract ID: 061

FORECASTING TOURIST ARRIVALS THROUGH NEWS SIGNALS: INTEGRATING TOPICS AND SENTIMENT IN SRI LANKA

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Abstract

Tourism demand forecasting is essential for planning and management, particularly in developing countries where the sector is vulnerable to external shocks. Beyond historical trends and seasonality, tourism demand is influenced by destination perception and social disruptions reflected in news media. This study investigates whether news-derived semantic topics and sentiment signals can enhance tourism demand forecasting in Sri Lanka. Tourism-related news articles are transformed into variables using Sentence-BERT embeddings, K-Means-based semantic clustering for topic extraction, and VADER sentiment analysis. VADER was selected as an efficient and reproducible approach for quantifying sentiment, complementing the semantic information captured by Sentence-BERT. Six K-Means clusters were retained to provide a balance between differentiation and avoiding excessive fragmentation of related news articles. The six topics, natural disasters, pandemic effects, economy, cultural events, energy crises, and travel advisories, were interpreted based on keywords, representative articles, and their relevance to tourism disruptions and destination perception. These variables, along with seasonal indicators and historical arrivals, are integrated into machine learning and deep learning models, including XGB, FNN, and LSTM are compared with a SARIMA baseline. The forecasting framework distinguishes a univariate model based solely on historical arrivals from feature-enhanced models that progressively incorporate seasonal indicators and news-derived topic and sentiment features. Feature selection and preprocessing were performed using training information only to ensure that test-period information did not influence model development. The results show that machine learning and deep learning models consistently outperform SARIMA. Adding seasonal indicators and news-based topic and sentiment features significantly improves forecasting accuracy. The FNN with seasonal and news-derived features achieves the best performance (RMSE = 8,842.66; MAE = 6,824.43; MAPE = 3.63%; R^2 = 0.9567). The most informative predictors were lagged tourist arrivals, seasonal indicators, and news-derived signals. Overall, the findings demonstrate that news topics and sentiment signals provide predictive information beyond historical arrivals and seasonal indicators, improving tourism demand forecasting and supporting informed policy and planning decisions.

Keywords: *Destination perception, News analytics, Semantic topic discovery, Sentiment analysis, Time series forecasting, Tourism demand forecasting*

Abstract ID: 067

A STUDY ON TOURIST ARRIVALS IN SRI LANKA: A COMPARATIVE ANALYSIS OF STATISTICAL TIME-SERIES AND MACHINE LEARNING APPROACHES

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Abstract
Tourism is an important sector of the Sri Lankan economy in terms of foreign exchange earnings, employment and economic growth. However, the industry is highly vulnerable to economic, political, and global events; thus, accurate forecasting is vital for tourism planning and policymaking. In this study, the forecasting performance of Autoregressive Integrated Moving Average (ARIMA), Autoregressive Integrated Moving Average with Exogenous Variables (ARIMAX), Random Forest (RF) and Extreme Gradient Boosting (XGBoost) was compared using annual tourist arrival data from 1970-2024, omitting 2021 owing to the severe interruption to international tourism caused by the COVID-19 pandemic. In order to assess the underlying tourism demand patterns under more typical conditions and to avoid the severe pandemic-related shock from disproportionately affecting model estimation, 2021 was excluded. The preprocessing of the data included logarithmic transformation, checking for stationarity using Augmented Dickey–Fuller (ADF) and Kwiatkowski–Phillips–Schmidt–Shin tests (KPSS), first-order differencing, and model assessment using Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and Mean Absolute Percentage Error (MAPE). The ARIMA (0,1,1) and ARIMAX (0,1,1) were found to be the best statistical models. XGBoost produced the best forecasting accuracy (MAE=6.725047e+05; RMSE=8.154636e+05; MAPE=84.993085) followed by Random Forest (MAE=7.520293e+05; RMSE=9.174555e+05; MAPE=103.236486). ARIMA (MAE=1.122617e+06; RMSE=1.283612e+06; MAPE=147.895124) and ARIMAX (MAE=1.871082e+06; RMSE=2.031093e+06; MAPE=215.033359) resulted in lower predictive performance. These results indicate the effectiveness of machine learning models in forecasting tourist arrivals in Sri Lanka, with Extreme Gradient Boosting attaining the greatest predictive performance among the models tested.

Keywords: *Autoregressive Integrated Moving Average, Autoregressive Integrated Moving Average with Exogenous Variables, Extreme Gradient Boosting, Mean Absolute Error, Random Forest*

Abstract ID: 078

PERCEPTION AND ACCEPTANCE OF FINGERPRINT ATTENDANCE SYSTEMS AMONG PROVINCIAL SCHOOL TEACHERS IN AMPARA REGION

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Abstract

Nowadays, fingerprint systems are increasingly being used in government schools. This study examines the perceptions and acceptance of the fingerprint attendance system among provincial school teachers in the Ampara region. It mainly focuses on understanding the factors that influence teachers' acceptance, such as perceived usefulness, ease of use, available support, trust, fairness, and feelings of pressure related to the system. Data were collected from 200 teachers using a structured questionnaire. Different statistical methods, including descriptive analysis, reliability testing, factor analysis, and multiple regression, were used to analyse the data. The results show that teachers generally have a moderate to high level of acceptance of the system; further, ease of use and facilitating conditions were identified as the most important factors influencing acceptance. This indicates that teachers are more willing to use the system when it is simple to operate and when adequate support and resources are available. Overall, the study represents the importance of making the system user-friendly and providing sufficient support to improve acceptance among teachers. It also suggests that addressing practical concerns and improving implementation can help increase user satisfaction. The findings can be useful for school administrators when planning and improving the school's attendance system.

Keywords: *Acceptance, Facilitating condition, Fingerprint attendance system, School Teachers*

Abstract ID: 079

FORECASTING BITCOIN RETURN VOLATILITY AND MONITORING FORECAST PERFORMANCE USING EXPONENTIAL WEIGHTED MOVING AVERAGE (EWMA) CHART

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Abstract

Volatility in Bitcoin is higher than that of other cryptocurrencies in the crypto market; hence, the need for volatility forecasting to manage risks. This research paper will forecast Bitcoin's return volatility and evaluate the forecasts using the Exponentially Weighted Moving Average (EWMA) control charts. The daily closing prices of Bitcoin from 1st January 2015 to 31st December 2024 were sourced from the website CoinMarketCap and converted to logarithmic returns. Graphical and descriptive statistics analysis revealed that the returns of Bitcoin have high volatility, clustering, asymmetry, and extreme changes. The EWMA approach was used to estimate the volatility of returns at different times, while forecast accuracy was measured by Mean Squared Error (MSE), Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE). The results revealed that the forecast error was relatively low, meaning that the EWMA approach is an efficient tool for generating accurate and reliable volatility forecast estimates. From the EWMA control chart, we note that most of the forecast errors lie within the control limits, though there have been some deviations from the control limits during times of high market volatility, specifically in 2020 when the pandemic hit. From the smoothing parameter comparison, we note that λ=0.94 generates more reliable and stable forecast estimates compared to λ=0.80. Overall, the findings confirm that the EWMA model and EWMA control charts are effective tools for forecasting and monitoring Bitcoin return volatility.

Keywords: *Bitcoin, Cryptocurrency, EWMA Control Chart, Forecast Accuracy, Time-Varying Volatility, Volatility Forecasting*

Abstract ID: 083

A TIME SERIES APPROACH TO MODELLING SIGNIFICANT WAVE HEIGHT ON THE SOUTH-EASTERN REGION OF SRI LANKA USING BUOY SENSOR DATA

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Abstract

The south-eastern coastal region of Sri Lanka, surrounding Pottuvil, Oluvil, and Akkaraipattu, has experienced rapid infrastructure growth in recent years, mainly in the fisheries, tourism, and harbour development. Reliable prediction of wave height is essential for the safe design and operation of coastal protection structures such as breakwaters, harbours, and seawalls. This study employs the Seasonal Autoregressive Integrated Moving Average approach to model and forecast significant wave heights (SWH) using ten years of buoy sensor data (2014–2023) collected at the Oluvil station (6.651 °N, 82.153 °E). The wave heights were divided into morning (06.00 A.M) and night (6.00 P.M) series, and the average wave height was calculated to examine temporal variations. The results of the analysis revealed that both time series were non-stationary and had strong annual seasonality associated with the monsoon cycles. After applying regular and seasonal differencing, the SARIMA $(1,1,0)(1,1,1)_{12}$ model was identified as the most suitable model for morning wave heights, while the SARIMA $(1,1,0)(2,1,1)_{12}$ model provided the best fit for night wave heights based on the AIC, SIC, and log-likelihood values. Model diagnostic tests confirmed that both estimated models were adequate. In-sample forecasting for the period 2020–2023 produced Mean Absolute Percentage Error (MAPE) values of 5.91% for the morning wave heights and 5.32% for the night series, indicating high forecasting accuracy. The results further showed that the nighttime wave heights were consistently higher and more variable than morning wave heights due to diurnal ocean-atmosphere interactions. These findings provide a reliable approach for forecasting wave heights and provide valuable support for coastal engineering design and infrastructure planning along the south-eastern coast of Sri Lanka.

Keywords: *SARIMA, Significant wave height, Buoy Sensor Data, Coastal Engineering, Monsoon*

Abstract ID: 088

CAREER READINESS AMONG UNDERGRADUATES: EXPERIENTIAL LEARNING AND ARTIFICIAL INTELLIGENCE (AI) INTEGRATED DIGITAL SKILLS AT SEUSL

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Abstract

In today's scenario, the transition from university to work life in Sri Lanka requires skills related to practical applications, digitalization, and Artificial Intelligence (AI). At the same time, it is not yet clear how students at regional universities, such as South Eastern University of Sri Lanka (SEUSL), feel about their career readiness, and how previous studies have linked certain variables to their perceptions. The purpose of this study was to explore the predictive nature of the quality of experiential learning, self-efficacy, faculty support, and acceptance of the newly designed AI-Integrated Experiential Learning Model (AIELM), which integrates internships, research, simulation, and experience with AI. A quantitative study utilizing a cross-sectional survey using a convenience sampling approach was used to obtain information from 386 university undergraduates in all six SEUSL faculties during November 2025 to February 2026, which is higher than the minimum 385 participants needed at a 95% confidence level using a $\pm 5\%$ margin of error based on Cochran's formula, through a pilot-tested 65-item questionnaire, which was conducted both online and on paper to accommodate the unequal availability of computers among participants, and data reliability was established using Cronbach's alpha. The final model accounted for 40% of the variance in readiness for career ($R^2 = 0.400, F_{(4,381)} = 63.47, p < 0.001$), where the predictor with the greatest influence on readiness was faculty support ($\beta = 0.415$), then self-efficacy ($\beta = 0.293$, in accordance with the Social Cognitive Theory by Bandura, followed by AIELM ($\beta = 0.125$), and finally the quality of the experiential learning ($\beta = 0.111$); interestingly, the quality of the experiential learning predicted readiness for career only when the effect of the faculty support was controlled, as a suppressor variable, and there were no differences among genders, first-generation students, year of study, GPA, or faculty members. These findings theoretically validate the integration of AI literacy in experiential learning as well as practically guide SEUSL, South Asian educational organizations, and policymakers to institutionalize faculty mentoring, mandatory experiential learning, and AI skills training.

Keywords: *AIELM, Artificial Intelligence, Career Readiness, Experiential Learning, Self-Efficacy*

Abstract ID: 090

NUTRITIONAL STATUS OF ADOLESCENTS BASED ON BMI FOR AGE Z SCORE IN THELLIPALAI MEDICAL OFFICER HEALTH AREA, JAFFNA DISTRICT

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Abstract

Adolescence is a critical stage of human development. Both undernutrition and overnutrition may have adverse consequences during adolescence. This study aimed to assess the nutritional status of adolescents aged 17–19 years in the Thellipalai Medical Officer of Health (MOH) area, Jaffna District, Sri Lanka, using BMI-for-age Z-scores (BAZ). Ethical approval was obtained from the Ethics Review Committee, Faculty of Medicine, University of Jaffna. This subgroup analysis included 38 male and 30 female adolescents from the Thellipalai Medical Officer of Health area, selected from a larger community-based study of 752 adolescents using a multistage stratified cluster sampling technique. During household visits, written informed consent was obtained from participants, and for those younger than 18 years, consent was obtained from a parent or guardian. Socio-demographic information was collected using an interviewer-administered questionnaire. Body weight and height were measured, and BAZ was calculated using WHO AnthroPlus software. Data were analysed using IBM SPSS Statistics version 21.0. The mean ages of male and female participants were 18.1±0.7 and 18.3±0.7 years, respectively. Of the participants, 6 (8.8%) were severely thin, 7 (10.3%) were thin, 51 (75.0%) had normal BAZ, 3 (4.4%) were overweight, and 1 (1.5%) was obese. Overall, 19.1% were undernourished, while 5.9% were overweight or obese. The findings demonstrate the coexistence of undernutrition and overnutrition among adolescents in the study population. Although most adolescents had normal BAZ, the relatively high prevalence of undernutrition and the presence of overweight and obesity indicate a double burden of malnutrition. Regular nutritional screening, nutrition education, and community-based interventions involving adolescents, families, schools, and health personnel are recommended to promote healthy diets and lifestyles.

Keywords: *Adolescents, BMI, Obesity, Thellipalai, Thinness*

Abstract ID: 096

THE RELATIONSHIP BETWEEN FINANCIAL RATIOS AND STOCK RETURNS: EVIDENCE FROM THE COLOMBO STOCK EXCHANGE

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Abstract

Investors and analysts often use financial ratios to assess firms' performance and forecast stock returns. But they have little track record in frontier markets like Sri Lanka. This study investigates the association between some financial ratios and the stock returns of companies listed on the Colombo Stock Exchange from 2017 to 2023. The analysis is based on five financial ratios, namely price-to-earnings ratio, earnings per share, return on equity, dividend yield, and price-to-book ratio. The study utilized a balanced panel data set of 100 listed companies (700 firms' yearly observations) and adopted panel regression techniques like pooled ordinary least squares, fixed effects, and random effects models. Model selection and diagnostics were used to determine the most appropriate specification. The fixed effects model was selected using the Hausman test. The results indicate that dividend yield and price-to-book ratio have a significant positive impact on stock returns, while earnings per share have a marginal positive impact. However, the price-to-earnings ratio and return on equity do not show a statistically significant relation to stock returns. The findings of the research suggest that the valuation and dividend-related indicators are more relevant in explaining stock performance in the Sri Lankan equity market than the earnings-based measures. The study provides valuable information to investors, financial analysts, and policymakers to make informed investment and financial decisions.

Keywords: *Colombo Stock Exchange, Financial Ratios, Price-to-book-ratio, Return on Equity, Stock Return*

Physical Sciences

Abstract ID: 027

THE SYNTHESIS AND CHARACTERIZATION OF $V_2O_5/MnO_2/TiO_2$ COMPOSITE CATHODE FOR AQUEOUS ZINC-ION BATTERIES

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Abstract

The demand for rechargeable aqueous zinc-ion batteries (ZIBs) is higher for large-scale energy storage uses due to their various advantages, including safety and low cost. The performance of ZIBs can further be enhanced by employing an advanced composite material as a cathode. The present work aims to develop and characterize a low-cost composite cathode material suitable for ZIBs based on Manganese dioxide (MnO_2) and Vanadium pentoxide (V_2O_5), incorporating Titanium dioxide (TiO_2) and Graphite as additives and Polyvinylidene fluoride-co-hexafluoropropylene (PVDF) as a binder. In this study, cathode samples were synthesized with various ratios of MnO_2: V_2O_5: TiO_2: PVDF: Graphite using the slurry coating method and characterized with Fourier Transform Infrared Spectroscopy (FTIR), Cyclic Voltammetry (CV), Galvanostatic charge-discharge measurement (GCD), and Electrochemical Impedance Spectroscopy (EIS). An aqueous solution of 0.5 M $ZnSO_4$ was used as the cycling electrolyte. The FTIR spectroscopy indicates the main characteristic absorption band representing Mn–O, V=O, and V–O–V stretching vibrations in all samples. Further, the sample containing 40% of V_2O_5 and 20% of MnO_2 yielded an outstanding electrochemical performance in CV, GCD, and EIS studies, with a specific capacitance of 85.88 F/g at a current density of 0.5 A/g. The energy density and the power density of the best electrode sample were found to be 20.46 W h/kg and 327.50 W/kg, respectively. This electrode shows the lowest resistance of 1.04 Ω. Our investigation indicates that the sample with a composition of V_2O_5 - 40% & MnO_2 - 20% is a promising candidate for a low-cost cathode material for ZIBs.

Keywords: *Zinc-ion batteries, Fourier Transform Infrared, Cyclic Voltammetry, Electrochemical Impedance Spectroscopy, Galvanostatic charge-discharge*

Abstract ID: 29

OPTIMIZATION OF MnO_2:V_2O_5 RATIO IN CARBON-BASED HYBRID ELECTRODES FOR HIGH-PERFORMANCE SUPERCAPACITORS

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Abstract

High-performance and cost-effective electrode materials are in demand for supercapacitors. Even though MnO_2 and V_2O_5 are known as pseudocapacitive materials, they have low electrical conductivity, which affects practical applications. This work aims to optimize the electrodes of MnO_2, V_2O_5, activated carbon (AC), and graphene oxide (GO). Electrode preparation was achieved by means of mechanical mixing and coating on stainless steel substrates using the doctor blade method. The optimum mass ratio between MnO_2 and AC was found to be 70:30. Then, the optimal mass ratio between MnO_2 and V_2O_5 was 2:1. The resultant electrode showed the highest electrochemical performance of 198 F g^{-1} in terms of capacitance at 0.5 A g^{-1}, an energy density of 27 Wh kg^{-1}, and a power density of 248 W kg^{-1}. FTIR analysis proved the presence of all electrode materials. EIS indicated good ion transfer and rapid ion movement. Pseudo-capacitance of metal oxides and conductivity of carbon materials are the reasons for the high capacity and fast ion transfer.

Keywords: *Supercapacitors, MnO_2, V_2O_5, hybrid electrodes, ratio optimization, energy storage*

Abstract ID: 044

DEVELOPMENT AND CHARACTERIZATION OF CARBON-CEMENT SUPERCAPACITORS USING RICE HUSK-DERIVED ACTIVATED CARBON BLACK

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Abstract
Rice husk is an abundant agricultural by-product in South and Southeast Asia and is an active raw material for the synthesis of activated carbon black (ACB) for electrical conduction. A low-cost electronically conducting cement composite material has been synthesized using carbon black derived from rice husk for use as an active material in supercapacitors. Three different ACB samples were synthesized from pristine rice husk at carbonization temperatures of 500 °C, 550 °C, and 600 °C, respectively, and characterized using Fourier Transform Infrared Spectroscopy (FTIR) separately. It was found that there existed a peak in the three samples corresponding to the Wavenumber region 1600-1700 cm^{-1}, indicating the graphitic character of C=C to electrical conductivity. Electronically conducting cement composite (ECCC) was prepared at different weight fractions of ACBs: 14%, 16%, and 18%. A total of nine samples were prepared corresponding to the three temperatures. These ECCC samples were characterized using Electrochemical Impedance Spectroscopy and Cyclic Voltammetry. The sample prepared at 550 °C with 18% of ACB yields the highest specific capacitance of 6,220.98 µF/g and ionic conductivity of 26.66 mS/cm, while the sample prepared at 550 °C with 16% sample was identified as the most balanced electrode, deriving 4,966.9 µF/g and 18.86 mS/cm ionic conductivity. Additionally, 600 °C with 16% sample shows the ideal electrochemical double layer capacity by lower charge transfer resistance. This study demonstrates that pyrolysis temperature and carbon content strongly regulate the conductive and diffusion behaviour of biomass-derived carbon-cement composites, emphasizing the potential of rice husk waste as a sustainable feedstock for multifunctional structural energy storage systems.

Keywords: *Carbon-cement supercapacitor, Activated Carbon Black (ACB), Rice Husk (RH), Energy storage, Structural Supercapacitor, Carbonization temperature, Electrochemical Performance, Sustainable Materials*