



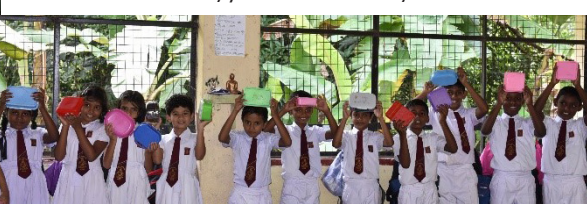
The Outreach Program of National Research Council

Some parts of the society are still unfamiliar with advancements of scientific research and the scientific community. To change this situation, it is needed to emphasize that Science and Technology is here for the own benefit of the public. It is a timely need to make the common public aware of the research findings and the way they affect the country, society and their everyday life. To disseminate above knowledge to the public, NRC implements its Outreach program on various scientific fields, since the inception of the NRC.

As a State-Owned Enterprise funded by tax-payer's money (obtained through the General Treasury), it is our duty to ensure all

the benefits including social benefits (which have been promised to be delivered by our grantees through their research) are actually delivered to all corners of the society. The outreach program is a main tool, standing next to the monitoring and evaluation program of NRC, to perform the above duty. It not only counts for social benefits but also counts for health and environmental safety of scientific research. At the same time, it attracts the young generation towards science and technology.

This collage of photos is a flashback of the NRC outreach program, along the times we have passed through.



Some Highlights of Achievements of the NRC Research Projects

Engineering Microbial Ecology in Agroecosystem via Bio-encapsulation of Microbial Communities to Improve Soil Health and Fertility

NRC IDG 20-128

Introduction

The global population is projected to reach 10 billion by 2050, presenting a significant challenge to global food security. According to the Food and Agriculture Organization (FAO) of the United Nations, food production must increase by approximately 70% to meet the nutritional demands of this growing population. Achieving this target depends heavily on the health and productivity of soil, which is a cornerstone of sustainable agriculture.

communities play a critical role in nutrient cycling, organic matter decomposition, and plant-microbe interactions.

However, intensive agricultural practices and environmental stressors have led to the depletion of bacterial diversity in many soils, contributing to a decline in soil fertility and structure. The restoration of these microbial communities is crucial to reversing soil degradation and enhancing soil function.



Image 1_Greenhous Trials

Soil health is broadly defined as the capacity of soil to function as a living ecosystem that supports plant productivity, maintains environmental quality, and promotes plant health within the boundaries of natural ecosystems. It is a fundamental indicator of agroecosystem sustainability and productivity. Among the vital factors influencing soil health and fertility, soil bacterial

Importantly, microorganisms, especially bacteria, do not function in isolation. They form complex, interactive networks, with multiple species coexisting and performing complementary ecological roles. Synthetic Microbial Ecology (SME) is an emerging field that seeks to design and engineer such microbial communities by understanding and manipulating intercellular interactions.

This approach offers a powerful strategy for developing robust, functionally optimized microbial consortia that can be introduced into soils to improve their health and resilience.

Project outputs

- The project has generated comprehensive soil bacterial community profiles from organic farms across the agro-ecological zones of Sri Lanka, with the objective of identifying beneficial microbial consortia. The gathered data has been utilized to develop a universal biofertilizer formulation, applicable across all agro-ecological zones, based on the principles of Synthetic Microbial Ecology (SME).
- The developed microbial consortia were encapsulated within a biochar matrix, resulting in a novel biofertilizer formulation designed for universal application across diverse agro-ecological zones.

This project aims to harness these principles through the synthesis of spatially linked microbial consortia tailored to enhance soil quality and restore soil health, thereby contributing to long-term agricultural sustainability.

- This innovative biofertilizer has been advanced to Technology Readiness Level (TRL) 6, and a local patent has been filed to protect the associated intellectual property rights.
- The project also enabled a comparative analysis of soil bacterial diversity and community profiles between organically and conventionally cultivated agricultural fields. The findings provide valuable insights to support the enhancement of soil bacterial communities in degraded conventionally managed soils.

Project outcomes

Reducing Inorganic Fertilizer Imports by Minimizing Dependency on Synthetic Nutrient Inputs

Sri Lanka's heavy reliance on synthetic fertilizers to meet the nitrogen (N), phosphorus (P), and potassium (K) needs of crops significantly increases agricultural production costs and poses risks to long-term food security. Addressing this challenge requires sustainable, biology-based alternatives that can supplement nutrient inputs while maintaining or improving current yield levels.

This project has contributed to the development of innovative biofertilizer formulations that harness biological nitrogen fixation and microbial-mediated phosphorus solubilization. These technologies offer a promising pathway to reduce the national dependence on synthetic fertilizers, thereby lowering fertilizer imports, supporting organic agriculture, and promoting sustainable food systems.

Enhancing Soil Health and Agroecosystem Productivity by Restoring Microbial Communities

The decline in soil fertility and agricultural productivity in Sri Lanka is closely linked to the degradation of soil microbial communities, largely driven by excessive use of chemical fertilizers and pesticides. Microbial communities—particularly bacteria—play a critical role in nutrient cycling, but their functionality depends on stable ecological interactions within the soil.

This project addresses these issues through microbial restoration strategies. By reintroducing and enhancing beneficial microbial consortia, the project has improved key soil functions such as nitrogen fixation and phosphorus solubilization. These efforts contribute significantly to reversing soil degradation, restoring ecosystem balance, and ensuring long-term agricultural sustainability.

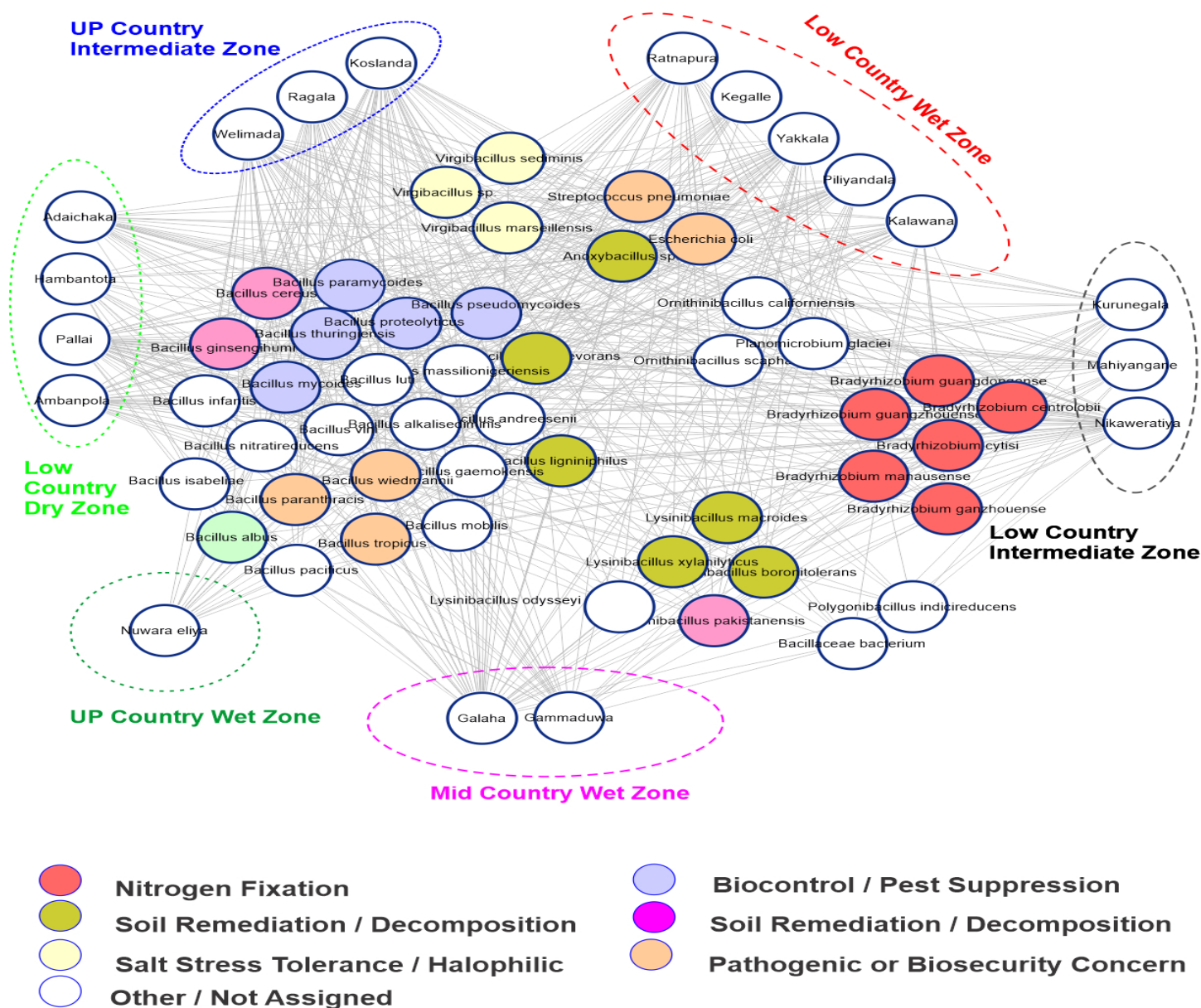


Image 2_Fertiliser formulation

Boosting Urban Agriculture Through Biofertilizer-Based Productivity Enhancement

With approximately 3.7 million people—18.2% of the population—living in urban areas, urban agriculture (UA) has become increasingly important in Sri Lanka. In highly urbanized districts like Colombo, where 77.6% of the population is urban, UA offers a localized, sustainable solution to urban food insecurity.

One of the major challenges in UA is the limited availability of quality agricultural inputs. The novel biofertilizer formulation developed through this project addresses this need by providing a high-quality, easy-to-use input that can significantly enhance crop productivity and nutritional quality. Its use in urban agriculture supports food self-sufficiency, promotes environmentally responsible practices, and meets the rising demand for fresh produce in city environments.



Way Forward

In the case of bio fertiliser formulation, following successful greenhouse trials, the next critical step is to conduct field testing over two consecutive seasons, as required by the Fertilizer Secretariat. This necessitates the establishment of a pilot-scale production facility and implementation of SLSI-compliant quality control protocols. Field trials should be carried out under the supervision of the Department of Agriculture to ensure regulatory compliance and reliable data collection. Upon validation, collaboration with the private sector will be essential for scaling up production and enabling technology transfer, ultimately supporting nationwide adoption and integration into sustainable agricultural practices.

Declaration:

The language, clarity, and readability of this document have been improved using A.I tools such as Quillbot™, Grammarly™



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Liquid Biopsy Breakthrough: Advancing Early Detection of Oral Cancer Through Molecular Biomarkers Characterization

NRC IDG 19-045

Introduction

Oral squamous cell carcinoma (OSCC) accounts for over 90% of oral cancers and remains a significant public health challenge in South Asia, including Sri Lanka. A major concern is the late presentation of most patients, which severely limits treatment success. The current gold-standard diagnostic method—histopathological evaluation via scalpel biopsy—is invasive, subjective, and not ideal for widespread community-based screening.

To address this challenge, the NRC-funded research project (IDG 22-031) focused on developing a non-invasive, body fluid-based diagnostic strategy. The study explored the use of metallomic profiling and mRNA expression analysis in serum, saliva, and blood to detect early biomarkers of OSCC and its precursor lesions, collectively referred to as Oral Potentially Malignant Disorders (OPMDs), including oral leukoplakia (OLK), oral lichen planus (OLP), and oral submucous fibrosis (OSF).

Research Outputs

This multidisciplinary study yielded several promising scientific contributions:

• Serum Metallomic Screening:

Trace metal profiling showed significantly elevated levels of Chromium (Cr), Cobalt (Co), Copper (Cu), Cadmium (Cd), and Zinc (Zn) in OSCC and OPMD patients when compared to healthy controls. These findings suggest a strong association between trace metal imbalance and oral carcinogenesis, potentially linked to regional environmental and dietary factors.

• Salivary mRNA Biomarker Profiling:

Extracellular RNA analysis from saliva samples revealed that the expression of IL-1 β , IL-8, SAT1, S100P, and OAZ1 could serve as a robust biomarker panel. This panel demonstrated high diagnostic accuracy:

- 100% predictive probability for OSCC (AUC = 1.000)
- 90% for OLP
- 80% for OSF

These findings highlight the diagnostic potential of salivary transcriptomics in the early and non-invasive detection of oral malignancy and high-risk OPMDs.

• Blood mRNA Biomarker Assessment:

Peripheral blood analysis of VEGF-A and CK-19 mRNA levels also revealed their potential to differentiate OSCC cases from healthy individuals. While their expression did not significantly differ across all OPMDs, both markers showed promise in enhancing the diagnostic accuracy of liquid biopsy models for OSCC.

Inductively coupled plasma optical emission spectrometry



QuantStudio™ 6 Flex Real-Time PCR
(Thermo Fisher Scientific)

Key Outcomes

The study supports the feasibility of using body fluids for early, non-invasive detection of oral cancer and its precursor lesions. Key outcomes include:

- Identification of a validated salivary mRNA biomarker panel with excellent diagnostic performance.
- Discovery of metal dysregulation patterns potentially linked to oral cancer etiology.
- Establishment of a clinically relevant, high-throughput diagnostic workflow suitable for community-level deployment.
- Contribution to the evolving field of liquid biopsy for oral oncology.

Way Forward

Future directions based on this research include:

- Clinical validation of the biomarker panels in larger, multi-center cohorts.
- Application of AI and machine learning techniques to develop predictive models using salivary and blood-based molecular data.
- Industry collaboration to design user-friendly, point-of-care diagnostic kits.
- Promotion of university-industry partnerships to support product development, patenting, and commercialization.



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Uncovering the Viral Toll in childhood diarrhoea: Kelaniya Study Highlights Urgent Need for Childhood Rotavirus Vaccination in Sri Lanka

NRC IDG 15-109

Introduction

A recent study led by Prof. N.P. Sunil-Chandra, Principal Investigator, Dept. of Medical Microbiology, the Faculty of Medicine, University of Kelaniya, has revealed the significant burden of rotavirus and adenovirus gastroenteritis among Sri Lankan children - highlighting their critical role in child morbidity and mortality. Through targeted viral diagnostics, and epidemiological surveillance, it provides the most detailed picture to date of the viral burden among children with gastroenteritis. Researchers emphasized that introducing rotavirus immunization into Sri Lanka's national vaccination program could be a vital step towards reducing preventable child mortality and improving health outcomes nationwide.

Acute gastroenteritis or diarrhoeal disease is a leading cause of child morbidity and mortality in developing countries of Asia, Africa and Latin America. It is a major disease problem in infants and children in Sri Lanka as well. Several viral agents viz. rotaviruses, adenoviruses, astroviruses, coronaviruses and caliciviruses (noroviruses and sapoviruses) have been identified in association with gastroenteritis in infants, children and adults throughout the world.

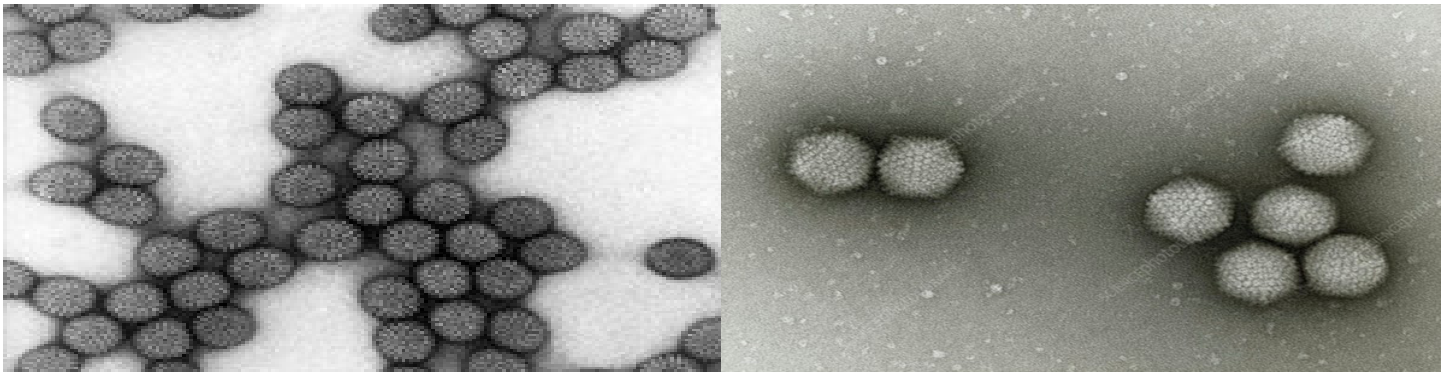
Rotavirus infections always occur highly in children than in adults and are usually the leading cause of life-threatening diarrhoea in infants and young children in developing countries. The role of rotavirus as a pathogen causing acute viral gastroenteritis in adults has long been unrecognized though it may cause severe infection in immunocompromised adults. To date, the burden of rotavirus in hospitalized adults with acute gastroenteritis has not been reported in Sri Lanka. Human adenovirus (HAdV) has been recognized as a common cause of diarrhoea in children worldwide.

Enteric adenoviruses are generally taken to be an important cause of viral diarrhoea among children less than 2 years of age leading to noticeable deaths in many countries. However, to date, there are no studies carried out to determine the role of enteric adenoviruses in hospitalized infants, children and adults of Sri Lanka.

This study aimed to estimate the burden of rotavirus, adenovirus or their co-infections among infants, children and adults located in geo-climatically different Western and Central provinces of Sri Lanka. Diarrhoeic fecal specimens were collected from a total of 571 children (aged ≤ 12 years including infants) and adults (aged > 12 years) medically diagnosed with acute gastroenteritis admitted to wards at the Colombo North Teaching Hospital, Ragama in Western Province (n=300) and Teaching Hospital, Kandy and Sirimavo Bandaranayake Specialized Children's Hospital, Peradeniya in Central province (n=271) for a period of 2 years and 8 months (March 2015 to November 2017). Fecal specimens were tested for the presence of rotavirus and enteric adenovirus antigens using commercially available indirect Enzyme Linked Immunosorbent Assay (ELISA).

Outputs

This study published in VirusDisease showed that the overall percent positivity of rotavirus infection among hospitalized diarrhoeal patients in the Western (n=300) and Central (n=271) provinces of Sri Lanka were 25.3% (76/300) and 44.7% (121/271) respectively. The percent positivity of rotavirus gastroenteritis among children leading to hospitalization was significantly high in both Western and Central provinces amounting to 32.1% (43/134) and 52.9% (108/204) respectively.



Transmission electron micrographs of A) rotavirus virions and B) adenovirus virions. Image Credit: A) Dr. Erskine Palmer - Centers for Disease Control and Prevention. B) M.Wurtz / Biozentrum, University of Basel / Science Photo Library

In comparison, the percent positivity in adults were 13.9% (15/108) and 15.6% (5/32) in the two provinces respectively. The odds of children being rotavirus positive is around three times that of adults being rotavirus positive in the Western province, whereas the odds of children being rotavirus positive is around six times that of adults being rotavirus positive in the Central province. Further, the odds of rotavirus gastroenteritis are significantly higher among children in Central province than that in Western province, but with infections in adults there is no significant difference between two provinces. However, the overall percent positivity of rotavirus gastroenteritis in hospitalized adults was 14.3% (20/140), which is not insignificant considering that the study group includes entirely hospitalized patients.

The overall percent positivity of adenovirus gastroenteritis among hospitalized patients in the Western and Central provinces of Sri Lanka were 1.7% (5/300) and 3.3% (9/271) respectively. Adenovirus gastroenteritis in hospitalized children in the Western and Central provinces were very low amounting to 2.2% (3/134) and 3.4% (7/204) respectively, with no significant difference between two provinces. Similarly, adenovirus gastroenteritis among hospitalized adults in the Western and Central provinces were rare amounting to 0.9% (1/108) and 0% (0/32) respectively, with no significant difference between two provinces.

This study also showed a very low overall percent positivity of co-infection or dual infection of rotavirus and adenovirus in hospitalized diarrhoeal patients in the Western and Central provinces of Sri Lanka amounting to 0.7% (2/300) and 1.5% (4/271) respectively. The percent positivity of rotavirus and adenovirus co-infection in the Western and Central provinces were 0% (0/134) and 2% (4/204) in children, and 0.9% (1/108) and 0% (0/32) in adult patients respectively.

Outcomes

This study reveals the burden of acute rotavirus and adenovirus gastroenteritis in diarrhoeal children and adults of two geo-climatically different provinces of Sri Lanka. The detection of adenovirus gastroenteritis and the rotavirus-adenovirus coinfections are reported for the first time in Sri Lanka. The present study reveals

that in hospitalized children and adults with acute gastroenteritis, rotavirus is the major cause of acute viral gastroenteritis compared to adenovirus in the Western and Central provinces of Sri Lanka. However, co-infections with rotavirus and adenovirus are found to be rare among children and adults in Sri Lanka. Moreover, the occurrence of rotavirus gastroenteritis is significantly higher in children (≤ 12 years) compared to adults (> 12 years) in the Western and Central provinces of Sri Lanka, whereas the occurrence of adenovirus gastroenteritis is very low in children and rare in adults of both provinces. When considering the age-related distribution of rotavirus or adenovirus gastroenteritis in children, the highest occurrence is in 1 - 3 years age group in the Western province and in 4 - 6 years age group in the Central province. However, the occurrence of rotavirus and adenovirus gastroenteritis in adult patients are found to be low with no significant difference between Western and Central provinces and is likely due to the acquired immunity in adults which may have prevented infection or hospitalization. Common epidemiological settings for rotavirus infection among adults include endemic disease, epidemic outbreaks, travel-related infection and infections transmitted from children to adults. Adults at particular risk of rotavirus infection include those exposed to infected children, travelers and immunocompromised individuals.



Oral vaccination against rotavirus infection. Image Credit: Gorlov-KV / Shutterstock

Way Forward

Results of this study showed that rotavirus contributes more (52.1%) and adenovirus to a lesser extent (4.9%) to the childhood diarrhoea in 1-3 years age. The remaining diarrhoeic children of this age group (43%) may have been infected with other bacterial and viral enteric pathogens, requiring further investigations to elucidate the importance of such pathogens. The high burden of rotavirus gastroenteritis observed in children in the Central province compared to Western province may have been due to multiple factors such as socioeconomic status, geo-climatic conditions and the circulating rotavirus genotype which requires further studies. Furthermore, this study provides useful insights into the introduction of childhood rotavirus vaccination in Sri Lanka and in other countries with similar standings where rotavirus vaccination has not been introduced to date. The research team is now planning to determine the rotavirus genotypes detected from the Western and Central Provinces of Sri Lanka in relation to immunization, and to ascertain the role of other enteric pathogens responsible for acute gastroenteritis particularly in the adult population. Testing for rotavirus and adenovirus gastroenteritis with

regard to age distribution in appropriate clinical and geo-climatic settings would better inform the burden of infection that facilitates differential diagnosis, patient management and control strategies including rotavirus vaccination.

The paper 'Burden of rotavirus and adenovirus gastroenteritis in children and adults hospitalized in two geo-climatically different provinces of Sri Lanka' is a Springer Nature publication in *VirusDisease* (2024) 35:620-629 <https://doi.org/10.1007/s13337-024-00893-8> and the results were presented at the IUMS 2024, Florence, Italy. Research was funded by NRC IDG 15-109, Sri Lanka



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Events & Staff Highlights

Appreciation of Services

Mrs. Dilini Dhampalee Wasalamuni joined NRC on 2nd May 2024 as a Scientific Research officer and she ended her service period on 14th June 2025. While appreciating her service, NRC wishes all the success for her future endeavours.



Drone technology use for rice weed management and development of Bioherbicide for eco-friendly weed control

A workshop on 21 March 2025 showcased newly developed plant-based bioherbicide formulations for rice weed control, which had been tested from laboratory to field level. These pre- and post-emergent bioherbicides reduced yield loss while being environmentally friendly and suitable for organic farming. The programme: Demonstrated preparation and spraying techniques, including the use of drone technology. Provided a general session on weed management and the environmental impact of chemical weed-icides. Shared progress to date and outlined the next strategic development plan. Participants: Farmers, agricultural officers, and students.



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