



# ANNUAL RESEARCH SESSION - 2024

## Scientific Approaches to Overcome Regional Challenges

### Abstracts of the Proceedings of ARS-FOS-2024

Faculty of Science  
Eastern University, Sri Lanka



ISBN 978-624-5731-44-2



## Abstracts of the Proceedings

of

Annual Research Session  
Faculty of Science  
ARS-FOS-2024

***"Scientific Approaches to Overcome Regional Challenges"***

12<sup>th</sup> December 2024  
Faculty of Science  
Eastern University, Sri Lanka

***Annual Research Session, Faculty of Science 2024 (ARS-FOS-2024)***

**ARS-FOS-2024, 12<sup>th</sup> December 2024**

**Session mode:** Hybrid

**Session organized by:** Faculty of Science, Eastern University, Sri Lanka

**Copyright and reprint permissions:** Copyright © 2024 Faculty of Science, Eastern University, Sri Lanka. All right reserved according to the Code of Intellectual Property Act, No. 36 of 2003. No part of this publication may be reproduced, stored, transmitted, or disseminated, in any form, or by any means without prior written permission from Faculty of Science.

**Disclaimer:** The materials in this publication have been supplied by authors, and the views expressed remain the responsibility of the named authors. The statements and opinions stated in this publication do not necessarily represent the views of the Faculty of Science. No responsibility is accepted by the Faculty of Science for the accuracy of information contained in the text and illustrations.

**Published by:**

Faculty of Science, Eastern University, Sri Lanka, Vantharumoolai, Chenkalady, Sri Lanka.

## *Message from the Vice-Chancellor*

*Professor V. Kanagasingam  
Vice-Chancellor  
Eastern University, Sri Lanka*



I am pleased to extend my heartfelt congratulations to the Faculty of Science for organizing the Annual Research Session 2024 (ARS-FOS-2024). The theme, "*Scientific Approaches to Overcome Regional Challenges*," is both relevant and inspiring, addressing the urgent need to tackle societal and environmental challenges through innovative scientific solutions.

Research is the systematic investigation to discover new knowledge or validate existing knowledge, or facilitate to practical applications. It is driven by curiosity and the pursuit of truth, aiming to provide answers to complex questions, solve real-world problems, and contribute to the advancement of society.

This session is a significant platform for academic staff, undergraduates and postgraduates to disseminate their research findings and foster a culture of knowledge sharing and collaboration. It provides an excellent opportunity for researchers to engage with societal stakeholders, including entrepreneurs and policymakers, ensuring that research outcomes contribute meaningfully to addressing regional and global challenges.

I would like to appreciate the Dean, Chairperson and Coordinator, the members of the organizing committee, academic mentors, and all participants for their dedication in making this event a vibrant and impactful gathering. By bringing together students, academics, and stakeholders, this session underscores Eastern University, Sri Lanka's commitment to advancing science for the betterment of society and the environment.

I wish the Annual Research Session 2024 every success and hope it continues to inspire innovative solutions and lasting collaborations.

## *Message from the Dean*

*Senior Professor P. Vinobaba  
Dean, Faculty of Science  
Eastern University, Sri Lanka*



It is with great pleasure and enthusiasm that we present the proceedings of the Annual Research Session-2024, organized by the Faculty of Science at Eastern University, Sri Lanka. This year's theme, "*Scientific Approaches to Overcome Regional Challenges*," is a reflection of the critical role that science and innovation play in addressing the unique and pressing issues faced by our region.

On behalf of the faculty, I would like to express our sincere gratitude to the Vice Chancellor, EUSL, Professor V. Kanagasigam for his guidance and support. I would also like to convey my warm thanks to Chair of ARS-FOS-2024 Senior Professor. S. Thirukkanesh. I also extend my appreciation to the organizing committee for their tireless efforts in putting together this event. Your hard work and attention to detail have ensured that this research session runs smoothly and is a resounding success. I want to express my gratitude to all the researchers, advisors, and mentors who have guided and supported our students in their research endeavors. Your guidance and mentorship are invaluable in shaping the researchers of tomorrow.

As we navigate through the complexities of socio-economic, environmental, and health challenges, the research shared in this session offers a wealth of knowledge, innovative methodologies, and collaborative solutions. The contributions from our esteemed scholars, researchers, and students not only highlight the current state of scientific inquiry but also pave the way for future advancements that can positively impact our communities and the broader region. In this session, we aim to foster dialogue, inspire collaboration, and promote a deeper understanding of how scientific research can be applied to improve the quality of life and ensure sustainable development. It is through such efforts that we can better address the local challenges we face, from climate change and biodiversity loss to public health and technology access.

We extend our heartfelt thanks to all contributors, participants, and attendees for their dedication to advancing scientific knowledge and for their unwavering commitment to creating a more resilient and prosperous future for the people of Sri Lanka and beyond. We hope that the insights shared during this session will inspire continued research, innovation, and partnership in our collective journey toward overcoming regional challenges.



## *Message from the Chairperson*

*Senior Professor S. Thirukkanesh  
Chairperson  
ARS-FOS-2024*



On behalf of the Organizing Committee, I am pleased to extend my message for the Annual Research Session 2024 (ARS-FOS-2024), hosted by the Faculty of Science, Eastern University, Sri Lanka. The primary goal of this academic forum is to share the findings of undergraduate research with relevant stakeholders on issues that are crucial to the region, the environment, and the local community.

The ARS-FOS-2024, with the theme “*Scientific Approaches to Overcome Regional Challenges*,” offers an important platform for presenting research across all areas of science. This event provides a vital opportunity to explore how scientific research can address regional challenges. We received 18 extended abstracts and 2 full papers from Honors Degree research projects for competitive award. Following a thorough review process, the editorial committee accepted 17 abstracts for inclusion in the conference proceedings. We believe that the research shared at ARS-FOS-2024 will encourage the exchange of original ideas, inspire future research, and broaden our understanding of various fields within advanced science.

ARS-FOS-2024 will be further enriched by a keynote address from the distinguished scientist, Professor Meththika Suharshini Vithanage, Founding Director of the Ecosphere Resilience Research Centre, Faculty of Applied Sciences, University of Sri Jayewardenepura. I sincerely thank Professor Meththika Suharshini Vithanage for accepting our invitation to share her valuable research insights with us, despite her demanding schedule. Her keynote address will provide a unique opportunity for all attendees to learn about the latest developments in scientific research.

I would also like to express my gratitude to the Vice Chancellor, Professor V. Kanagasigam, for his support in organizing this conference. My sincere thanks to the Dean of the Faculty of Science, Senior Professor P. Vinobaba, for his continued support and cooperation. I am deeply grateful to the Editor-in-Chief of ARS-FOS-2024, Professor S. Arasaretnam, Secretary Dr.A.J.M. Harris, and the Organizing Committee members for their tireless efforts in ensuring the success of this event. My heartfelt thanks also go to the IT Committee for their expertise in facilitating all virtual meeting activities.

Lastly, I would like to extend my appreciation to the presenters for their contributions, and congratulate them on successfully sharing their research findings. I hope that ARS-FOS-2024 will provide a dynamic and stimulating platform for engaging discussions and productive exchanges of ideas.

Finally, I express my appreciation to the presenters for enriching the conference with your contributions, and congratulate them for successfully publishing their research findings. I wish fervently that the ARS-FOS-2024 will be a resounding success.

## *Message from the Editor-in-Chief*

*Professor S. Arasaretnam*  
*Editor-in-Chief*  
*ARS-FOS-2024*



The Faculty of Science is organizing the Annual Research Session 2024 (ARS-FOS-2024) with the theme of '**Scientific approaches to overcome regional challenges**'. The invitation to submit extended abstracts and full papers generated an unprecedented 20 submissions. The session mainly focuses on the dissemination of undergraduate research that addresses societal needs and environmental issues. The ARS-FOS-2024 provides an opportunity for undergraduates to disseminate their research findings to the societal stakeholders in a vibrant conference environment where academics, researchers and entrepreneurs participate.

I wish to thank the many reviewers who accepted our invitation and reviewed the extended abstracts and full papers. They submitted their reviews on time despite their busy schedules. Your contribution helped us maintain high standards and assist young scientists in improving their submissions.

I also wish to thank the editorial committee of Annual Research Session-2024, who assisted me to coordinate and manage the review process efficiently.

## *Brief Biography of the Keynote Speaker*

***Prof. Meththika Suharshini Vithanage,***

*Founding Director, Ecosphere Resilience Research Centre*

*Office of the Dean, Faculty of Applied Sciences*

*University of Sri Jaywardenepura, Nugegoda 10250*

*Sri Lanka*



Prof. Meththika Vithanage stands as a luminary in the realm of Natural Resources, heralding a transformative era in environmental research and academia. As the esteemed Professor and founding director of the Ecosphere Resilience Research Centre at the University of Sri Jaywardenepura, Sri Lanka, her pioneering vision has propelled her to the forefront of global scholarship. Prof. Vithanage's influence extends far beyond her home institution, as evidenced by her roles as an Adjunct Professor at the Institute of Agriculture, University of Western Australia, and the National Institute of Fundamental Studies, Sri Lanka. Recently appointed as an Eminent Visiting Scientist at the Saveetha Institute of Medical and Technical Sciences, India, she continues to illuminate pathways for innovative research and collaboration. With a multifaceted academic background spanning water chemistry, environmental remediation, microplastics, and waste biomass conversion, Prof. Vithanage has earned international acclaim for her groundbreaking contributions. Her induction as a Fellow of the National Academy of Sciences in Sri Lanka (NASSL) in 2022 underscores her exceptional scholarship and leadership in the field. Recognized as a Highly Cited Researcher by Clarivate, she epitomizes excellence, ranking within the top 0.1% of highly cited scientists globally. Prof. Vithanage's accolades, including the prestigious Fayzah M. Al-Kharafi award from The World Academy of Science (TWAS) in 2020 and the Most Outstanding Senior Researcher in Physical Sciences award by the Committee of Vice Chancellors and Directors, Sri Lanka, attest to her unwavering commitment to scientific excellence. With a prolific publication record comprising over 250 SCI-indexed journal articles, 60 book chapters, and 10 co-edited books published by esteemed publishers such as Elsevier, Springer, Wiley, and CRC Press, her scholarship continues to shape the landscape of environmental science. Dr. Vithanage's citation record, exceeding 24,000 with an H-index of 76, reflects the profound impact of her research on global discourse and practice. As Chairperson of the Young Scientists Forum and recipient of the Best Young Scientist award from the National Science and Technology Commission, Sri Lanka, she empowered the next generation of scholars to push the boundaries of knowledge and innovation. In addition to her scholarly achievements, Prof. Vithanage is passionate on science popularization, having authored over 100 newspaper articles and 5 books aimed at engaging school children and the general public with the wonders of science. Prof. Vithanage's legacy as one of the foremost authorities on biochar and microplastic research, and her tireless pursuit of excellence, inspire and illuminate the path forward for environmental research worldwide.



## *Keynote Speech*

### **Biochar as a Catalyst for Sustainable Innovation to Overcome Regional Challenges**

**Prof. Meththika S.Vithanage**

*Ecosphere Resilience Research Center, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka*

*National Institute of Fundamental Studies, Kandy, Sri Lanka*

*The UWA Institute of Agriculture, University of Western Australia, Australia*

*Sustainability Cluster, University of Petroleum and Energy Studies, Dehradun, India*

Biochar, an organic matter derived from biomass pyrolysis, is a game-changing catalyst that fosters innovation across multiple disciplines by combining science, research, and technology. With its porous structure and unique features, this carbon-rich material offers a path to dramatic breakthroughs in agriculture, environmental sustainability, and renewable energy. It has presented a scientific breakthrough for regional challenges by integrating research, technology, and sustainable practices. Its porous structure and diverse properties render biochar a transformative solution for agriculture, environmental management, and renewable energy with respect to regions concerned about food security, water quality issues, and climate resilience. Its application as a soil amendment increases the fertility of soil, promotes retention of nutrients, and reduces greenhouse gas emissions, hence serving as a tool for sustainable agriculture in resource-constraint environments. In environmental remediation, biochar's ability to treat wastewater and remove emerging contaminants is promising, although it still needs optimization. Most importantly, it has great potential in carbon sequestration and waste-to-resource conversion for the reduction of regional carbon footprints. This abstract digs into biochar's increasing horizons, charting its progression from soil amendment to a key substance in construction, electronics, and nanotechnology as a material to overcome regional challenges. Biochar is a revolutionary force pushing innovation, supporting scientific curiosity, and accelerating technology discoveries toward a sustainable and resilient future through interdisciplinary collaborations and tireless research.

**Keywords:** Biochar; nanobiochar; sustainable development; renewable energy; carbon footprint


## Table of Contents

Programme Agenda	1
Identification of a novel native fungus, <i>Trichoderma asperellum</i> as a potential biocontrol agent to manage major rice pathogens	4
Evaluation of plant extracts for controlling downy mildew in cucumber ( <i>Cucumis sativus</i> ) cultivated under protected house conditions in Sri Lanka	5
Comparative efficacy of agar well diffusion and broth microdilution methods in antimicrobial susceptibility testing of selective serotonin reuptake inhibitors (SSRIs)	6
Impact of light on reproductive success of Maize Weevils, <i>Sitophilus zeamais</i> (Coleoptera: Curculionidae)	7
Effect of extraction techniques on the stability and quality of coconut oil over extended storage periods	8
Seed germination of selected underutilized fruit crop species under different light conditions	9
Larval indices and insecticide susceptibility patterns of <i>Aedes aegypti</i> in Batticaloa district, Sri Lanka	10
Prevalence and factors influencing gastrointestinal parasitic infections among cattle in selected regions of the Batticaloa district, Sri Lanka	11
Preparation and characterization of polystyrene – clay nanocomposites for various applications	12
Hydration and dehydration of copper sulfate pentahydrate studied by Near Infrared spectroscopy: Determination of activation energy for the dehydration kinetics	13
Investigation of phyto chemical analysis and green synthesis silver and copper nanoparticles and antibacterial activity of <i>Bunchosia armeniaca</i>	14
Exploring relationships among rarely purchased items using the apriori algorithm in market basket analysis	15
A comparative study of apriori and fp-growth algorithms in frequent itemset mining	16
Study of neutrosophic b-continuous maps in the neutrosophic topological spaces	17
On $\alpha^*$ -closed sets in topological spaces	18
An optimization approach to assign delivery agents to the customers	19
Fourth order perturbed modified Heisenberg Hamiltonian of simple cubic structured ferromagnetic films with five spin layers	20



**ANNUAL RESEARCH SESSION-2024**  
**FACULTY OF SCIENCE**  
**EASTERN UNIVERSITY, SRI LANKA**

**Technical Session Schedule – ARS-FOS-2024 (12.12.2024)**

SESSION 1: BIOLOGICAL SCIENCES (11.00 am)	
Meeting Link: <a href="https://tinyurl.com/4ea29zth">https://tinyurl.com/4ea29zth</a>	
Meeting ID: 912 8724 5105	
Meeting Passcode: Ars@2024	
Chairperson: Dr. (Mrs.). M. Vinobaba Evaluator for Best Presenter: Prof. R. Kapilan	

Time	Abstract ID	Abstract title and authors name
11.00 – 11.15 am	ARS-FOS-2024-B-02	Identification of a novel native fungus, <i>Trichoderma asperellum</i> as a potential biocontrol agent to manage major rice pathogens  <u><i>Fernando, H.N.S.<sup>1*</sup>, Silva, J.N.<sup>1</sup> and Sureshika, K.G.N.<sup>1</sup></i></u>
11.15 – 11.30am	ARS-FOS-2024-B-03	Evaluation of plant extracts for controlling downy mildew in cucumber ( <i>Cucumis sativus</i> ) cultivated under protected house conditions in Sri Lanka)  <u><i>Priyankara A.B.P.<sup>1</sup>, Rameskaran M.<sup>2</sup>, Thibisha R.<sup>3</sup>, Keerthika S.<sup>3*</sup> and Prasannath K.<sup>3</sup></i></u>
11.30 – 11.45am	ARS-FOS-2024-B-04	Comparative efficacy of agar well diffusion and broth microdilution methods in antimicrobial susceptibility testing of selective serotonin reuptake inhibitors (SSRIs)  <u><i>Jayakody T.C.<sup>1*</sup>, Sudesh A.D.H.<sup>2</sup>, Karunarathna E.D.C.<sup>2</sup> and Wanigasekara D. N.<sup>3</sup></i></u>
11.45 – 12.00 noon	ARS-FOS-2024-B-05	Impact of light on reproductive success of Maize Weevils, <i>Sitophilus zeamais</i> (Coleoptera: Curculionidae)  <u><i>Wanasinghe W.M.T.D.<sup>1</sup>, Patabendige A.P.K.Y.<sup>1</sup>, de Silva W.A.P.P.<sup>1</sup> and Weeraratne T.C.<sup>1*</sup></i></u>
12.00 – 12.15pm	ARS-FOS-2024-B-06	Effect of extraction techniques on the stability and quality of coconut oil over extended storage periods  <u><i>Hettiarachchi H.A.S.S.<sup>1*</sup>, Ranathunga R.A.N.<sup>1</sup>, Kekulandara D.N.<sup>2</sup> and Gunathilake K.D.P.P.<sup>3</sup></i></u>


12.15 – 12.30pm	ARS-FOS-2024-B-07	Seed germination of selected underutilized fruit crop species under different light conditions <i>Wijesinghe K.G.T.K.<sup>1</sup>, de Silva N.1,2, and Anoma P.3*</i>
12.30 – 12.45pm	ARS-FOS-2024-B-08	Larval indices and insecticide susceptibility patterns of <i>Aedes aegypti</i> in Batticaloa district, Sri Lanka <i>Aruniya B<sup>1*</sup> and Ranathunga R.M.T.B.<sup>1</sup></i>
12.45 – 01.00pm	ARS-FOS-2024-B-09	Prevalence and factors influencing gastrointestinal parasitic infections among cattle in selected regions of the Batticaloa District, Sri Lanka <i>Rajapura B.C.<sup>1*</sup> and Ranathunga R.M.T.B.<sup>1</sup></i>

**SESSION 2: PART-1. MATHEMATICS, COMPUTER SCIENCE AND ICT (11.00 am)**

Meeting Link: <https://tinyurl.com/2s49ax55>  
 Meeting ID: 442 738 6499  
 Meeting Passcode: Ars@2024  
 Chairperson: Prof. F.C. Ragel  
 Evaluator for Best Presenter: Dr. T. Sritharan




Time	Abstract ID	Abstract title and authors name
11.00 – 11.15 am	ARS-FOS-2024-MT-01	Study of neutrosophic b-continuous maps in the neutrosophic topological spaces <i>Malkanathi D.M.S.<sup>1*</sup> and Elango P.<sup>1</sup></i>
11.15 – 11.30am	ARS-FOS-2024-MT-04	An optimization approach to assign delivery agents to the customers <i>Paramadevan P. *</i>
11.30 – 11.45am	ARS-FOS-2024-ICT-02	Exploring relationships among rarely purchased items using the Apriori algorithm in market basket analysis <i>Kirushan M.*</i>
11.45 – 12.00 noon	ARS-FOS-2024-ICT-03	A comparative study of apriori and fp-growth algorithms in frequent itemset mining <i>Kirushan M.*</i>
12.00 – 12.15pm	<b>SESSION BREAK</b>	

<p><b>SESSION 2: PART 2- PHYSICAL SCIENCES (12.15 am)</b></p> <p>Meeting Link: <a href="https://tinyurl.com/2s49ax55">https://tinyurl.com/2s49ax55</a>                  Meeting ID: 442 738 6499                  Meeting Passcode: Ars@2024                  Chairperson: Prof. S. Arasaretnam                  Evaluator for Best Presenter: Prof. K. Velayuthamurty</p>	
--	---

12.15 – 12.30pm	ARS-FOS-2024-CH-02	Hydration and dehydration of copper sulfate pentahydrate studied by Near Infrared spectroscopy: Determination of activation energy for the dehydration kinetics  <i>Ajhanthan, M.<sup>1*</sup> and Christy, A.<sup>2</sup></i>
12.30 – 12.45pm	ARS-FOS-2024-CH-03	Investigation of phyto chemical analysis and green synthesis silver and copper nanoparticles and antibacterial activity of <i>Bunchosia armeniaca</i>  <i>Nafeela M.R.R.<sup>1*</sup>, Manoranjan T.<sup>1</sup> and Thavaranjini A.C.<sup>2</sup></i>
12.45 – 01.00pm	ARS-FOS-2024-PH-01	Fourth order perturbed modified Heisenberg Hamiltonian of simple cubic structured ferromagnetic films with five spin layers  <i>Abeyasinghe A.M.L.W.B.<sup>1*</sup> and Yapa N.U.S.<sup>1</sup></i>

<p><b>SESSION 3: UNDERGRADUATE RESEARCH SIGNIFICANT TO REGION/NATION (2.45 pm)</b></p> <p>Meeting Link <a href="https://tinyurl.com/26fcys49">https://tinyurl.com/26fcys49</a>                  Meeting ID: 998 6953 5646                  Meeting Passcode: Ars@2024                  Chairperson: Prof. S. Sithambaresan</p>	
--	---

Time	Abstract ID	Abstract title and authors name
2.45 – 3.15 pm	ARS-FOS-2024-CH-01	Preparation and characterization of polystyrene – clay nanocomposites for various applications  <i>Mudalige N.I.<sup>1*</sup> and M. Koneswaran M.<sup>1</sup></i>
3.15 – 3.45 pm	ARS-FOS-2024-MT-03	On $\alpha^*$ -closed sets in topological spaces  <i>Dissanayaka, D.M.S.M.<sup>1*</sup> and Sathananthan, S.<sup>1</sup></i>

<p><b>CONCLUDING REMARKS AND AWARDS (3.45pm ONWARDS)</b></p> <p>Meeting Link: <a href="https://tinyurl.com/26fcys49">https://tinyurl.com/26fcys49</a>                  Meeting ID: 998 6953 5646                  Meeting Passcode: Ars@2024                  Time: 3.45pm                  By: Dr. K. Premakumar</p>	
---	---



## Identification of a novel native fungus, *Trichoderma asperellum* as a potential biocontrol agent to manage major rice pathogens

Fernando, H.N.S.<sup>1\*</sup>, Silva, J.N.<sup>1</sup> and Sureshika, K.G.N.<sup>1</sup>

---

**Abstract.** At present, fungal diseases cause heavy yield losses in rice cultivation in Sri Lanka. Use of fungicides plays a major role in rice fungal disease management. However, this has been closely associated with many environmental and ecological problems resulting in environmental pollution, loss of biodiversity and long-term human and animal health hazards. Use of biological control agents is one of the best alternatives available in plant disease management. Hence, this study aimed to isolate some fungal biocontrol agents from rice plants to investigate their potential for rice disease management and molecularly identify them. The experiment was undertaken at the Regional Rice Research and Development Center, Bombuwela, Sri Lanka. Ten fungal endophytic isolates were selected to evaluate their *in vitro* antagonism against major fungal rice pathogens. The experiment was placed in Completely Randomized Design with four replicates. Inhibition percentage was calculated based on the colony diameter of the pathogen. The experiment revealed that S-1 isolate was the best for inhibition of all the pathogens. Total DNA was extracted from S-1 and subjected to PCR using primers ITS1 and ITS4. Amplified DNA was sequenced and the obtained DNA sequences were compared with the existing DNA sequences in the National Centre for Biotechnology Information Data Base (NCBI). BLASTn analysis confirmed the S-1 isolate as *Trichoderma asperellum*. Further studies are required to find the efficacy of *T. asperellum* isolate S-1 under field conditions.

**Keywords:** Biocontrol agents, Fungal diseases, Fungicides, *Trichoderma asperellum*

<sup>1</sup> Regional Rice Research and Development Centre, Bombuwela, Sri Lanka

\*Corresponding author: nishadishashi@yahoo.com

---

## Evaluation of plant extracts for controlling downy mildew in cucumber (*Cucumis sativus*) cultivated under protected house conditions in Sri Lanka

Priyankara A.B.P.<sup>1</sup>, Rameskaran M.<sup>2</sup>, Thibisha R.<sup>3</sup>, Keerthika S.<sup>3\*</sup> and Prasannath K.<sup>3</sup>

---

**Abstract.** Cucumber (*Cucumis sativus* L.) is a popular vegetable in Sri Lanka, but downy mildew poses a serious threat, leading to reduced yields. This study aimed to assess the effectiveness of botanicals in controlling the disease. Multistar RZ F1 cucumber seeds were sown in polybags and agronomic practices were followed. Ginger rhizome, garlic clove, neem seeds, and castor seeds were washed, chopped, shade-dried, and ground into powder. One hundred grams of each were soaked in 300 mL of sterile distilled water, stored for 48 hours, filtered and the extract was obtained. The mycelial powder of the downy mildew fungus (*Pseudoperonospora cubensis*) was collected from the infected leaves and introduced as dust to the lower surface of the leaves of the 4-week-old plants. One week after the inoculation of the pathogen, a 5% concentration of each treatment was thoroughly sprayed on the leaves. This application was repeated weekly, while control pots were left untreated. Mancozeb fungicide was used as a positive control. The Completely Randomized Design was deployed to arrange the six treatments and each of their ten replicates. The experiment was conducted under protected house conditions, with a temperature range of 25±2 °C. Growth parameters, namely plant height, number of leaves per plant and number of flowers per plant, and disease parameters, such as disease severity and average number of spots, were taken at weekly intervals. The results indicated that disease severity and average number of spots significantly ( $P<0.05$ ) decreased in mancozeb-treated plants compared to the other treatments, with a mean value of 0.0% and 1.5, respectively. Further, cucumber plants treated with neem and garlic extracts showed the second lowest disease severity with values of 3.7% and 5.2%, respectively. Neem, castor, and garlic extract-treated plants also had a reduced average number of spots on the leaves, ranking just behind those treated with mancozeb with average mean values of 2, 5.9 and 4.1, respectively. Regarding growth parameters, the performance of plants treated with most botanicals and fungicides had no significant statistical differences ( $P>0.05$ ). In contrast, all plants in the control pot perished 6 weeks after planting due to severe downy mildew infection. Therefore, it was concluded that neem and garlic botanicals could be an environmentally friendly alternative to chemical fungicides to control downy mildew in cucumber.

**Keywords:** Botanical fungicide, Downy mildew, Eco-friendly disease management, Fungal disease

<sup>1</sup>Department of Biosystems Technology, Faculty of Technology, Eastern University Sri Lanka

<sup>2</sup>University Farm, Faculty of Agriculture, Eastern University, Sri Lanka.

<sup>3</sup> Department of Agricultural Biology, Faculty of Agriculture, Eastern University, Sri Lanka.

\*Corresponding author: shakthykeerthy@gmail.com

---

## Comparative efficacy of agar well diffusion and broth microdilution methods in antimicrobial susceptibility testing of selective serotonin reuptake inhibitors (SSRIs)

Jayakody T.C.<sup>1\*</sup>, Sudesh A.D.H.<sup>2</sup>, Karunaratna E.D.C.<sup>2</sup> and Wanigasekara D. N.<sup>3</sup>

---

**Abstract.** Antimicrobial susceptibility testing is essential for assessing the efficacy of potential antimicrobial agents, including pharmaceuticals and natural products. Two widely employed procedures in this testing are the agar well diffusion and broth microdilution techniques, each offering distinct advantages and limitations. Although both techniques are widely practiced, it is important to investigate the most applicable method for screening the antimicrobial activity of pharmaceuticals and natural products. In this study, a comparative analysis was performed utilizing both methods—agar well diffusion and broth microdilution—to evaluate the antimicrobial properties of six selective serotonin reuptake inhibitors (SSRIs): fluoxetine, paroxetine, citalopram, escitalopram, sertraline, and fluvoxamine, all with known antibacterial activity. The SSRIs were tested at a concentration of 20 mg/mL against four bacterial species: *Staphylococcus aureus* (ATCC 25923), *Staphylococcus aureus* (12228), *Pseudomonas aeruginosa* (ATCC 27853), and *Escherichia coli* (ATCC 25922). The agar well diffusion method revealed no inhibition of *P. aeruginosa* by citalopram, escitalopram, and sertraline, whereas inhibition zones were observed for fluoxetine, paroxetine, and fluvoxamine against the same microorganism. In contrast, the broth microdilution method demonstrated consistent inhibition across all SSRIs and bacterial species at the same concentration. These findings highlight methodological discrepancies between the two methods, particularly in the effectiveness of detecting antimicrobial activity. While both methods offer useful insights, the results suggest that the broth microdilution method is more reliable for accurate antimicrobial susceptibility testing. Thus, the broth microdilution method is recommended as the preferred testing procedure for evaluating the antimicrobial potential of novel pharmaceuticals and alternative antimicrobial agents, given its enhanced accuracy in detecting inhibitory effects that may be overlooked by diffusion-based approaches.

**Keywords:** Antimicrobial susceptibility testing, SSRIs, Agar well diffusion, Broth microdilution

<sup>1</sup>Department of Biomedical Science, Faculty of Applied Sciences, Lincoln University College, Malaysia

<sup>2</sup>Prof. Janitha Liyanage Central Laboratory, Gampaha Wickramarachchi University of Indigenous Medicine, Sri Lanka

<sup>3</sup>Department of Biochemistry, Faculty of Medicine, University of Ruhuna, Sri Lanka

\*Corresponding author: tcjayakody99@gmail.com

---

## Impact of light on reproductive success of Maize Weevils, *Sitophilus zeamais* (Coleoptera: Curculionidae)

Wanasinghe W.M.T.D<sup>1</sup>, Patabendige A.P.K.Y<sup>2</sup>, de Silva W.A.P.P.<sup>3</sup> and Weeraratne T.C.<sup>4\*</sup>

---

**Abstract.** *Sitophilus zeamais* (Motschulsky, 1855), commonly known as maize weevil is a destructive pest of stored cereal grains especially rice in tropical and subtropical countries. This study was aimed to investigate the impact of different colored light exposures on the reproductive success of stored grain weevils (*Sitophilus zeamais*), assessing how varying light wavelengths influence the mating behavior, egg-laying rates, and overall population growth under controlled environmental conditions. Laboratory colonies of *S. zeamais* were established on disinfected rice grains in plastic containers at  $27 \pm 2$  °C and 70% relative humidity. Five colours of LED light sources; blue, green, yellow, red and white were used for the study along with dark as the control. Three pairs of newly emerged males and females of *S. zeamais* (6-7 days old) were introduced into  $20.00 \pm 0.05$  g of disinfected white raw rice grains and were exposed to each light colour in opaque cardboard boxes (three replicates per light) for two months period continuously. Number of weevils in each container and final grain weight were reported at the end of two months. The results revealed that the reproductive success of *S. zeamais* was lowest under yellow colour treatment (0.67%) while it was highest in green colour treatment (3.00%) ( $p = 0.007$ ). The average number of individuals observed under green treatment was  $24 \pm 1$  followed by blue ( $21 \pm 1$ ), dark ( $15 \pm 1$ ), white ( $14 \pm 1$ ), red ( $13 \pm 1$ ), and yellow treatment ( $10 \pm 1$ ). The final grain weight was increased in all the treatment mainly due to the developmental stages of *S. zeamais* (mass of eggs and larval stages). The least weight increase was observed under yellow light (1.75%), might be due to the minimum load of eggs and immature stages developing within the eggs. The results, therefore, revealed that yellow treatment is relatively more effective as it reduces the reproductive success of the *S. zeamais*. The outcome of the study recommends yellow light exposure when storing rice grain to reduce the damage from *S. zeamais*. The study will be continued to draw conclusions on the feeding behavior of these pests.

**Keywords:** *Sitophilus zeamais*, Light emitting diodes, Wavelength, Population, Reproduction.

<sup>1,2,3,4</sup> Department of Zoology, University of Peradeniya, Peradeniya, Sri Lanka.

\*Corresponding author: thiliniw@sci.pdn.ac.lk

---

## Effect of extraction techniques on the stability and quality of coconut oil over extended storage periods

Hettiarachchi H.A.S.S.<sup>1\*</sup>, Ranathunga R.A.N.<sup>1</sup>, Kekulandara D.N.<sup>2</sup> and Gunathilake K.D.P.P.<sup>3</sup>

---

**Abstract.** Coconut oil is recently recognized as an edible oil with numerous health benefits even though it is used for years as a culinary ingredient. Oil quality is important because it directly impacts the nutritional value, safety, and functionality of the oil in various applications. The quality of coconut oil during storage depends on the extraction techniques. This study aimed to compare copra-derived coconut oil (CDCO) and virgin coconut oil (VCO) over extended storage periods of 18 months at different temperatures (at room temperature (25°C-32°C) and at air conditioned (AC) temperature (23°C) for 18 months focusing on their quality parameters such as peroxide value (PV), iodine value (IV), and free fatty acid (FFA) percentage. Standard fat analyzing methods were followed to collect data. While the IV values of both oils showed no significant differences, CDCO exhibited significantly higher PV, FFA content, and unsaturated fatty acid content compared to VCO ( $p < 0.05$ ) in fresh oil samples. Both CDCO and VCO showed an increase in PV and FFA content over time, however CDCO deteriorated more rapidly, comprising significantly higher values by the end of the storage period. The highest FFA ( $2.458 \pm 0.062\%$ ) and PV ( $2.919 \pm 0.117$  meq/kg) were reported in CDCO stored at room temperature, while the lowest FFA ( $1.389 \pm 0.006\%$ ) and PV ( $1.657 \pm 0.105$  meq/kg) were recorded in VCO stored at AC conditions. The findings align with previous studies, suggesting that lower storage temperatures enhance oil stability by reducing oxidative deterioration. This study revealed that, VCO demonstrated superior quality for long-term storage, and both oils retained their quality parameters better when stored at 22°C. This suggests that VCO is more stable than CDCO during extended storage, especially at low temperatures.

**Keywords:** Copra, Free Fatty Acid, Peroxide Value, Virgin Oil

<sup>1</sup> Department of Physiology, Faculty of Medicine, Wayamba University of Sri Lanka, Kuliyaipitiya, Sri Lanka

<sup>2</sup> Department of Biochemistry, Faculty of Medicine, Wayamba University of Sri Lanka, Kuliyaipitiya, Sri Lanka

<sup>3</sup> Department of Food Science and Technology, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), Sri Lanka

\*Corresponding author: [sasinishamila7@gmail.com](mailto:sasinishamila7@gmail.com)

---



## Seed germination of selected underutilized fruit crop species under different light conditions

Wijesinghe K.G T.K<sup>1</sup>, de Silva N.<sup>1,2</sup>, and Anoma P.<sup>3\*</sup>

---

**Abstract.** Indigenous ancient crop species, which are still used at low levels, are often recognized as underutilized but have the potential to contribute to food security, nutrition, health, and income generation. These species have traditionally been used for food, fiber, fodder, oil, or medicinal purposes. Poor germination and prolonged dormancy are key factors contributing to their underutilization. Therefore, understanding the factors that affect seed germination and seedling emergence in underutilized crop species is important. This study examined the effect of light and dark conditions on seed germination in *Averrhoa bilimbi*, *Antidesma bunius*, *Canavalia ensiformis*, *Coccinia grandis*, *Cordia dichotoma*, *Momordica denudata*, *Sauropus androgynus*, *Ipomoea alba*, and *Solanum violaceum* under three experimental treatments: 24-hour darkness, 24-hour light, and 12-hour light + 12-hour dark (control). One hundred seeds from each species (n=5) were soaked in distilled water overnight under above three light regimes, placed in petri dishes under moist conditions, and observed for 50 days. Results showed that seeds of *A. bunius*, *C. dichotoma*, and *S. violaceum* did not germinate in any of the experimental treatments, indicating seed dormancy. More than 80% of seeds from *A. bilimbi*, *C. ensiformis*, *I. alba*, and *S. androgynus* germinated equally across all light treatments ( $p>0.05$ ). *A. bilimbi* exhibited vigorous germination under 24-hour light condition, while *C. ensiformis* and *I. alba* germinated quickly under the 12-hour light + 12-hour dark conditions. *S. androgynus* performed best under 24-hour darkness. Seeds of *C. grandis* and *M. denudata* showed lower germination rates (< 50%) under 24-hour light and 12-hour light+12-hour dark conditions, but did not germinate at all under 100% darkness. However, both species germinated more quickly under 24-hour light compared to the 12-hour light+12-hour dark condition. This study confirms that light or dark conditions did not significantly affect the overall percentage of seed germination for all species, but the time to germination was considerably reduced under certain light and/or dark treatments. Further research is needed to improve seed germination rates in the three dormant species and the two species with low germination percentages.

**Keywords:** Dark and light conditions, Enhanced seed germination, Indigenous, Seed dormancy

---

<sup>1</sup> Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka.

<sup>2</sup> Department of Crop Science, University of Peradeniya, Peradeniya, Sri Lanka.

<sup>3</sup> Department of Botany, University of Peradeniya, Peradeniya, Sri Lanka.

\*Corresponding author: anomap@sci.pdn.ac.lk

## Larval indices and insecticide susceptibility patterns of *Aedes aegypti* in Batticaloa district, Sri Lanka

Aruniya B.<sup>1\*</sup> and Ranathunga R.M.T.B.<sup>2</sup>

---

**Abstract.** The increasing resistance of *Aedes aegypti* mosquitoes to commonly used insecticides exacerbate the challenges faced by vector control programs, highlighting the urgent need for enhanced monitoring efforts. Particularly, concerning is the lack of recent literature addressing insecticide resistance within the Batticaloa district, emphasizing the critical necessity for comprehensive research in this area. Therefore, this study aimed to investigate the prevalence of insecticide resistance and susceptibility among *Ae. aegypti* populations in the Batticaloa district, Sri Lanka. From August 2023 to February 2024, larval surveys were conducted across three distinct Medical Officer of Health (MOH) areas: Batticaloa, Eravur, and Koralai Patru Central (KPC). Bioassays employing three different insecticides - deltamethrin, malathion, and permethrin - were conducted on adult *Ae. aegypti* mosquitoes using standardized protocols outlined by the World Health Organization (WHO). Concurrently, larval indices including the House index (HI), Breteau index (BI) and container index (CI) were calculated to assess the larval infestation levels across the MOH areas. The comprehensive examination of 4,458 potential breeding sites with water retention revealed 138 *Ae. aegypti* positive containers within the Batticaloa district. A total of 1,082 *Ae. aegypti* mosquito larvae were identified during the study period. The highest value of HI was ranged 28 in Batticaloa and the values of HI were ranged from 16.67 to 28. The BI were from 23 to 38 and highest BI was observed in Batticaloa. The CI were ranged from, 2.40 to 3.97 and the highest CI was observed in KPC. Susceptibility was observed when percent mortality ranged from 98 to 100%. The incipient insecticide resistance was indicated by mortality rates between 80 and 97%. According to the calculation this study finds, *Ae. aegypti* was developed resistant to 7.55% Permethrin. In conclusion, this study identifies highest values HI and BI were observed in Batticaloa while KPC were identified as highest CI. To conclude this study underscores the pressing need for sustained monitoring and intervention strategies to combat *Ae. aegypti*-mediated dengue transmission in the Batticaloa district. The observed variations in larval indices and insecticide susceptibility highlight the dynamic nature of vector control challenges. Addressing these issues requires collaborative efforts involving policymakers, healthcare authorities, and local communities to implement targeted interventions aimed at mitigating insecticide resistance and reducing mosquito-borne disease burden.

**Keywords:** *Aedes aegypti*, Dengue, Insecticide resistance, Larval indices, Vector control.

---

<sup>1,2</sup> Department of Zoology, Faculty of Science, Eastern University, Sri Lanka

\* Corresponding author: aruniyabalakrishnan97@gmail.com

## Prevalence and factors influencing gastrointestinal parasitic infections among cattle in selected regions of the Batticaloa district, Sri Lanka

Rajapura B.C<sup>1\*</sup> and Ranathunga R.M.T.B<sup>2</sup>

---

**Abstract.** Gastrointestinal (GI) parasitic infections pose a significant challenge in cattle management, with varying effects influenced by age, gender, weather conditions, and infection severity. Despite the lack of published studies, this research aimed to assess the prevalence of GI parasites among cattle in the Batticaloa District. Cattle were randomly selected from four areas; Chenkaladi, Karadiyanaru, Eravur, and Valachchenai from August to December 2023, covering both the dry season (August–September) and the wet season (October–November). Gender was recorded for each sample to analyze sex-based prevalence differences and cattle were classified into two age groups: calves (below 12 months old) and adults (12 months and older), to evaluate age-related variations in parasitic prevalence. Freshly voided 87 fecal samples were collected and transported to the Zoology laboratory in Eastern University, Sri Lanka. In the laboratory, fecal samples were examined for their physical properties such as consistency and color, which can indicate possible parasitic infections. The salt flotation method and the direct smear method were used for detecting nematode and cestode eggs. Microscopic examinations were carried out using OPTIKA light and LABOMED Lx 400 digital microscopes. Freshly voided fecal samples were collected, revealing that 89.65% (n=78) of the sampled cattle were positive for eggs of one or more GI parasite species. The study identified a spectrum of GI parasites, including *Fasciola* spp., *Paramphistomum* spp., *Toxocara* spp., *Capillaria* spp., *Taenia* spp., *Nematodirus* spp. and Strongyle type. Analysis by gender showed a higher prevalence in females (91.48%, n=43) compared to males (87.50%, n=35), while calves (below 6 months) exhibited the highest infection rate (95.24%, n=20). Seasonal variations were observed, with a 100% prevalence during the wet season (n=46) compared to 78.05% during the dry season (n=32). Geographically, Chenkaladi recorded the highest infection rate at 92%, followed by Karadiyanaru at 91.3%, Valachchenai at 90%, and Eravur at 84%. Recommendations for effective parasite management include regular mass deworming, frequent diagnostic assessments, and farmer training on infection control and prevention. Furthermore, future investigations should explore the economic impact of GI parasites in the study areas and their potential transmission to the human population. This study underscores the need for comprehensive veterinary services to enhance cattle farming practices and mitigate the impact of GI parasitic infections.

**Keywords:** Cattle, Gastro Intestinal Parasites (GI), Batticaloa District

---

<sup>1,2</sup> Department of Zoology, Faculty of Science, Eastern University, Sri Lanka

\* Corresponding author: buddhima96rajapura@gmail.com

## Preparation and characterization of polystyrene – clay nanocomposites for various applications

Mudalige, N. I.<sup>1\*</sup> and Koneswaran, M.<sup>2</sup>

---

**Abstract.** Polymer–clay nanocomposites have garnered significant attention due to their enhanced properties compared to pure polymers and traditional composites. These nanocomposites are created by incorporating nano-sized inorganic fillers into a polymer matrix, which alters the material's properties. This research focuses on synthesizing acylated polystyrene-Na/clay nanocomposites with varying clay loadings (0%, 1%, 3%, and 5% by weight) and using diethyl phthalate (DEP) as a plasticizer. The resulting nanocomposites were analyzed using several techniques, including Fourier-Transform Infrared (FT-IR) Spectroscopy, Thermogravimetric Analysis (TGA), and Scanning Electron Microscopy (SEM). The thermal behavior of the clay, polystyrene, and polystyrene/clay nanocomposites was assessed via TGA, which demonstrated that the inclusion of clay nanoparticles enhances the material's thermal stability. Higher clay loadings contributed to improved thermal resistance. Additionally, the plasticizer's incorporation exhibited a synergistic effect, shifting the degradation peak and reducing the onset temperature of decomposition. FT-IR analysis confirmed the successful formation of the acylated polystyrene/clay nanocomposite, with a broad absorption band detected between 3300 and 3700  $\text{cm}^{-1}$ . SEM images revealed a well-dispersed distribution of clay nanoparticles throughout the polymer matrix, forming a network-like structure. The cation exchange capacity (CEC) of sodium-treated clay was also investigated. The raw clay had a sodium concentration of 174.962 mg/L and a CEC of 126.667 meq/100g. After sodium treatment, the CEC increased to 170.97 meq/100g, with a sodium concentration of 235.932 mg/L. Films made from the nanocomposite, containing various clay loadings (0%, 1%, 3%, and 5%), were tested for their hydrophobic properties. The film with 3% clay loading showed the highest contact angle of 115.8°, indicating superior hydrophobicity. The flame retardancy of the nanocomposites was tested, revealing that the sample with 1% clay loading exhibited the slowest burning rate, which SEM images attributed to uniform clay dispersion. Additionally, the water absorption tests indicated that composites with higher clay content absorbed more water, while the 0% clay sample had the lowest water absorption. These findings suggest that polystyrene/clay nanocomposites possess potential for use in various industrial applications due to their enhanced properties.

**Keywords:** Polymer–clay nanocomposites, Thermal stability, Hydrophobicity, Flame retardancy

<sup>1,2</sup> Department of Chemistry, Faculty of Science, Eastern University, Sri Lanka

\*Corresponding author: [naminimudalige@gmail.com](mailto:naminimudalige@gmail.com)

---

## Hydration and dehydration of copper sulfate pentahydrate studied by Near Infrared spectroscopy: Determination of activation energy for the dehydration kinetics

Ajhanthan, M.<sup>1\*</sup> and Christy, A.<sup>2</sup>

---

**Abstract.** The recent investigation into the dehydration and rehydration of water molecules on copper sulfate pentahydrate by second derivative near-infrared spectroscopy has provided spectroscopic evidence for the presence of three different groups of water molecules in the crystals. The copper sulfate pentahydrate samples were isothermally treated at 200°C, 250°C, 300°C in glass vials under 50% humidity to study the dehydration of the sample. During the thermal treatment at each temperature, the samples have been analyzed by infrared spectrometry with second derivative approach. The near- infrared spectra of the samples treated at 200°C, 250°C, and 300°C were measured at 15-minute intervals. Furthermore, the rehydration of anhydrous copper sulfate at 50% humidity was also investigated. The infrared absorptions corresponding to the combination frequencies of the OH stretching vibration of water molecules in the region 5500–4200 cm<sup>-1</sup> were studied in both cases to understand the progress of dehydration and rehydration processes. The spectral profiles of the copper sulfate pentahydrate scanned during thermal treatment at the above three iso thermal temperatures were used in determining the activation energy calculations. The results revealed that copper sulfate pentahydrate contains three distinct groups of water molecules with different polarities. The near- infrared spectroscopic analysis revealed that the activation energies for these three groups of water molecules varied depending on the experimental conditions. This clearly showed that the compound underwent dehydration in three steps, with the water molecules leaving in a 2:2:1 ratio. The near- infrared spectra measured during the dehydration process showed that the intensity of absorptions of the three groups of water molecules in the region mentioned above was different. The single water molecule attached to the crystal structure showed high intensity compared to the other water molecules present in the crystal. The heat-induced dehydration of copper sulfate pentahydrate followed first-order reaction kinetics along with an activation energy of three distinct sets of water molecules as 18.7 KJ/mol, 111.04 KJ/mol and 158.104 KJ/mol.

**Keywords:** Near-infrared spectroscopy, second derivative, dehydration, rehydration, copper sulfate pentahydrate.

<sup>1</sup> Department of Chemistry, Faculty of Science, Eastern University, Sri Lanka

<sup>2</sup> Department of Chemistry, Faculty of Engineering and Natural Sciences, University of Agder, Kristiansand, Norway

\*Corresponding author: [ajhanthajhanthan26@gmail.com](mailto:ajhanthajhanthan26@gmail.com)

---



## Investigation of Phyto Chemical Analysis and Green Synthesis Silver and Copper Nanoparticles and Antibacterial Activity of *Bunchosia armeniaca*

Nafeela M.R.R.<sup>1\*</sup>, Manoranjan T.<sup>1</sup> and Thavaranjini A.C.<sup>2</sup>

**Abstract.** This study investigates the phytochemical properties, nanoparticle synthesis, and antibacterial activities of *Bunchosia armeniaca*, a less-known medicinal plant in the Malpighiaceae family in Sri Lanka. Extracts from the plant's leaves and stems were prepared using ethanol and hexane, followed by an analysis of their phenolic and flavonoid contents. The antioxidant activity was assessed using the phosphomolybdate and hydrogen peroxide assays. The ethanolic leaf extract exhibited the highest antioxidant activity, followed by ethanolic stem, hexane leaf, and hexane stem extracts. The total phenolic content of the ethanolic leaf extract was  $37.52 \pm 0.5$  mg/GAE/g, indicating significant phenolic activity. Nanoparticles were synthesized by reacting aqueous leaf extracts with silver nitrate and copper sulphate. The resulting silver (AgNPs) and copper nanoparticles (CuNPs) were characterized using UV-Vis spectroscopy, FTIR, and XRD. The AgNPs and CuNPs displayed absorption peaks at 453 nm and 525 nm, respectively, and their crystalline structure was confirmed through XRD analysis. The average sizes of the synthesized nanoparticles were 27 nm (AgNPs) and 36 nm (CuNPs). The antibacterial activities of the extracts and synthesized nanoparticles were evaluated using agar disc diffusion against four bacterial species: *Staphylococcus aureus*, *Escherichia coli*, *Bacillus* sp., and *Enterococcus* sp. The ethanolic extracts and AgNPs demonstrated potent antibacterial activity, especially against *Staphylococcus aureus*. Comparatively, the CuNPs also exhibited significant antibacterial effects but were less active than the AgNPs. These results suggest that *Bunchosia armeniaca* possesses promising antioxidant and antibacterial properties, with potential applications in nanomedicine and antimicrobial therapy.

**Keywords:** *Bunchosia armeniaca*, silver nanoparticles, copper nanoparticles, phytochemical analysis, antioxidant activity, antibacterial activity.

<sup>1</sup>Department of Chemistry, Faculty of Science, University of Jaffna, Sri Lanka.

<sup>2</sup>Department of Botany, Faculty of Science, University of Jaffna, Sri Lanka.

\*Corresponding author: nafeelarifay@gmail.com

## Exploring relationships among rarely purchased items using the apriori algorithm in market basket analysis

Kirushan M.\*

---

**Abstract.** This is one of the most critical data mining techniques used by retailers in extracting consumer purchasing patterns through frequent itemsets bought together. Market Basket Analysis; the approach presented in this paper is a novel optimized frequent itemset mining in Market Basket Analysis with a view to improving efficiency and scalability. Within the context of this work, the Apriori algorithm was applied to the full Online Retail Dataset. This dataset includes more than 500,000 transactions for a UK-based online retailer between December 2010 and December 2011. Rigorous data preprocessing was done through cleaning and one-hot encoding to make the data ready for effective analysis in this methodology. The strategic threshold parameters were set to a minimum support of 0.07 and a confidence and lift of 0.8 and 6, respectively. Only major and reliable rules were returned. On application, this optimized framework returned robust item associations that provided active insights into some key strategic marketing decisions, such as targeted recommendations, cross-selling, and upselling. It further corroborates the importance of setting appropriate thresholds within association rule mining to derive meaningful and trustworthy insights. The additional value that this research brings to the domain is that, through the optimization of frequent itemset mining, data-driven strategies can assist in increasing sales and customer loyalty.

**Keywords:** Association rule mining, Frequent itemset, Correlation, Market basket analysis

---

\*Department of Computing, Faculty of Science, Eastern University, Sri Lanka.

\*Corresponding author: kirushan1000@gmail.com

---

## A comparative study of apriori and fp-growth algorithms in frequent itemset mining

Kirushan M.\*

---

**Abstract** Frequent itemset mining is one of the most fundamental tasks in data mining and association rule learning and it becomes very important in discovering the underlying patterns and associations existing within large transactional databases. This paper compared two preeminent algorithms in this area: Apriori and FP-Growth algorithms. The Apriori algorithm is known predominantly for its simplicity and basic nature. However, it usually become computationally ineffective due to the huge generation of candidate itemset and repetitive database scans. In contrast, the FP-Growth algorithm, shows its inefficiency avoidance through using a compact data structure called the FP-tree, hence reducing the number of database scans and candidate generations. In this paper, the two algorithms were evaluated against some key criteria; runtime efficiency, memory usage, scalability, and implementation complexity. The results of the experimental analysis showed that while Apriori is still a great pedagogic tool and performs reasonably well on dense datasets, FP-Growth efficiently and scales much better, particularly for large and sparse datasets. This comparative study provided insight into the practical applications of each of these algorithms and guides in the selection of proper techniques under specific data mining needs.

**Keywords** Association rule mining, Frequent itemset, Correlation, Market basket analysis

---

\*Department of Computing, Faculty of Science, Eastern University, Sri Lanka.

\*Corresponding author: [Kirushan1000@gmail.com](mailto:Kirushan1000@gmail.com)

## Study of neutrosophic $b$ -continuous maps in the neutrosophic topological spaces

Malkanthi D.M.S.<sup>1\*</sup> and Elango P.<sup>2</sup>

---

**Abstract.** The general topology has applications to almost all branches of Mathematics and plays a vital role in Mathematics. Many real-life problems in business, finance, medical sciences, engineering and social sciences deals with uncertainties. There are difficulties in solving the uncertainties by traditional mathematical models. The set theory for the mathematical logic started with the true and false statements; but in real life we have the values between true and false. In fuzzy sets, we do not have uncertainty values. To include the uncertainty, the neutrosophic sets were introduced. Based on neutrosophic sets, neutrosophic topological spaces were developed. In this paper, we study the neutrosophic  $b$ -continuous maps between two neutrosophic topological spaces using the neutrosophic  $b$ -open sets. We define a map  $f: X \rightarrow Y$  is a neutrosophic  $b$ -continuous if the inverse image of a neutrosophic open set in  $Y$  is a neutrosophic  $b$ -open set in  $X$ . Then, we prove that a map is a neutrosophic  $b$ -continuous map if and only if the inverse image of every neutrosophic closed set in  $Y$  is a neutrosophic  $b$ -closed set in  $X$ . We also show that every neutrosophic continuous map is a neutrosophic  $b$ -continuous map, every neutrosophic  $\alpha$ -continuous map is a neutrosophic  $b$ -continuous map, every neutrosophic semi-continuous map is a neutrosophic  $b$ -continuous map and every neutrosophic pre-continuous map is a neutrosophic  $b$ -continuous map. Finally, we prove that the composition of a neutrosophic  $b$ -continuous map and a neutrosophic continuous map is a neutrosophic  $b$ -continuous map.

**Keywords:** Neutrosophic topological space, Neutrosophic  $b$ -open set, Neutrosophic  $b$ -continuous map, Neutrosophic  $\alpha$ -continuous map, Neutrosophic semi-continuous map

---

<sup>1,2</sup> Department of Mathematics, Faculty of Science, Eastern University, SriLanka

\*Corresponding author: [sujeewadissanayakadmsm96@gmail.com](mailto:sujeewadissanayakadmsm96@gmail.com)

## On $\alpha^*$ -closed sets in topological spaces

Dissanayaka, D.M.S.M.<sup>1\*</sup> and Sathaanathan, S.<sup>2</sup>

---

**Abstract.** Topology is an important branch of Mathematics. Topological ideas are present in almost all areas of today's mathematics. It has become a powerful instrument of mathematical research. In this project, we studied all kind of closed sets generalized closed sets (briefly g-closed), semi-generalized closed sets (briefly sg-closed), generalized semi-closed sets (briefly gs-closed), generalized  $\alpha$ -closed sets (briefly  $g\alpha$ -closed),  $\alpha$ -generalized closed sets (briefly  $\alpha g$ -closed), generalized semi-preclosed sets (briefly gsp-closed), Regular generalized closed sets (briefly rg-closed), weakly closed sets (briefly w-closed), regular closed and regular open sets, pre closed and pre-open sets, semi-closed and semi-open sets,  $\pi$ -closed and  $\pi$ -open sets, regular semi open sets,  $\alpha^*$ -closed sets and investigated some of their properties. We choose the  $\alpha^*$ -closed set for our investigation and studied the relationship between above closed sets in topological spaces.

**Keywords:**  $\alpha^*$ -closed set, g-closed set, w-closed set,  $\alpha g$ -closed set, sg-closed set.

---

<sup>1,2</sup> Department of Mathematics, Faculty of Science, Eastern University, Sri Lanka.

\*Corresponding author: [sharmadamadushani97@gmail.com](mailto:sharmadamadushani97@gmail.com)

## An Optimization Approach to Assign Delivery Agents to the Customers

Paramadevan P. \*

---

**Abstract.** In this research work, we study the problem of allocating delivery agents of a transportation company to fulfill customer orders across various locations. Delivery agents are chosen from a pool of registered agents through a mathematical process, with the aim of minimizing the overall traveling distance as well as with minimum approved operational cost. For transportation businesses sector that depend on streamlining delivery routes and cutting down on inefficiencies to guarantee prompt order fulfillment, the optimal delivery assignment procedure is essential. Our suggested solution architecture strikes a compromise between a fixed operating cost constraint and the physical proximity of delivery personnel to each customer. To enhance resource allocation and route optimization, the method combines cost analysis with distance-based allocation techniques. The proposed Integer Linear Programming strategy seeks to retain the profitability of the transporting company while minimizing travel-related costs and improving operational efficiency.

**Keywords:** Delivery agent, Transportation company, Integer Linear Programme

---

\* Department of Mathematics, Faculty of Science, Eastern University, Sri Lanka.

\*Corresponding author: [paramadevanp@esn.ac.lk](mailto:paramadevanp@esn.ac.lk)



## Fourth order perturbed modified Heisenberg Hamiltonian of simple cubic structured ferromagnetic films with five spin layers

Abeyasinghe A.M.L.W.B.<sup>1\*</sup> and Yapa N.U.S.<sup>2</sup>

---

**Abstract.** The magnetic properties of ultrathin simple cubic structured ferromagnetic film with five spin layers were investigated using fourth order perturbed Heisenberg Hamiltonian. Only spin exchange interaction, long range dipole interaction and second order magnetic anisotropy were considered. MATLAB computer software was used to plot 3D and 2D graph of energy versus stress induced anisotropy and azimuthal angle of spin. 3D plots of total magnetic energy versus angle and magnetic anisotropy constant of bottom spin layer were drawn for different values of magnetic anisotropy constant of top spin layer also the 3D plots of total magnetic energy versus angle and spin exchange interaction were drawn for same values of magnetic anisotropy constant. The peaks along the axis of the angle are closely packed in this case. Some spikes appeared in the 2D plot of magnetic energy versus azimuthal angle of spin. The angle between magnetic easy and hard directions was not 90 degrees. The sharp energy maximums can be found in the 2D plot drawn for the magnetic anisotropy constant major maximum value. According to the 3D plots, the peak value of the magnetic energy gradually increases with the increase of the second order magnetic anisotropy, when the magnetic anisotropy constant of top spin layer significantly increases, the total magnetic energy increases. Although shapes of the 3-D plots of different second order anisotropy constant are same.

**Keywords:** Heisenberg Hamiltonian, fourth order perturbation, simple cubic structure, ferromagnetic

---

<sup>1,2</sup> Department of Physics, Open University of Sri Lanka, Kandy, Sri Lanka

\*Corresponding author: lakminawaruna@gmail.com