



InRC

RESEARCH GRANTS COMPLETION AWARDS

10 JULY 2020

Research Highlights

Message from the Vice-Chancellor University of Peradeniya



Prof. Upul B. Dissanayake

One of the key goals of the University of Peradeniya is to conduct high quality research to address national, regional and global issues. In a rapidly changing world, it is of utmost importance to keep pace with developments in science, technology and innovation. However, impactful research which has the potential to improve the world we live in, requires resources. In a country like Sri Lanka, it is challenging to conduct intensive and broad-scaled research as financial support and other resources are at a minuscule. This often discourages the researcher.

At a time like this, I greatly appreciate the efforts made by the International Research Centre, which is currently established as the International Relations Office, for providing research grants for the prestigious scholars of the University of Peradeniya to conduct their researches. InRC has granted 18 research grants since the year 2013 and today we mark the completion of all 18 grants and I am honoured to forward this message on the occasion of the Ceremony of Completion to appreciate the work done by the esteemed grantees of our University. I would like to take this opportunity to thank the International Relations Office for providing grants to our scholars and I hope the findings of these research projects may benefit the society.

Prof. Upul B. Dissanayake
Vice-Chancellor
University of Peradeniya

Message from the Director, International Relations Office



Dr. Shameen Jinadasa

University of Peradeniya, which is ranked as the No. 1 University in the island according to THE, QS and Webometric ranking systems, has a strong and well-established research culture at present. We, the International Relations Office (InRO), are happy to have contributed to this achievement in various ways over the past years. By awarding research grants to prestigious scholars and by enhancing global relations and collaborative research programmes, we strive to develop a rich research culture at the University.

Through InRC research grants, we have awarded grants worth over 2.5 million Rupees to conduct wide scale and cutting-edge research for the academia. I would like to thank the former Director Dr. Nanda Gunawardhana for initiating the InRC research grant scheme.

Today, as we mark the completion of all research grants funded under this scheme, I make this an opportunity to convey my heartfelt compliments to all the grantees, research assistants and students who constituted in gaining outstanding achievements and contributed to enlightening the world with new knowledge and innovations.

Dr. Shameen Jinadasa
Director
International Relations Office
University of Peradeniya

Message from the Former Director, International Research Center



Dr. Nanda Gunawardhana

International Research Centre (InRC), since established in 2012, has played an active and significant role in promoting the research culture in University of Peradeniya. In par with the vision of University of Peradeniya “to be a centre of excellence in higher education with national, regional and global standing”, InRC strives to uphold the international identity of University of Peradeniya by fostering fruitful international collaborations.

In my perspective, I believe, no improvement is possible without commitment, dedication, and most importantly, without venturing beyond your comfort zone. As such, during my tenure as the Director of InRC, myself and the staff embraced the challenges and worked hard to reinforce the strategic plan and strengthen the operations of InRC. As a result, in 2013 we could considerably increase the number of research and academic collaborations between University of Peradeniya and world-renowned universities around the globe, and InRC could awarded grants worth over Rs. 2.5 million rupees to 18 Staff members in University of Peradeniya and 18 students to pursue PhD/MPhil/MSc/BSc. degrees. 56 abstracts and 29 articles (17 in indexed journals and 12 in non-indexed journals) were published based on the projects carried out under these grants. Therefore, with humble pride I say that the untiring efforts of the InRC have paved the way for the University of Peradeniya to become the number one ranked University in Sri Lanka and to be included in the 401-500 band in World University Ranking of the Times Higher Education World University Rankings for 2020. Today, as we mark the completion of all the 18 grants, I congratulate Dr. Shameen Jinadasa the Director of InRO and his team, the staff and grantees for the accomplishment, and also, I express my sincere gratitude to all who have put forth the effort to achieve this milestone.

Finally, I wish you all strength and success in the endeavour of establishing University of Peradeniya as a world-leading hub of research and development.

Dr. Nanda Gunawardhana
Former Director / International Research Center
University of Peradeniya

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Dr. P.C.G. Bandaranayake

Agricultural Biotechnology Center
Faculty of Agriculture

Publications from the grant

Abstracts	03
Refereed Journals	02
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Dr. Pradeepa Bandaranayake is currently serving as the Director of Agricultural Biotechnology Centre, and a Senior Lecturer attached to the Faculty of Agriculture, University of Peradeniya. She has four postgraduate degrees: PhD from the University of California Davis with Designated Emphasis and Biotechnology, MSc in Horticulture and Agronomy from the University of California Davis, MSc in Biotechnology and an MPhil Degree in Crop Science from University of Peradeniya. Winning the prestigious Fulbright Fellowship from the US Government was the turning point in her life. During her graduate studies at UC Davis, she has received several prestigious fellowships and has received the outstanding student and the outstanding researcher awards. At present, she has active collaborations with UC Davis and several other US universities. Currently, Dr. Pradeepa conducts her research in molecular biology, biochemistry and genomics, leading several foreign and locally funded projects. She has co-authored many scientific publications and book chapters. Currently she supervises 15 postgraduate students. She also serves in several national level committees in biotechnology and related areas. She has recently received several prestigious fellowships and awards including the Presidential Awards for several years, the NRC Merit Award, the Cochran Fellowship, Endeavour Research Fellowship, the Early Career Fellowship from the OWSD, Annual Research Excellence Award Faculty of Agriculture and the SL-CARP awards for Excellence in Agriculture Research 2019.

Evaluating genetic resources of an endemic wild rice species, *Oryza rhizomatics* Vaughan, for defeating water scarcity in rice cultivation

Project Period: January 2014 – January 2019

Grant Amount: LKR. 2,500,000.00

Rice is the staple food for more than half of the world's population and developing countries account for 95% of the total production. More than 8.5 million hectares of rice are currently grown in highly drought-prone or drought-prone upland rice areas in South and Southeast Asia. In Sri Lanka, rice is cultivated as a wetland crop in all the districts securing 32% of employment in the country.

Water deficit, commonly referred to as 'drought', causes major economic losses in rice production throughout the world. It has been estimated that rice production consumes about half of the total water consumption of a country. However, drought stress is still the single most important constraint in rice production, mostly due to variation in the rainfall patterns from year to year, and also uneven distribution of rainfall in a rice growing season. To meet the ever-growing demand for rice by 2030, a significant increase of at least 35% in yield is needed. Thus, there is an urgent need for developing new rice cultivars with high yield and improved drought tolerance and water-use efficiency. Thus, our study evaluated *Oryza. rhizomatis* Vaughan as a genetic resource for drought tolerance in cultivated rice.

O. rhizomatis Vaughan was first described in 1990 as a new rice species found only across the dry zone of Sri Lanka. So far it has only been reported from seasonally dry habitats in Sri Lanka and considered as an endangered endemic species. While cultivated rice, *Oryza sativa*, is an annual herb without visible rhizomes, *O. rhizomatis* is a perennial herb, with underground rhizomes from which many thick roots develop (Figure 01).

First we conducted an islandwide survey and collection revisiting previously identified places and new locations in the North and East areas. While collecting 14 accessions of *O. rhizomatis*, we noticed a significant loss of previously identified habitats due to developmental activities and natural disasters. Nevertheless, we were able to collect more samples from the Yala National Park.

Then, we conducted a detailed replicated study on morphology, molecular biology and physiology of the collection maintained under greenhouse conditions. There were considerable morphological differences among those, both in growth and reproductive traits. The genetic diversity among the accessions was assessed using Simple Sequence Repeat (SSR) and Inter Simple Sequence Repeat (ISSR) regions. Interestingly, accessions also showed significant difference in response to drought. Only three accessions out of 14 were highly resistant to the drought while few others were highly susceptible. These three accessions were collected from seasonal drying areas of Puttalam district. Drought resistant accessions were further

studied and looked at the differential expression of known drought related genes before and after exposure to the drought conditions.

After completion of the study, we handed over a live collection to the Plant Genetic Resource Centre, Department of Agriculture for national use. It is by far the largest collection of *O. rhizomatis* in the world.



Figure 1: Natural habitat and phenotypes of *O. rhizomatis*

Co-Supervisors/ Collaborators:

1. Prof. D.K.N.G. Pushpakumara, Dean, Faculty of Agriculture, University of Peradeniya
2. Dr. Gamini Samarasinghe, Director HORDI, Department of Agriculture, Sri Lanka

Acknowledgments:

The guidance and active participation of the retired Research Officers, Mr. P.V. Hemchandra and Mr. A.S.U. Liyanage in sample collection is highly appreciated. The support given by the staff members of the Agricultural Biotechnology Centre throughout the project is also acknowledged.

Research Students:

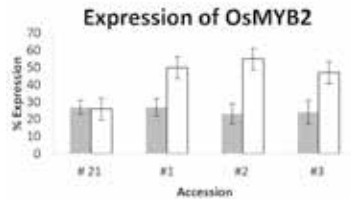
Ms. A.V.C. Abhayagunasekara (PhD student registered at PGIA)

current affiliation: Assistant Director of Agriculture (Research), Fruit Crops Research and development Gannoruwa, Peradeniya

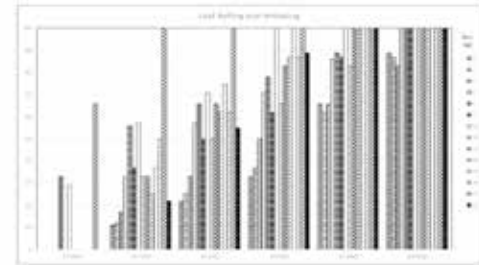
Evaluating genetic resources of an endemic wild rice species, *Oryza rhizomatics* Vaughan, for defeating water scarcity in rice cultivation



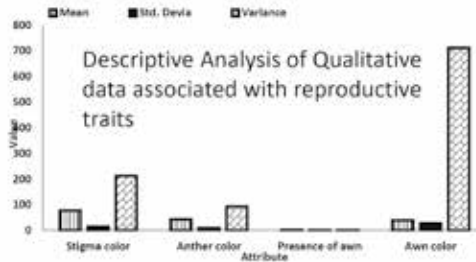
Collection sites



Morphology of *Oryza rhizomatics*



Variation in drought effect: Leaf rolling and Yellowing. Y axis - %



Physiology of *Oryza rhizomatics* collection

Dr. R.P. Illeperuma

Department of Medical Laboratory Science
Faculty of Allied Health Sciences

Publications from the grant

Abstracts	07
Manuscripts in Preparation	01
Patents in Preparation	01



Dr. Rasika Illeperuma currently serves as a Senior Lecturer at the Department of Medical Laboratory Science, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka. He earned his BDS Honors degree in 2004 from the University of Peradeniya and earned his MSD and PhD degrees from the Graduate School, Yonsei University, Oral Cancer Research Institute, Yonsei University College of Dentistry, Seoul, South Korea (2008-2012). Concurrently he served as an Assistant Teacher at the Department of Oral Pathology, Yonsei University College of Dentistry during this period. Dr. Illeperuma worked as a lecturer in Western Medicine (Modern Medicine Unit) Institute of Indigenous Medicine, University of Colombo, Sri Lanka (April 2007-May 2013). He then joined the Oral Cancer Research Institute, Yonsei University as a Post-Doctoral Researcher in August 2015. Dr. Illeperuma served as the Head, Department of Nursing, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka from July 2017 – February 2019. He also serves as a visiting Lecturer and an examiner at the Postgraduate Institute of Medicine (PGIM), Colombo, Sri Lanka for Postgraduate Diploma in Family Medicine Programme. He has received several awards and fellowships throughout his career. Best research proposal award (3rd place) at the MORCC Oral Health Symposium & Research Proposal Competition, President's Award for Scientific Publications for the year 2015, Best Presentation, Best Research Paper, Daphne Attygalle Prize for the best paper in cancer and research fellowship-Oral Cancer Research Institute, Yonsei University are among many.

Elucidating oxidative DNA damage and DNA double strand breaks in carcinogenic transformation of oral premalignant lesions caused by areca nut consumption

Project Period: January 2015 – January 2018

Grant Amount: LKR. 1,260,000.00

Objectives: Areca nut (AN) induced Oral Premalignant Diseases (OPMDs) are a health burden in Asian countries which causes higher morbidity and mortality. Oral Submucous Fibrosis (OSMF) and Oral Leukoplakia (OL) are the most vulnerable AN induced OPMDs which have a considerable malignant transformation rate. The underlying mechanism of carcinogenesis in OPMDs is still obscure. It was found that the oxidative stress caused by AN can induce carcinogenesis in OPMDs. Based on our previous research, it was found that some of these OPMDs have DNA damage caused by oxidative stress. Tropical countries are rich of herbs with antioxidants. Our attempt was to test few herbs as a remedy to reverse the potential carcinogenesis in AN induced OPMDs by reducing the oxidative stress caused by AN.

Findings: Expression of Phospho histone H2AX, DNA double-strand breaks (DNA DSBs) marker was tested immunohistochemically in OPMDs with the history of AN consumption and compared with normal oral mucosa (NOM) and oral squamous cell carcinoma (OSCC). Phospho histone H2AX was significantly increased in OL and OSMF compared to the NOM ($p < 0.05$). In-vitro studies using immortalized human oral keratinocytes (IHOK) shown that AN induced reactive oxygen species (ROS) production can be significantly reduced by the ethanol extracts of the antioxidant rich herbs *Shumacheria castaneifolia* leaves (SC-extract) and *Solanum nigrum* linn leaves (SN-extract). Antioxidant properties of the herbs were analyzed by DPPH assay. Furthermore, the amount of Phospho histone H2AX in response to 24hr AN treatment was considerably reduced in pretreated IHOK cell with SC extract. Murine model experiment also revealed that the herbal extracts can reduce the AN induced DNA DSBs in oral mucosa.

Discussion: The chemotherapeutic properties of polyphenols and antioxidants have recently received an increasing interest because these compounds can modulate each step of carcinogenesis. The aim of this study was to analyze DNA double stranded breaks (DSBs) in areca nut (AN) induced oral keratinocytes and to test whether it can be reduced by crude extract of *Shumacheria castaneifolia* (ESC) leaves rich in polyphenols and antioxidants. It was clear that ESC can reduce the AN induced DNA damage caused by ROS.

Conclusions: This study is evident that blocking ROS generation by herbal extracts as a promising approach to reverse DNA DSBs caused by AN. Especially, to prevent malignant transformation in OPMDs, ESC would be a candidate remedy which warrants further studies in this regard.

Co-Supervisors/ Collaborators:

1. Prof. W.M. Tilakaratne – Department of Oral Pathology, Faculty of Dental Sciences, University of Peradeniya (Co-Supervisor).
2. Prof. Jin Kim- Department of Oral Pathology, Yonsei University College of Dentistry, Seoul, Korea (Co-Supervisor).
3. Prof. B.S.M.S. Siriwardhena - Department of Oral Pathology, Faculty of Dental Sciences, University of Peradeniya (Collaborator).
4. Dr. Dilrukshi Jayewardene- Department of Medical Laboratory Science, Faculty of Allied Health Sciences University of Peradeniya (Collaborator).

Acknowledgments:

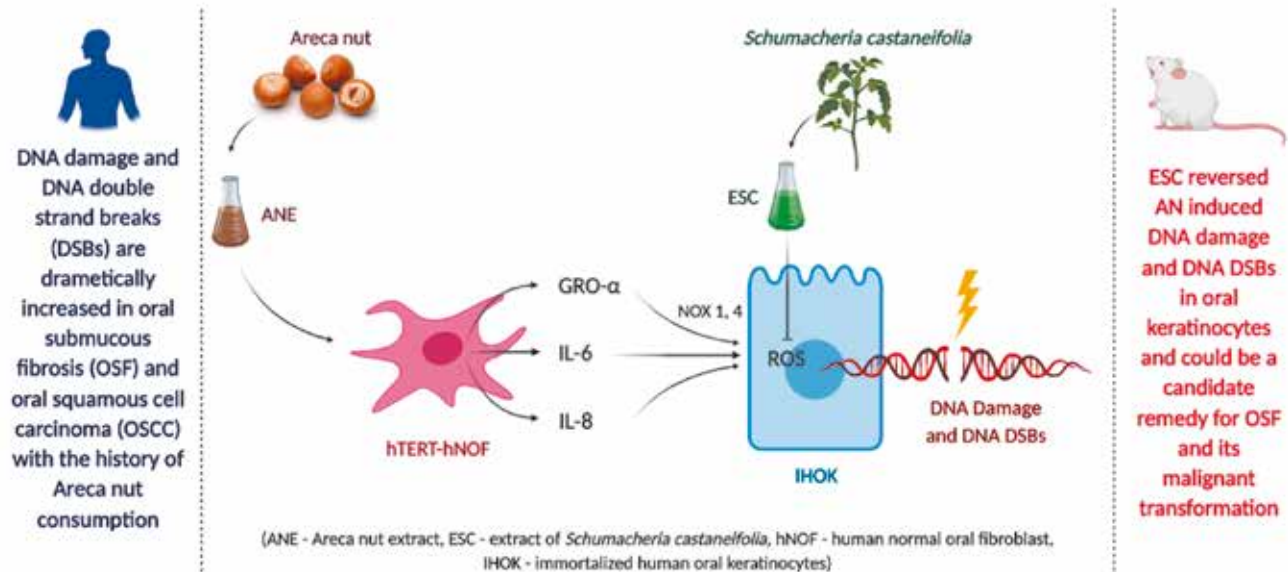
The financial support from the University of Peradeniya Research Grants RG/AF2013/14AHS, RG/2014/CG-2/10/AHS and InRC research grants InRC /RG/13/02 are greatly acknowledged. The laboratory facilities provided by the Oral Cancer Research Institute, Yonsei University College of Dentistry, Seoul Korea are highly appreciated.

Research Students:

Mr. W.M.K.M. Bandara- BSc (MLS) Special graduate

Working in this project as a PhD Candidate attached to the Centre for Research in Oral Cancer, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka

Elucidating oxidative DNA damage and DNA double strand breaks in carcinogenic transformation of oral premalignant lesions caused by areca nut consumption



Ms. S.T. Sudeshika

Department of Pharmacy
Faculty of Allied Health Sciences

Publications from the grant

Abstracts	01
Refereed Journals	01



Ms. Thilini Sudeshika is a lecturer in Department of Pharmacy, Faculty of Allied Health Sciences since 2013. She received her B.Pharm and MPhil degrees from University of Peradeniya. Currently, she is reading for her PhD in University of Canberra, Australia. Ms. Thilini is a young researcher who is interested in variety of fields including pharmacometrics, pharmacology and toxicology, pharmacy practice and pharmacy legislation. She has published her work both locally and internationally. She has made several contributions to chronic kidney disease of unknown aetiology (CKDu) and pharmacy practice in Sri Lanka. Her current study which was focused on determining the sun protection factor of commercially available sunscreens, will offer insights into strengthening the regulations required when registering the sunscreens in Sri Lanka.

Determination of Sun Protection Factor (SPF) in commercially available sunscreens in Sri Lanka

Project Period: March 2014 - June 2015

Grant Amount: LKR. 177,633.20

Background and aims: Over exposure to Ultraviolet (UV) solar radiation during noon time is recognized as causing negative effects on human skin and is known to cause skin cancers. Majority of Sri Lankans have low risk for skin cancers due to high level of melanin in their skin; however, excessive UV exposure can cause photodermatitis and photoaging. The application of sunscreens with correct Sun Protection Factor (SPF) is required to protect the skin from harmful UV exposure. This study was designed to determine SPF of commercially available sunscreens in Sri Lanka.

Methods: Thirty sunscreens of various manufacturers were purchased from the market. The active ingredients of each sample were checked with the approved standard ingredients list. The purchased sunscreens were de-identified by a provided code (product no:1 to 30). The *in-vitro* SPF was determined according to the spectrophotometric method following a dilution series with ethanol stated by Dutra *et al.* in 2004.

Results and discussion: The SPF values on the labels of the products ranged from 15 to 60. Product no. 9 exhibited the maximum absorbance of UV in the study. Only 27% of sunscreens had observed SPF values comparable with the label. The SPF of 73% of products highly deviated from the value in the label. The properties of the active ingredients and many other reasons can cause the deviation of the observed SPF values in the commercially available sunscreens.

Conclusion: This study has revealed that the protection specified in the label could not be achieved from the most of sunscreens in Sri Lanka even though they have the sunscreen effect. Therefore, this matter should be considered by the relevant authorities in Sri Lanka before the consumers purchase sunscreens.

Co-Supervisors/ Collaborators:

1. Dr. H.M.D.R. Herath – Department of Pharmacy
2. Ms. C.B. Gunawardhne – National Institute of Fundamental Studies (NIFS), Kandy

Acknowledgments:

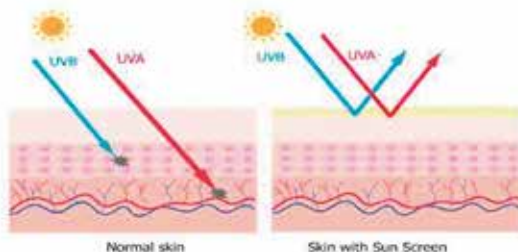
Financial assistance by the InRC, University of Peradeniya is well appreciated. The support of co-investigators, Dr. H.M.D.R. Herath, Ms. C.B. Gunawardhne and Ms. N.G.P.D. Nawarathne is greatly appreciated. The guidance of Prof. D. B. M. Wickramaratne is highly acknowledged. Special gratitude for Ms. T.W. Hettiarachchi, Ms. K.I.M. De Silva, Ms. C. Punchihewa, Ms. R. K. Suraweera, Ms. C. Galketiya and Mr. N.M.Y. Bagyawantha and non-academic staff of Department of Pharmacy (Mr. R.M.C.B. Karunaratna, Mrs. D.R.N.N.K. Senawirathna, Mrs. R.G.B.V. Jayasooriya, Mr. H.M. K. B. Ellegala and Mr. M.U.W.M. Kudabanda) for their enormous support throughout the project.

Research Students:

Ms. N.G.P.D. Nawarathne
Bachelor of Pharmacy final year research project in 2015
Research Topic: Awareness of usage of sunscreens among school children in Kandy

Determination of Sun Protection Factor (SPF) in commercially available sunscreens in Sri Lanka

What is known?



Sun Protection Factor (SPF)

Indicator of the effectiveness of sunscreens

Regulations of sunscreens in Sri Lanka

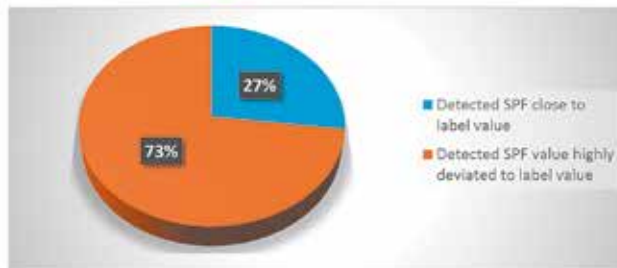
Registered as a cosmetic product and available in market



Aim

To evaluate the quality of sunscreens in Sri Lanka with respect to Sun Protection Factor (SPF)

Key findings



What is new?

- According to our knowledge, this is the first study in Sri Lanka to assess SPF values in sunscreens
- The protection specified in the label could not be achieved from the most of sunscreens in Sri Lanka even though they have the sunscreen effect.



Prof. D.B.M. Wickramaratne

Department of Pharmacy
Faculty of Allied Health Sciences

Publications from the grant

Abstracts	04
Refereed Journals	03
Thesis	01



Prof. D.B.M. Wickramaratne is a Professor in Pharmaceutical Chemistry at the Department of pharmacy, Faculty of Allied Health Sciences, University of Peradeniya. He graduated from the University of Peradeniya with a BSc. (Sp.) in Chemistry in 1981. He obtained his PhD in 1987 from the University of Peradeniya and worked as a post-doctoral researcher at the Department of Chemistry, University of Peradeniya. Later, he joined the International Program in Chemical Sciences at Department of Chemistry, Royal Institute of Technology, Stockholm, Sweden as a Post-doctoral fellow in 1988. He worked as a research associate at the Department of Chemistry, University Peradeniya, Department of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, University of Illinois at Chicago and Department of Medicinal Chemistry, School of Pharmacy, University of Kansas, Lawrence, Kansas (1989-1996). Prof. Wickramaratne joined the Department of Pharmacy, Faculty of Allied Health Sciences, University of Peradeniya in 2007. He served as the Dean of the Faculty of AHS for nine years (2010 – 2019).

Investigation of anti-diabetic and anti-oxidant activities of the plants *Adenanthera pavonina*, *Argyreia populifolia* and *Benincasa hispida*

Project Period: 2013 - 2019

Grant Amount: LKR. 404,596.25

Diabetes mellitus is a metabolic disease characterized by hyperglycemia, resulting from either a defect in insulin secretion or insulin action, or both. In this study, leaves of *Adenanthera pavonina*, upper part of the *Argyreia populifolia* and mature fruit peels of *Benincasa hispida* were tested for their anti-diabetic and anti-oxidant activities using DPPH and alpha amylase assays. The main objective of this study was to investigate hypoglycemic activity and associated toxicity of the aqueous and ethanol extracts of *A. pavonina*, which showed highest anti-diabetic and anti-oxidant activities among the tested extracts. It was also aimed to develop a hard gelatin capsule formulation which is safe, cheaper and can also alleviate the diabetic symptoms, thereby providing multifaceted benefits. Sprague Dawley male rats were used to determine the activity of the ethanolic extract of leaves of *A. pavonina* (EEAP). After 30 days, oral glucose tolerance test (OGTT) was performed to determine the glucose tolerance activity. Animals were examined daily for survival and evident behavioral or motor impairments. At the end of the experiment the animals were sacrificed humanely and liver, spleen, heart, and kidneys were removed for histopathological examination. Based on the OGTT and toxicity study results, the most effective and safe extract was chosen to prepare the capsule filling blend. The prepared blend was subjected to pre-formulation studies and was then filled into empty capsules using manual capsule filling machine.

Co-Supervisors/ Collaborators:

1. Dr. P.H.P. Fernando, Department of Biochemistry, Faculty of Medicine, University of Peradeniya
2. Ms. N. Asoka Sanjeewani, Department of Pharmacy, Faculty of Allied Health Sciences, Kothalawala Defense University (KDU)
3. Dr. M.N. Wickramaratne, FAPPSc, Sabaragamuwa University of Sri Lanka

Acknowledgments:

The assistance of Dr. M.N. Wickramaratne and Ms. C. Punchihewa in initiating the in-vivo activities of the plants is highly acknowledged. Dr. P.H.P. Fernando for providing all the animal testing facilities, Ms. A. Sanjeewani, Department of Pharmacy, KDU for conducting all the experiments, Technical and laboratory staff of the Department of Pharmacy for providing all the facilities, and the Quality control laboratory staff of the SPMC for assisting to prepare capsules are greatly appreciated.

Research Students:

Ms. N.A. Sanjeewani
MPhil Degree in PGIA (2019)

Investigation of anti-diabetic and anti-oxidant activities of the plants *Adenanthera pavonina*, *Argyreia populifolia* and *Benincasa hispida*

- Ethanolic extract of the *Adenanthera pavonina* has the capability of regulating blood glucose level in rats.
- and most effective dose in rats is 250 mg/kg/day b.wt.
- Further, there were no any acute or sub-acute toxicity associated with both ethanolic and aqueous extracts of *A. pavonina* and those extracts were consisted of phytochemicals.
- A ready to take capsule was formulated.
- Clinical Trials should be conducted before the commercialization of the product.



Dr. M.M.P. Perera

Department of Geography
Faculty of Arts

Publications from the grant

Abstracts	01
Refereed Journals	07
Manuscripts in Preparation	01



Dr. Muditha Prasannajith Perera obtained his BA (Hons) Degree in Geography from the University of Peradeniya. He scored the first place in Anuradhapura District in his A/L results, from Yakalla Maha Vidyalaya, Galenbindunuwewa. He is also a two times Island First winner of two national level competitive exams. In addition to his academic achievements, numbers of events are credited to him such as art, oratory, short stories, poetry, general knowledge, and sports, at different scale up to national level which shows his versatility. However, after graduation, he joined the Department of Geography, University of Ruhuna as an Assistant Lecturer. Then, he joined the Sri Lanka Forestry Institute of the Forest Department as a permanent lecturer in Forestry & Environmental Management, where he gave the fullest support to develop the theoretical and practical activities. Later with this experience plus a three-year research background inclusive of Huruluwewa Watershed Management Project (SCORE), under the International Irrigation Management Institute, he joined the Department of Geography, University of Peradeniya in 2008. He has published few books and research papers in national as well as international level in addition to the publishing magazine and newspaper articles. Dr. Muditha Perera completed his MPhil Degree in 2010. He has completed his PhD studies related to tank cascade issues in the Dry Zone of Sri Lanka, in 2016.

The hydro-ecological impact of Agro-well development in tank cascades of the North Central dry zone of Sri Lanka

Project Period: January 2014 - January 2018

Grant Amount: LKR. 615,534.00

The concept of “Agro-wells” arrived to the dry zone of Sri Lanka with the revelation of the feasibility of groundwater availability in the 1950s, as a solution for water deficit in the dry season. However, the rate of construction of Agro-wells accelerated with the interventions of the governmental and non-governmental organizations, since 1989. The thin alluvial layer in the small valleys consisted of “small tank cascade systems” in the dry zone was the main aquifers which serves as the shallow groundwater reserves for Agro-wells. These tank cascades were one of the most remarkable inventions of the ancient hydraulic civilization in the country.

Farmers are still expanding the construction of Agro-wells and land development based on economic profitability, without considering if negative impacts. The ‘hydro-ecology’ of these tank cascade systems may be vulnerable and some of the impacts might be significant. Therefore it has become a national level requirement to bring some comprehensive knowledge on this issue. Therefore considering this background, 20 tank cascades from the North Central dry zone covering the Malwathu Oya basin and Yan Oya basin were randomly selected and used for the study.

The overall objective of this study was to examine, whether there is a significant impact of Agro-well development on the hydro-ecology of tank cascades in the North Central dry zone of Sri Lanka. Six experimental tests relevant to six parameters were designed and necessary data for two years were collected, for this comprehensive study (Figure1).

Satellite images, GIS maps, half recovery pumping tests, computing well specific capacity, Simpson’s diversity index calculations, electrical conductivity testing, impact assessment scoring analysis were used for data analysis. Further “differentiate mean t tests” and “hypothesis tests” were used to identify the significance of each experimental test.

Groundwater levels of all cascades fluctuated between 0 - 5.48 m within a year, without showing a difference between high Agro-well density cascades and low Agro-well density cascades. Increase of the half recovery time of Agro-wells and inversely proportionate reduction of well specific capacity during the dry season of sample cascades, were not significantly different. Further, net groundwater extraction from Agro-wells in a high Agro-well density cascade was 7.9%, out of the total infiltration to the ground. These findings have revealed that no significant impact existed yet, to the groundwater table depletion as well as to reduce the groundwater availability, due to groundwater extraction through Agro-wells in tank cascades.

Average Simpsons’ diversity index values for floral diversity and the differentiate “mean t test” have shown that there was no significant impact.

However, some reservation damages, including floral degradation and physical damages were revealed. Further environmental regulations on reservations have also been violated. Due to continuous Agro-well irrigation and under the current context, the soil salinity status in Agro-well lands may reach “moderate salinity level”, after next 25 years. Farmers’ perceptions on both negative and positive impacts were also revealed. Then, a matrix analysis was used to conclude all findings and subsequently designed a “Statistical Model” to find a numerical value for the overall impact. Finally it was revealed that “minor negative impact level” has emerged due to Agro-well development in the tank cascades of the North Central dry zone of Sri Lanka.

Co-Supervisors/ Collaborators:

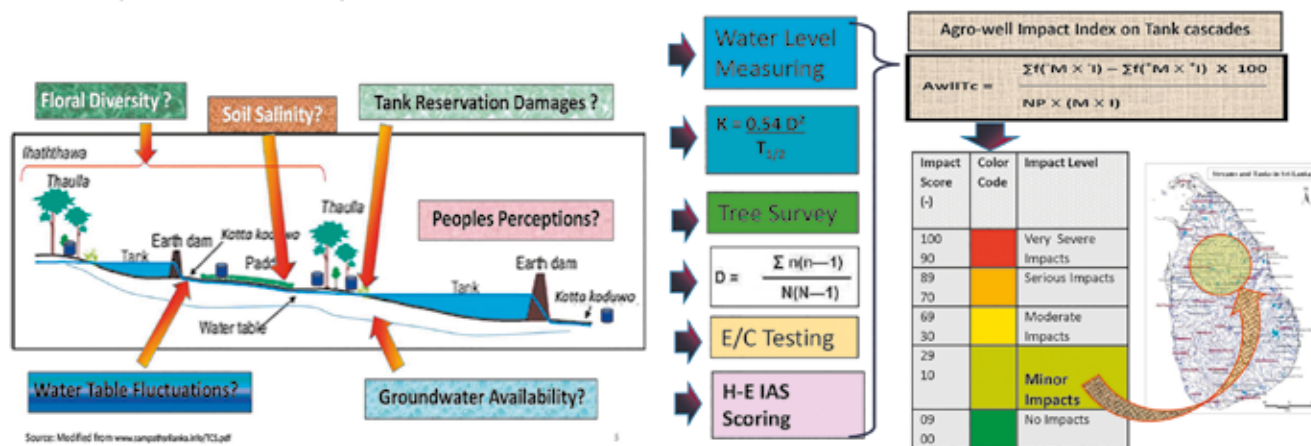
1. Emeritus Prof. C.M. Madduma Bandara
2. Prof. K.W.G. Rekha Nianthi

Acknowledgments:

The financial support provided by the International Research Centre, University of Peradeniya (Grant Reference Number: InRC/ RG/13/06) and National Centre for Advanced Studies in Humanities and Social Sciences, Sri Lanka (Grant Reference Number: 14/NCAS/PDN/Geo/37) is greatly appreciated. Technical supports given by the International Water Management Institute (IWMI), Natural Resources Management Centre (NRMC), and Faculty of Agriculture & Faculty of Science of the University of Peradeniya are also hereby acknowledged.

The hydro-ecological impact of agro-well development in tank cascades of the North Central dry zone of Sri Lanka

- The research focused to examine a controversial matter in the context of resource management in the dry zone of Sri Lanka, to gain a better understanding on the “impacts of Agro-well development which mostly prevailed in Tank Cascades”.
- Six experimental tests relevant to six parameters were designed for this comprehensive study.



Dr. (Mrs.) L. Seneheweera

Department of Fine Arts
Faculty of Arts

Publications from the grant

Abstracts	01
Artistic Work	02



Dr. Leena Seneheweera is a senior lecturer at the Department of Fine Arts, Faculty of Arts, University of Peradeniya. Her expertise lies in the fields of fine arts: particularly in music, musicology, Buddhist Art, relationship between music and visual art, society, intangible cultural heritage, and disability studies. She disseminates her knowledge through both teaching and research. She has also performed her artistic work through music performances and directing musical drama as an artist. Furthermore, Dr. Leena has produced a music CD with Sri Lankan Nurthi songs as a singer and an artistic director. She is the academic coordinator at Special Needs Recourse Center, Faculty of Arts and she serves as a music therapist for people with autism and for those who are suffering from chronic disease. Also, she is engaged in educating the moral standards of both abled and differently abled students in the Faculty of Arts through her artistic experience and leadership.

A musicological analysis of Sri Lankan Nurthi music

Project Period: 2013 - 2016

Grant Amount: LKR. 307,000.00

The purpose of the study was to produce a CD with original and unpopular Nurthi songs with its narration and to publish its musicological analysis from semi classical music genre of Nurthi in Sri Lanka. It is a music theatre and introduced from Indian Baliwala theatre troupe in the end of 18th century to Sri Lanka. Since then Nurthi songs of that theatre have been popularized among Sri Lankan music lovers. At present, some melodies have been misrepresented. Furthermore, the original melodies were displaced in possession from the musicians, researchers or written documents to musical community in Sri Lanka. Therefore, the study mechanized to rediscover original and unpopular Nurthi melodies as an intangible cultural heritage in Sri Lanka. The main problem of the study was to investigate the relative importance in the background of Nurthi music in Sri Lanka and to identify the strategy that could be used to transform and safeguard its musicological value as Sri Lankan intangible cultural heritage. Qualitative research method was proceeded and preliminary data were collected from original gramophone records and via sessions of interview with Nurthi musician Kalabhushana Lionel Gunathilake and his music collection. The result of the study was provided, even today the audience accept this music genre because it is consisted semi -classical musical forms and this type of production could be used to safeguard musical heritage in Sri Lanka and this message can be updated through live performances. A live musical show was performed on 02 April 2019 which also included launching of a CD containing 10 selected Nurthi song.

Acknowledgments:

The support provided by the Vice-Chancellor, University of Peradeniya and the Dean, Faculty of Arts, Head, Department of Fine Arts, University of Peradeniya is highly acknowledged. The assistance offered by Mr. Lionel Gunathileke, Orchestra in SLBC and professionals of the Tower Hall studio is greatly appreciated. Director and staff of the InRC, University of Peradeniya, Director and staff of the Department of Cultural Affairs, Kandy district and Students of the Department of Fine Arts are also hereby acknowledged.

A musicological analysis of Sri Lankan Nurthi music

- **The purpose** of the study was to produce a CD with original and unpopular Nurthi songs with its narration, and to publish its musicological analysis from 10 selected songs of various Nurthi theatres and organize a live concert on the basis of those selected songs.
- **The problem** of the study: What were the relative importance in the background of Nurthi music and which strategy could be used to transform and safeguard its musicological value as Sri Lankan intangible cultural heritage
- **Qualitative research method was followed** and Preliminary data were gathered from Nurthi music expertise Kalabhushana Lionel Guathilaka's gramophone music collection
- **Results:** Rediscovered original melodies and updated Nurthi musical form through Audio CD and Live performances
- Identified Nurthi songs as an intangible cultural heritage in Sri Lanka
- **Conclusion** This type of production could be created to safeguard musical heritage in Sri Lanka and it was confirmed through use of digital media and live performances (see the example given).



Ms. S.M.W.T.P.K. Ariyaratna

Department of Chemical and Process Engineering
Faculty of Engineering

Publications from the grant

Manuscripts in Preparation	02
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Ms. S.M.W.T.P.K. Ariyaratna, has obtained her Bachelor of Science in Engineering degree from the Faculty of Engineering, University of Peradeniya in 1997. She has specialized in Chemical Engineering with mechanical biased. She has assumed duty in the Department of Chemical and Process Engineering, University of Peradeniya in 1997 as a Temporary Instructor. She then followed a research based Diploma in Chemical and Process Engineering. In the year 2000, she joined the Department as an Engineering Teaching Assistant in the permanent carder. Currently she is working as a Senior Engineering Teaching Assistant. Her MPhill degree reserch was on designing of novel adsorption column to treat wastewater generated from rice mills in Sri Lanka. Currently, she is reading for her PhD in anaerobic digestion, in solid waste management technology. She is involved in designing process plants, lecturing on waste management systems, supervising ongoing undergraduate and post graduate research on solid waste and wastewater management. She is also interested in Life Cycle Assessment (LCA) studies and trying to apply them into local, small scale processes in Sri Lanka.

Environmental profile of power generation from rice husk in Sri Lanka

Project Period: January 2014 - January 2016

Grant Amount: LKR. 661,449.80

According to the statistical digest of Ceylon Electricity Board, it can be understood that Sri Lanka's present energy consumption is mostly from fossil fuels: 35% by thermal oil and 26% by coal. Importing electricity from other countries alarm for energy security. In addition, combustion of thermal oil and coal, links with the emission of CO₂ SO₂ and NO_x which creates severe environmental degradations. In this context, the government has initiated exploring renewable energy opportunities.

Biomass is identified as one of the potential energy sources and amongst several types of potential biomass, rice husks receive an important attention under waste to energy concept. Energy generation from rice husk may reduce the use of conventional energy sources and hence reducing the respective greenhouse gas emissions. However, assessing the overall environmental performance is obligatory to bring the technology from conceptual to operational stage.

This study is to analyse the environmental impacts of power generation from rice husk with conventional power plants. Life Cycle Assessment methodology was chosen as the assessment tool. The results imply that rice husk is a potential energy source to minimize the adverse environmental impacts of conventional power generation approaches.

Co-Supervisors/ Collaborators:

1. Prof. D.G.G.P. Karuarathne , Department of Chemical and Process Engineering, Faculty of Engineering, University of Peradeniya

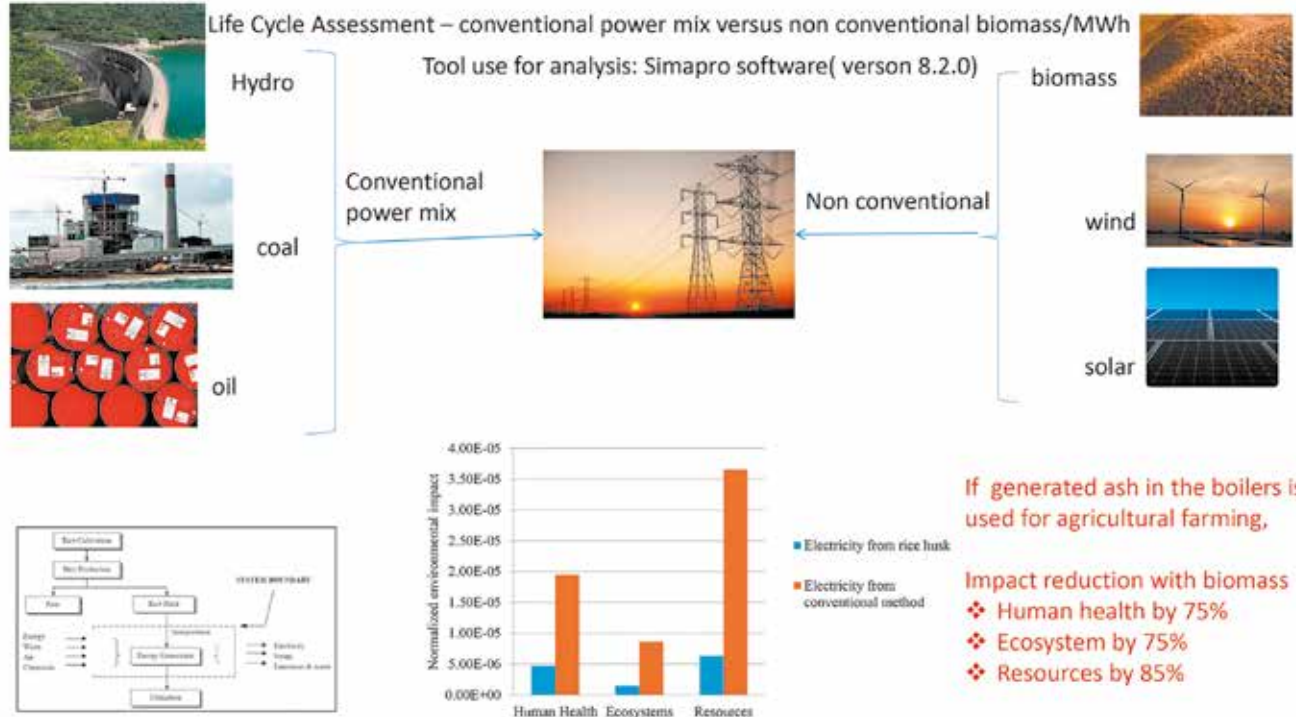
Acknowledgments:

The financial support provided by the International Research Center, University of Peradeniya is hereby acknowledged. The guidance and assistance provided by Prof. D.G.G.P. Karunaratne and Dr. Maheshi Danthurebandara is highly appreciated. The assistance offered by Mrs. Warnika weerasekara, a technical officer in the department, in handling software is greatly acknowledged. The study was carried out at Hairu power plant situated at Ninthavur in Ampara district, Sri Lanka. All the members supported during the collection of data are greatly appreciated.

Research student:

H.P.D.S.N. Siriwardhana (Undergraduate), BSc. Engineering

Environmental profile of power generation from rice husk in Sri Lanka



Dr. (Mrs). S.R. Herath

Department of Civil Engineering
Faculty of Engineering



Publications from the grant

Manuscripts in Preparation

04

Dr. Shobha Herath is a Senior Lecturer in Civil Engineering at Faculty of Engineering, University of Peradeniya. She specializes in materials modelling and mechanics of materials. Her other interests lie in designing custom made bone implants. She is a graduate of Faculty of Engineering, University of Peradeniya. She obtained her Masters degree from Nagoya University, Japan and PhD degree from University of California at Santa Barbara, USA. Upon completing her higher studies, she joined the Faculty of Engineering, University of Peradeniya. Since then, she is involved in undergraduate and postgraduate teaching and research. She is also a part of national level consultancy project on condition assessment of railway bridges in Sri Lanka. At the faculty, she engages in various other duties such as coordinating orientation programs, student counselling, quality assurance work etc. She was instrumental in organizing two international conferences at the Faculty of Engineering dedicated to two renowned academics on their retirement. She has several Journal papers published during her career and presented papers at international conferences. She is also a member of Biomedical Engineering Research Group of University of Peradeniya for the last 10 years. The group engages in various nationally important multidisciplinary biomedical projects.

Use of homogenization technique to model constitutive laws for new materials

Project Period: January 2014 - January 2016

Grant Amount: LKR. 1,120,703.00

This study has explored the potential of using the finite element method (FEM) as a computational tool to identify constitutive laws for new and heterogeneous materials. In view of conducting experiments on such materials is complicated and expensive, the aim and objectives of the research are identified to be vital and novel. The materials investigated are: perforated plates, open cell forms and carbon nanotube reinforced composites. Homogenization techniques are used to formulate pertaining unit cells for these materials, and those were subjected to periodic boundary conditions.

The results of the numerical analysis conducted on plates were compared with the available experimental results and thereby the computational procedure was validated. The other results were mainly used to identify constitutive laws and guidelines on the behaviour of those materials. The results of the analysis on open cells show that FCC cell geometry provides better outcomes than SC geometry. The results pertaining to the carbon nanotube reinforced composites indicate that the maximum stresses in the matrix occur at the interface with the end-cap and that, except for polymer matrix, the location of peak stresses is not affected by the prescribed boundary conditions. The investigation also identified impressive research gaps as matters for future work.

Co-Supervisors/ Collaborators:

1. Dr. K.R.B. Herath, Department of Civil Engineering, University of Peradeniya

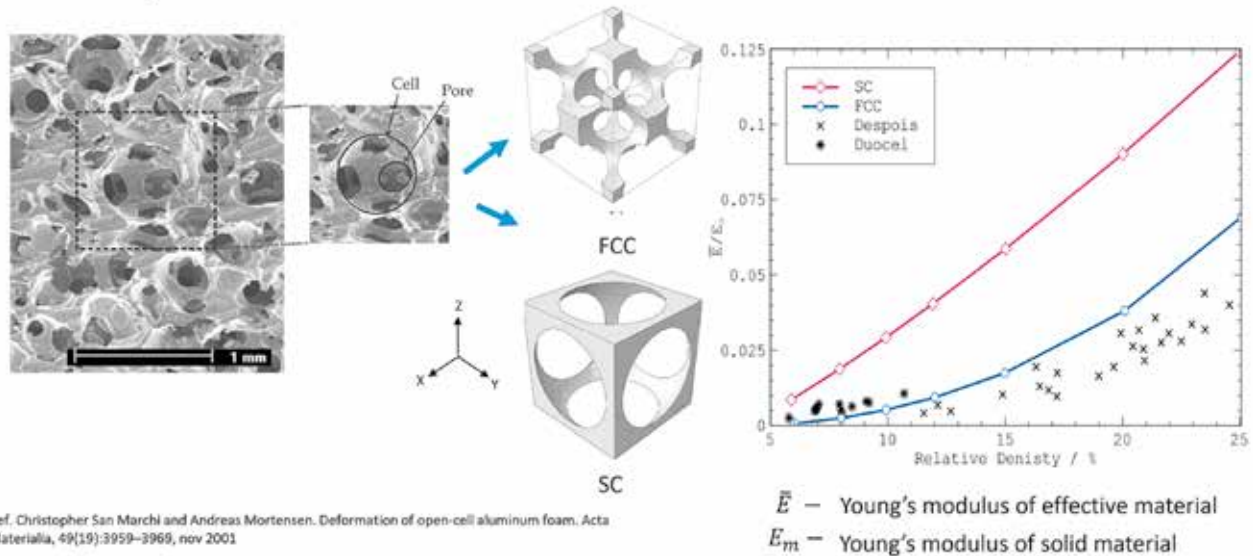
Acknowledgments:

The financial support provided by the InRC is hereby acknowledged. The assistance provided by the Metallurgy Laboratory of Department of Civil Engineering and the efforts of the MPhil student Mr. SASP Sathurusinghe are greatly appreciated.

Research student:

Mr. S.A.S.P. Sathurusinghe, MPhil in Engineering

Graphical abstract



Dr. (Mrs.) H.K. Nandalal

Department of Civil Engineering
Faculty of Engineering



Publications from the grant

Abstracts

10

Dr. Hemalie holds a BSc degree in Civil Engineering from the University of Peradeniya. (1984), MSc degree in Soil and Water Resources from the University of Wageningen, The Netherlands (1995) and a PhD degree in Civil Engineering from the University of Peradeniya (2011). Presently, she works as a Senior Lecturer at the Department of Civil Engineering, University of Peradeniya. She teaches surveying and Geographic Information Systems (GIS) in Civil Engineering at undergraduate and postgraduate levels. Her research interests are in the areas of application of GIS in Civil Engineering and rainfall-runoff modelling/flood modelling with GIS. She has authored 15 journal and conference papers. Under her supervision 4 MSc students and 1 MPhil student have successfully completed their studies. Dr. Nandalal also is an active member of the Institution of Engineers (IESL), Sri Lanka.

Integrating remote sensing/geospatial technologies into water resource management and transportation engineering

Project Period: January 2014 - June 2019

Grant Amount: LKR. 985,459.30

Introduction: Remote Sensing (RS) and Geographic Information System (GIS) have become potential and indispensable tools for solving many problems of civil engineering. RS observations provide data on earth's resources in a spatial format, GIS co-relates different kinds of spatial data and their attribute data, so as to use them in various fields of civil engineering.

Objectives: The main objective was to investigate the use of RS and GIS technology in the field of Civil Engineering. Under four areas following objectives were formulated;

- ◆ To estimate the urban expansion using GIS and RS
- ◆ To estimate the flood extent using flood modelling incorporating GIS
- ◆ To estimate the spatial distribution of rainfall and its trends using GIS
- ◆ To estimate the vulnerability of road networks due to different criteria.

Methodology: To identify the Urban Sprawl the changes of FCTC (Forest Cover Land Cover) in slope GIS and RS was used. Landsat TM bands (for the years 2004, 2011 and 2018) and SRTM 30m Digital Elevation Models were used as base layers for the analysis. Estimation of Flood Extent was approached using GIS, HEC-GeoRAS and HEC-RAS software. Loggal Oya Dam Breaching Analysis was taken as the case study. Spatial and Temporal Analysis of Rainfall Patterns using GIS was carried out using daily rainfall data and processed through different statistical techniques and GIS was used to develop maps of Mahaweli system H. A methodology was developed to assess the level of vulnerability of the transport network due to public service centres using GIS. The resulted vulnerability was compared with the Google Map traffic congestion indicators. Another investigation was carried out to identify the vulnerability of road network due to natural factors like a flooding. This study was based on external impacts like natural disasters, which influence the road network.

Results and Discussion: Using the satellite images, the area covered by FCTC were extracted for different years and Figure 1 presents the area covered by FCTC in 2004. Estimation of flood extent for different flow conditions of a dam breach and the flood extents were estimated using GIS and river flow model. Figure 2 presents the flood extent for the Steady Flow condition due to possible dam breach of Loggal Oya reservoir. Spatial analysis of rainfall patterns using GIS in Mahaweli System H is shown in Figure 3. The highest annual mean rainfall was observed in

Mahailluppallama, Thalawa and Galnewa gauging stations, respectively. Application of GIS to identify vulnerability of roads was investigated. The vulnerability of a road network due to public service centers was estimated using several indices. The results are presented graphically in Figure 4. The vulnerability of a road network due to natural disaster was studied using several indices to estimate the overall vulnerability of a road network due to a disaster. Flooding was the natural disaster used in this study and the road network in the Ratnapura District as the study area.

Conclusions: In this research, several applications of GIS and RS in civil engineering were made and produced promising results, in the areas such as flood modelling, rainfall distribution and road network analyses.

Acknowledgments:

The support and coordination provided by the former Director International Affairs Office, Dr. Nanda Gunawardhana, the present Director, Dr. K.B.S.N. Jinadasa and present and past staff members of the International Relations Office, specially Ms. Kalhari Abeykoon are hereby acknowledged. The support given by the Heads of the Departments and the staff members of the Department of Civil Engineering throughout the research period is greatly appreciated.

Research students:

- ◆ S.K. Epasinghe, 2017, MSc in GIS and RS, Postgraduate Institute of Science, University of Peradeniya.
- ◆ S.S. Kosgolla, 2019, PG Programme in Sustainable Built Environment, Department of Civil Engineering, University of Peradeniya.
- ◆ S.P. Ranatunga, 2019, PG Programme in Environmental and Water Engineering, Department of Civil Engineering, University of Peradeniya.
- ◆ M. Ratnayake, 2019, PG Programme in Environmental and Water Engineering, Department of Civil Engineering, University of Peradeniya.

Integrating remote sensing/geospatial technologies into water resource management and transportation engineering

- In this research it was investigated methods to Integrate Remote Sensing / Geospatial Technologies into the area of Civil Engineering.
- These researches were conducted at undergraduate level as well as post graduate level.
- It was found that application of RS and GIS is very useful in the area of Civil Engineering.
- Under four areas the investigations were carried out
 - Estimate the urban expansion using GIS and RS
 - Estimate the flood extent using flood modelling incorporating GIS
 - Estimate the spatial distribution of rainfall and its trends using GIS
 - Estimate the vulnerability of road networks due to different criteria



Figure 2: Flood Inundation Area of Steady Flow Scenario in Google Earth view

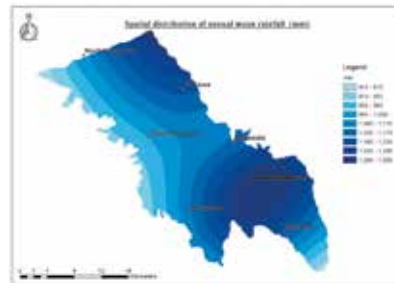


Figure 3: Spatial distribution of mean annual rainfall (mm)



Figure 4: Overall VI of morning peak hour of Kandy city



Figure 1: Area covered by forest/trees in 2004

Prof. W.D.M.T.L. Dassanayake

Department of Physiology
Faculty of Medicine

Publications from the grant

Abstracts	01
Refereed Journals	01



Prof. Tharaka Dassanayake is a Professor in Neurophysiology at the Faculty of Medicine, University of Peradeniya, an Honorary Consultant Neurophysiologist at the Teaching Hospital Peradeniya and a Conjoint Senior Lecturer at the University of Newcastle, Australia. He obtained his MBBS and MPhil degrees from the University of Peradeniya and his PhD from The University of Newcastle, Australia. He obtained his training in neurophysiology and advanced cognitive assessment at the Calvary Mater Hospital, Newcastle and established the first Cognitive Neuroscience lab in Sri Lanka, that also provides advanced cognitive assessment services. His research interests are in neurophysiology and cognitive sciences. He has published 21 full-text research articles in international peer-reviewed journals and has presented his research in numerous international and local conferences. He is a reviewer for 12 international peer-reviewed journals. He was the Chairman of the Faculty of Medicine Research Committee from 2015 – 2017.

Normative data for Cambridge Neuropsychological Automated Battery (CANTAB) for Sri Lankan adults

Project Period: March 2014 - December 2018

Grant Amount: LKR. 135,000.00

Objective: Neuropsychological test batteries validated for Sri Lankan population are extremely scarce. Cambridge Neuropsychological Test Automated Battery (CANTAB) is a language-independent test battery used in many countries, but the original UK norms may not be representative in the local setting due to sociocultural differences. Our aim was to generate age-, sex-, and education-adjusted norms for the CANTAB for Sri Lankan adults.

Method: Three-hundred and eleven healthy, community-living adults aged 20–64 years completed CANTAB subtests of visual attention (Reaction Time and Rapid Visual Information Processing), visual memory (Paired Associates Learning and Delayed Matching to Sample); and executive functions (Stockings of Cambridge, Stop Signal Task, and Spatial Working Memory). We conducted multiple linear regression analyses with sex, age and years of education fitted as predictors to model the CANTAB outcome variables.

Results: Younger age and longer education were associated with better performance in most CANTAB measures. Men outperformed women in few measures of psychomotor speed and visuospatial skills, but sex explained only a small proportion of test variance. We report regression-equations to predict CANTAB norms based on sex, age and years of education; and the test variances accounted by these factors.

Conclusions: We propose sex-, age- and education-adjusted CANTAB norms for Sri Lankans aged 20–64 years and supplement the regression formulae with a calculator that produces predicted and standard scores of a given test subject. These norms would help in interpreting the results of clinical samples in future studies, taking into account the variability introduced by sex, age and education.

For complete details, the published full paper can be accessed from the doi: 10.1080/13854046.2019.1662090

Co-Supervisors/ Collaborators:

1. Dr. G. M. D. I. Ariyasinghe, Department of Psychiatry, Faculty of Medicine, University of Peradeniya

Acknowledgments:

The financial support provided by the International Research Centre (grant InRC/RG/13/12) and Australian National Health and Medical Research Council (grant 1030069) through South Asian Clinical Toxicology Research Collaboration, University of Peradeniya are highly acknowledged. The assistance provided by Noorul Ikram, Mohomed Azam, Udayaprashanth Gnanaseharan, Husain Ameen, Subhagya Kulatunga and Gamage Shiroma is greatly appreciated.

Normative data for Cambridge Neuropsychological Automated Battery (CANTAB) for Sri Lankan adults

THE CLINICAL NEUROPSYCHOLOGIST
<https://doi.org/10.1080/13854046.2019.1662090>

 **Routledge**
Taylor & Francis Group

Sex-, age-, and education-adjusted norms for Cambridge Neuropsychological Test Automated Battery in literate Sri Lankan adults

Tharaka Lagath Dassanayake^a and Dewasmika Indrapali Ariyasinghe^b



CANTAB: Computerized testing of cognitive functions

The underlying regression calculations are based on a sample of Sri Lankan adults between 20 and 64 years of age. To calculate the predicted raw scores enter the Sex (in cell E1), Age (in cell E2) and years of education (in cell E3) of the subject. To calculate the standard score (SDs from the predicted raw score) of a given subject enter the CANTAB summary data sheet raw scores in the 'Observed Raw Score' column. *For ease of interpretation, poor performance (i.e. poorer accuracy or longer response latency) is denoted by negative SD scores.

Sex (male=1, female=0)	1
Age (years)	40
Years of education	13

Tests and Outcome Measures	Predicted raw Score	Standard deviation	Observed raw Score	Standard score*
Motor Screening (MOT)				
Mean latency (ms)	1020.39	286.19	930.40	0.31
Mean error (mm)	7.73	2.55	7.91	-0.07
Reaction Time (RTI)				
Mean simple reaction time (ms)	309.16	64.55	244.67	1.00
Mean simple movement time (ms)	423.63	120.11	292.89	1.09
Mean five-choice reaction time (ms)	347.1	59.7	280.38	1.12
Mean five-choice movement time (ms)	414.4	104.49	309.62	1.00

Is your patient cognitively impaired? Standard score calculator

InRC/IRG/13/15

Prof. N.S. Kalupahana

Department of Physiology
Faculty of Medicine



Publications from the grant

Abstracts	05
Refereed Journals	02

Prof. Kalupahana currently serves as a Professor in Human Nutrition at Faculty of Medicine, University of Peradeniya. He is an adjunct professor at Nutritional Sciences, Texas Tech University, USA. Also, he is a consultant nutritionist, Faculty of Medicine, University of Peradeniya who provides visiting clinical nutrition services to the Teaching Hospitals of Peradeniya and Kandy. He obtained his MBBS degree from the University of Peradeniya in 2001 and obtained his MPhil degree in human physiology from the University of Peradeniya in 2006. He received his PhD degree from the University of Tennessee, Knoxville, TN, USA in 2011. His research activities are focused on identifying mechanisms responsible for obesity-associated metabolic derangements with a view of developing preventive and treatment strategies for these disorders including Type-2 Diabetes Mellitus.

Identification of mechanisms responsible for insulin resistance in Sri Lankan adults

Project Period: January 2015 - December 2016

Grant Amount: LKR. 331,000.00

South Asian individuals develop metabolic complications of obesity at lower levels of adiposity compared to their western counterparts. Hence, the aim of the current study was to investigate Body Mass Index (BMI)-dependent changes in serum adipokines in Sri Lankan women and determine their association with metabolic complications of obesity.

Adult females who underwent routine abdominal surgery at Teaching Hospital, Peradeniya were recruited (n=59). Anthropometric measures and fasting pre-operative blood samples were obtained while ultrasound scanning was performed to detect hepatic steatosis. During surgery, white adipose tissue (WAT) samples were obtained from the omentum and anterior abdominal wall. Histological sections of WAT were used to measure the adipocyte area and identify the crown-like structures (CLS).

Overweight or obese women had significantly higher serum resistin levels, CLS and adipocyte area compared to normal weight women, while no significant difference in serum adiponectin levels was observed among the different groups. Moreover, serum resistin had significant positive correlations with age, waist circumference and mean omental WAT area. Individuals with hepatic steatosis and impaired fasting glucose also had significantly higher serum resistin levels compared to women without these derangements.

In conclusion, the adipokine resistin may be important in the pathogenesis of obesity-related metabolic complications in South Asians.

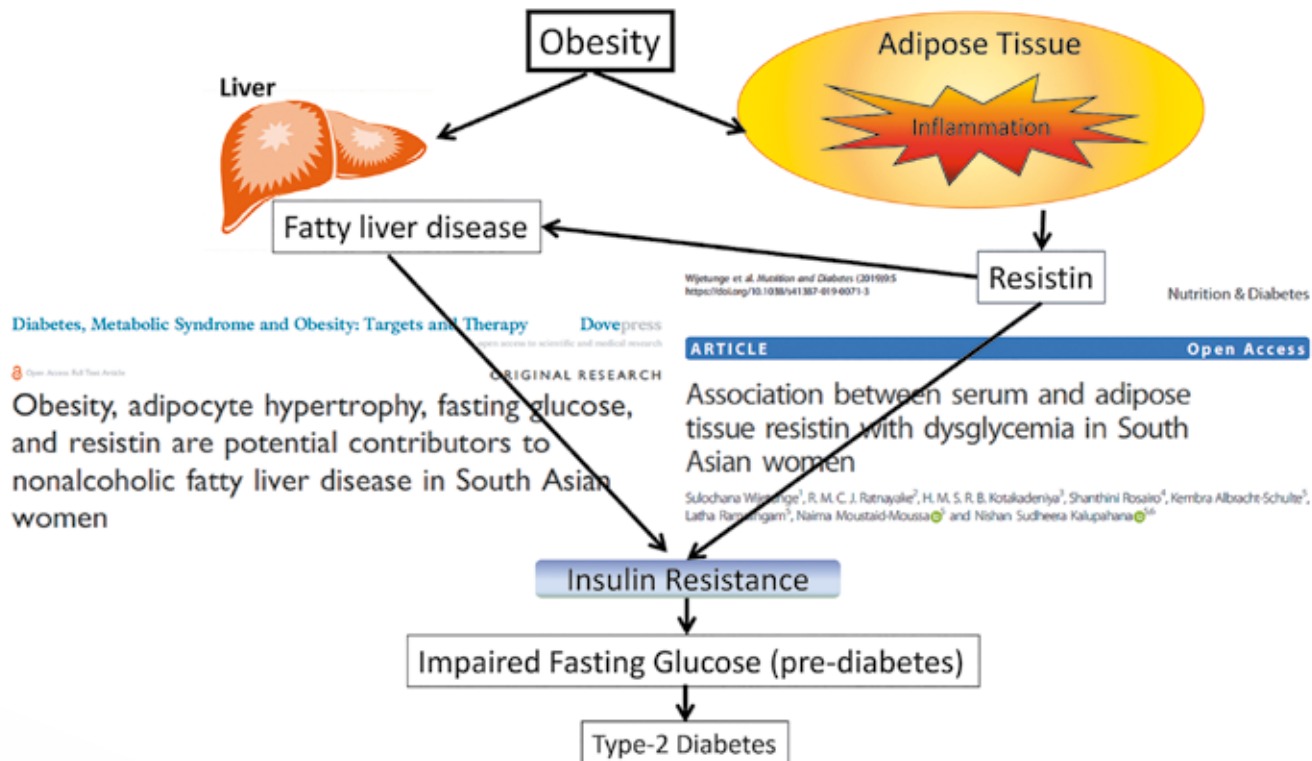
Co-Supervisors/ Collaborators:

1. Dr. Sulochana Wijetunga, Department of Pathology, Faculty of Medicine, University of Peradeniya
2. Dr. R. Kotakadeniya, Department of Surgery, Faculty of Medicine, University of Peradeniya
3. Dr. C. Ratnayake, Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Peradeniya
4. Dr. S. Rosairo, Department of Radiology, Faculty of Medicine, University of Peradeniya

Acknowledgments:

The support given by the patients at the Teaching Hospital, Peradeniya is hereby acknowledged.

Identification of mechanisms responsible for insulin resistance in Sri Lankan adults



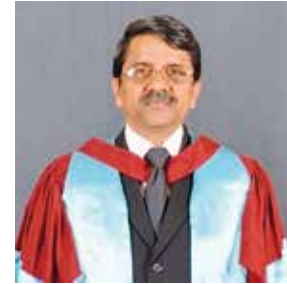
Prof. V.S. Weerasinghe

Department of Physiology
Faculty of Medicine

Publications from the grant

Refereed Journals

02



Prof. Vajira Weerasinghe is a Senior Professor of Physiology attached to the Faculty of Medicine, University of Peradeniya. He obtained his PhD in Neurophysiology from the University of Southampton, UK in 1994 and received a post-doctoral training in Advanced Neurophysiology at the King's College London, UK in 2002. He has published more than 40 Research articles in high impact factor journals such as Neurology, Clinical Neurophysiology, Journal of Neurophysiology, PLOS Medicine, PLOS One, Journal of Physiology, Toxicon, Clinical Toxicology, Neurotoxicology and Nutritional Neuroscience. He has delivered several prestigious orations including Senaka Bibile Memorial Oration, K.N. Seneviratne Memorial Oration, A.C.E. Koch Memorial Oration and Valentine Basnayake Memorial Oration. He has received Sir Nicholas Attygalle Prize for the best research paper in 2008 and the Presidential Award for Scientific Research in several years and the most coveted K.S.M. Health Research Prize in 2013. He became the President of the Physiological Society of Sri Lanka in 2004 and in 2008 and the President of the Kandy Society of Medicine in 2009. He was the former Dean of the Faculty of Medicine, University of Peradeniya in 2015 and the Former Deputy Vice Chancellor of the University of Peradeniya in 2011.

Assessment of the effect of theanine and caffeine on cognitive processing studied using reaction time, evoked potentials and event related potentials

Project Period: July 2013 - July 2014

Grant Amount: LKR. 50,000.00

Background: L-theanine is a constituent of tea which is claimed to enhance cognitive functions.

Objective: This study aimed to determine whether theanine and theanine-caffeine combination have acute positive effects on cognitive and neurophysiological measures of attention, compared to caffeine (a positive control) and a placebo in healthy individuals.

Method: In a placebo-controlled, five-way crossover trial in 20 healthy male volunteers, we compared the effects of L-theanine (200 mg), caffeine (160 mg), their combination, black tea (one cup) and a placebo (distilled water) on cognitive (simple [SVRT] and recognition visual reaction time [RVRT]) and neurophysiological (event-related potentials [ERPs]) measures of attention. We also recorded visual (VEPs) and motor evoked potentials (MEPs) to examine any effects of treatments on peripheral visual and motor conduction, respectively.

Results: Mean RVRT was significantly improved by theanine ($P=0.019$), caffeine ($P=0.043$), and theanine-caffeine combination ($P=0.001$), but not by tea ($P=0.429$) or placebo ($P=0.822$). VEP or MEP latencies or SVRT did not show significant inter-treatment differences. Theanine ($P=0.001$) and caffeine ($P=0.001$) elicited significantly larger mean peak-to-peak N2-P300 ERP amplitudes than the placebo, whereas theanine-caffeine combination elicited a significantly larger mean N2-P300 amplitude than placebo ($P<0.001$), theanine ($P=0.029$) or caffeine ($P=0.005$). No significant theanine $\times$ caffeine interaction was observed for RVRT or N2-P300 amplitude.

Conclusion: A dose of theanine equivalent to eight cups of black tea improves cognitive and neurophysiological measures of selective attention, to a degree that is comparable with that of caffeine. Theanine and caffeine seem to have additive effects on attention in high doses.

Co-Supervisors/ Collaborators:

1. Dr. Chanaka Kahathuduwa, Department of Physiology, Faculty of Medicine, University of Peradeniya
2. Dr. Tissa Amarakoon, Department of Chemistry, Faculty of Science, University of Kelaniya
3. Prof. Tharaka Dassanayake, Department of Physiology, Faculty of Medicine. University of Peradeniya
4. Dr. Nimal Punyasiri, Tea Research Institute of Sri Lanka, Talawakelle

Acknowledgments:

The financial support provided by the National Research Council (Grant 09-32) and the International Research Centre of University of Peradeniya (Grant InRC/RG/13/19), Sri Lanka is hereby acknowledged.

Research student:

Dr. Chanaka Kahathuduwa, Lecturer, Department of Physiology, Faculty of Medicine, MPhil degree awarded in 2017 from the University of Peradeniya.

Assessment of the effect of theanine and caffeine on cognitive processing studied using reaction time, evoked potentials and event related potentials

An experimental study on the effects of active chemical compounds found in tea (theanine and caffeine) on brain cognitive functions



Study methodology

This is a placebo-controlled, five-way crossover trial on 20 healthy male volunteers using L-theanine (200 mg), caffeine (160 mg), their combination and black tea on visual reaction time and a measure of attention known as P300

Results

Mean recognition reaction time significantly improved by theanine, caffeine and theanine-caffeine combination but not by tea or placebo. Theanine and caffeine elicited significantly larger mean P300 amplitude than the placebo whereas theanine-caffeine combination elicited a significantly larger mean P300 amplitude than placebo, theanine or caffeine.

Improvement of P300 amplitude by combination of theanine and caffeine

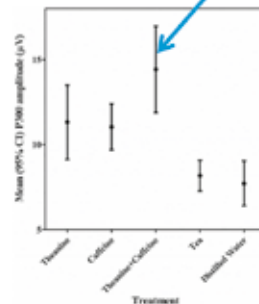


Figure 2 P300 event-related potential amplitudes after theanine, caffeine, theanine-caffeine combination, tea and distilled water

P300 waveforms

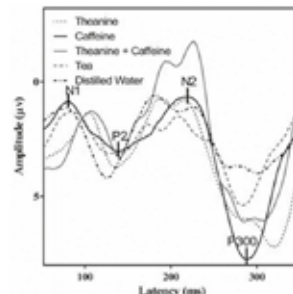


Figure 1 Grand averaged auditory event-related potential waveforms derived for target stimuli after theanine, caffeine, theanine-caffeine combination, tea and distilled water

Conclusion

High doses of theanine and caffeine seem to have an additive effect of improving selective attention aspect of brain cognitive function

Dr. (Ms). S.C.K. Rubasinghe

Department of Botany
Faculty of Science



Publications from the grant

Abstracts	06
Refereed Journals	04

Dr. Sumudu currently works as a Senior Lecturer at the Department of Botany, Faculty of Science, University of Peradeniya. She has joined the Department of Botany in 2006 and proceeded to the University of Edinburgh, United Kingdom in September 2007 for her higher studies. She obtained her PhD in Molecular Plant Phylogenetics and Taxonomy. She returned to the Department in 2011 as the first trained bryophyte systematist of Sri Lanka. Dr. Sumudu has initiated research on taxonomy, biogeography and molecular phylogenetics of Sri Lankan bryophytes. Her teaching expands in the fields of plant diversity, phytogeography, evolution and diversity of cryptogrammic plants, angiosperm morphology and anatomy and analytical methods in molecular biological sciences. Currently, she serves as the secretary to the Board of Study in Plant Sciences, Postgraduate Institute of Science, University of Peradeniya.

Taxonomy, biogeography and evolutionary relationships of thalloid liverworts and hornworts of Sri Lanka

Project Period: January 2014 - January 2018

Grant Amount: LKR. 2,770,460.81

Bryophytes (liverworts, mosses, and hornworts) occupy a pivotal position in land plant evolution. They are the first group of extant plants to successfully colonize land. They are unique among all other land plants in having a dominant gametophyte generation in their life cycle and an unbranched single sporophyte dependent on the haploid gametophyte plant. Due to their small stature, difficult taxonomy and lack of expertise on the group, no taxonomic or phylogenetic studies have previously been undertaken on Sri Lankan bryophytes and thus remained as one of the most poorly understood groups of plants in the country. Further, due to lack of research, their species diversity and conservation status remain uncertain.

The main objectives of this study were to carry out a detailed taxonomic survey on Sri Lankan thalloid liverworts and hornworts, to build up a molecular phylogeny and to trace their biogeographic and evolutionary relationships.

The study presents the first taxonomic investigation of Sri Lankan thalloid liverworts and hornworts. Fresh specimens were collected from throughout the country covering all possible geographic localities. Specimens collected, were identified up to generic/specific level using macro and micro morphological, anatomical and spore ornamentation characters of the gametophyte and sporophyte reviewed using dissecting, compound and scanning electron microscopes. Seventeen species under 08 genera, 07 species under 05 genera and 06 species under 05 genera were morphologically identified under complex thalloid liverworts, simple thalloid liverworts and hornworts, respectively. They included five new species records to Sri Lanka. For each genus and species identified during the study, taxonomic keys, descriptions, illustrations and distribution maps are provided along with ecological, taxonomic and nomenclatural notes.

The study also presents the first robust phylogenetic framework for the Sri Lankan thalloid liverworts and hornworts based on three plastid gene regions (*rbcL*, *psbA*, *matK*) and one nuclear gene region ITS2 sequenced for 60 accessions of complex thalloids, 21 of simple thalloids and 08 accessions of hornworts. The current circumscriptions and relationships of the genera and species identified during the study were tested using Maximum Parsimony and Bayesian inferences. The resulted phylogeny confirmed the identity of the genera and species encountered during the study, including the new species records to the country. Newly generated sequences for Sri Lankan taxa were assembled with those available for taxa from throughout the world and a world phylogeny was prepared incorporating Sri Lankan taxa. Sri Lankan taxa were represented in well-supported separate clades in the resulted phylogeny. Distribution patterns were identified and their biogeographic affinities traced and described.

The Sri Lankan thalloid liverworts and hornworts exhibit close affinities with India and South East Asia, explained by the major dispersal events occurred in the plate tectonic history of earth.

Distribution of habitats of thalloid liverworts and hornworts were identified and threats prevailing were recognized. The study highlights the necessity of implementing conservation measures to protect this evolutionary and ecologically important plant group.

Co-Supervisors/ Collaborators:

1. Dr. D. G. Long & Dr. L. L. Forrest, Royal Botanic Garden Edinburgh, Scotland, U.K.

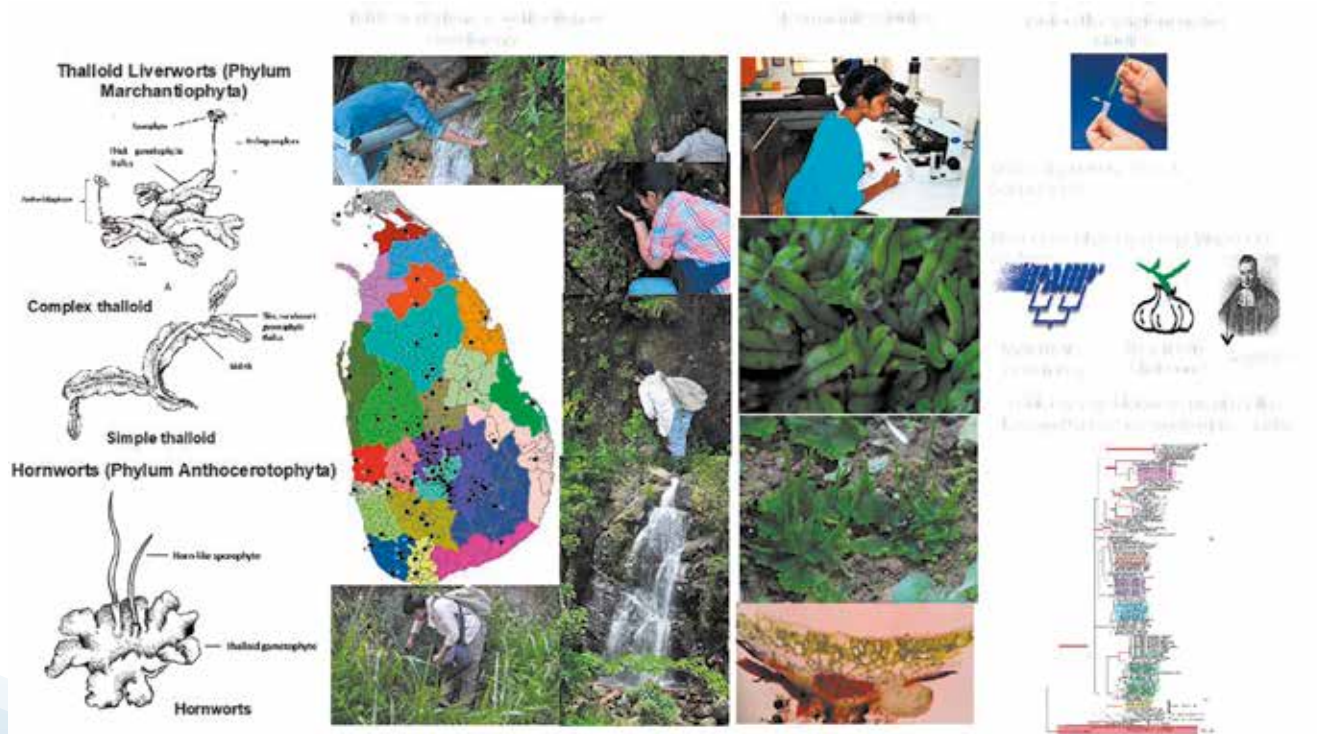
Acknowledgments:

The financial assistance provided by the International Research Center University of Peradeniya (InRC/RG/13/20) is acknowledged.

Research student:

Ms. N.C.S. Ruklani, Department of Botany, Faculty of Science PhD, Degree awarded in May 2018.

Taxonomy, biogeography and evolutionary relationships of thaloid liverworts and hornworts of Sri Lanka



Prof. S.H.P.P. Karunaratne

Department of Zoology
Faculty of Science

Publications from the grant

Abstracts	07
Refereed Journals	03
Manuscripts in Preparation	01



BSc., MSc. (Perad.), PhD. (Lond.); Senior Professor and chair of Zoology (2009 to date); Professor of Zoology (2001-2009); Deputy Vice Chancellor, University of Peradeniya, Sri Lanka (Jan 2018 to date); Director & Senior Research Professor/ National Institute of Fundamental Studies, Sri Lanka (Sept 2015 – Dec 2017); (Dean, Faculty of Science (2007-2013) University of Peradeniya); Elected Fellow of the National Academy of Sciences Sri Lanka (2006 to date) & Elected Fellow of the Royal Entomological Society, London, UK (1997 to date); Member of the DDT expert group, WHO, Geneva, Switzerland (2015 – 2019); Research publications 181 in peer reviewed Journals/proceedings, 2660 citations; Google Scholar h-index of 28;. Several National and International Awards for Excellence in Research including SLAAS General Research Committee Award (2018), CVCD Excellence Award (2016), Indian Medical Council Vestergaard Frandsen Award (2011), SLAAS Bernard Soysa Memorial Award (Gold Medal) (2005), UGC Hiran Thilakaratne Award (2001), TWAS Young Scientist Award (1999); Research interest on Mosquito control, Insecticide resistance in insects, Molecular mechanisms of insecticide resistance, Control of insect pests in agriculture and insect vectors of human and livestock diseases, DNA barcoding and phylogeny of insects, Insect ecology, behaviour and molecular biology.

DNA barcoding of Sri Lankan *Anopheles*, *Aedes* and *Culex* mosquitoes, and determination of age structure of selected *Aedes albopictus* populations in relation to disease transmission and insecticide resistance

Project Period: November 2014 - October 2017

Grant Amount: LKR. 1,471,123.10

Introduction: Although Sri Lanka is considered as a malaria and filariasis free nation, the threat of re-emergence of outbreaks still remains due to the high prevalence and abundance of major and potential vectors. DNA barcoding has become increasingly popular as an efficient method of species identification since it produces results with high precision even from a part of the specimen, within a short period of time. Also the knowledge on the population genetic structure of mosquito vectors of disease is vital in understanding their vectorial capacity, increasing the efficacy of existing vector control programmes and in implementing novel vector control strategies. The incubation period within the mosquito's body before the dengue virus is transmitted to human body, is 8-12 days. Hence, age structure of the dengue mosquito population has been identified as one of the most sensitive parameters that influence the epidemiology of the disease.

During this study, a combined effort was made to characterize the mosquito fauna in Sri Lanka by morphological features and DNA barcoding using Cytochrome c oxidase subunit 1 (cox1) gene, internal transcribed spacer 2 (ITS2) and D3 region as the molecular markers. Further, the population genetic structure of three abundant malaria vectors; *Anopheles subpictus*, *An. peditaneatus* and *An. vagus* from five administrative districts was determined using partial sequences of cox1 gene. The study also aimed to use transcriptional age grading technique to determine the age structure of populations of dengue vectors *Aedes aegypti* and *Ae. albopictus*.

Methodology

DNA barcoding: DNA barcoding was conducted to confirm the taxonomic status of morphologically identified 15 species of subfamily Anophelinae and 14 species of subfamily Culicinae collected from Ampara, Badulla, Batticaloa, Jaffna, Kurunegala Matale, Mannar and Nuwara-Eliya and Kandy districts of Sri Lanka.

Population genetic structure analysis: Partial *cox1* sequences of *Anopheles peditaeniatatus*, *An. subpictus* s.l., *An. vagus* from, Ampara, Badulla, Batticaloa, Jaffna and Kurunegala were used for population genetic structure analysis.

Age structure analysis: Expression levels of three age responsive genes; *Ae15848*, *Ae8505* and *Ae4274* were used to develop multivariate calibration models for *Aedes aegypti* and *Ae. albopictus* and, the effect of temperature and the larval rearing temperature on the developed models were tested.

Results and Discussion:

DNA barcoding: Molecular analysis with 185 *Cytochrome c Oxidase subunit I*, 127 Internal transcribed spacer 2 and 32 D3 expanding region (only for anophelins) sequences were 100% comparable with morphological identifications of all species except for *Anopheles subpictus*, *Aedes pallidostratus* and *Aedes* spp. 1. Morphologically identified *An. subpictus* comprised of two genetic entities; *An. subpictus* species A (specimens from all districts except Jaffna) and species B (specimens from Jaffna). *Aedes* spp. 1 could not be identified morphologically or by publicly available sequences. *Ae. pallidostratus* was morphologically identified and the sequences were submitted to the GenBank as the first records for this species.

Population genetic structure analysis: *Anopheles peditaeniatus*, *An. subpictus* s.l., *An. vagus* had high haplotype diversities. A significant genetic structure variation (86.57%) was observed between *An. subpictus* populations ($p > 0.05$) verifying the existence of two *An. subpictus* sibling species. There was no genetic structure variation in *An. peditaeniatus* and *An. vagus* populations. Also the genetic structures of both these species were not affected by geographic distances.

Age structure analysis: More than 80% correlation was observed between expression of age responsive genes and the age of female mosquitoes. The accuracy of age predictions for *Ae. aegypti* and *Ae. albopictus* females were 2.19 (± 1.66) and 2.58 (± 2.06) days respectively. Adult rearing temperature difference of 4 °C (23 °C to 27 °C) did not show a considerable effect on this approach. However, a significant effect was evident with the larval rearing temperature.

Co-Supervisors/ Collaborators:

1. Prof. S.N. Surendran - Department of Zoology, University of Jaffna, Sri Lanka
2. Dr. (Mrs) M.D.B. Perera- Anti-Malaria campaign (Ministry of Health), Kurunegala, Sri Lanka
3. Ms. T.C. Weeraratne- Department of Zoology, University of Peradeniya, Sri Lanka

Acknowledgments:

The contribution made by the Entomological team of Anti-malaria Campaign Kurunegala is acknowledged. The financial assistance provided by the University of Peradeniya is highly appreciated.

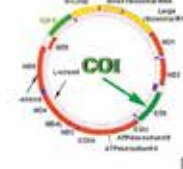
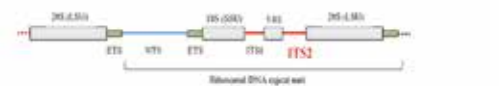
Research student:

Ms. T.C. Weeraratne, PhD, Degree awarded in 2017

DNA barcoding of Sri Lankan *Anopheles*, *Aedes* and *Culex* mosquitoes, and determination of age structure of selected *Aedes albopictus* populations in relation to disease transmission and insecticide resistance



DNA barcoding



Subfamily anophelinae
(123 COI, 88 ITS2, 32 D3)

15 species



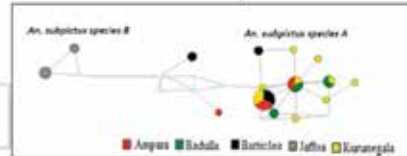
Subfamily Culicinae
(62 COI, 36 ITS2)

14 species

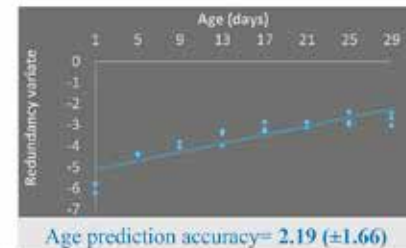


Population genetic structure

An. peditaeniatius
An. vagus
An. subpictus



Age structure determination



Ph.D. thesis by Ms. T.C. Weeraratne

DNA barcoding, genetic diversity, genetic structure and age structure of selected mosquito species of Sri Lanka

Publications

Full papers in SCI journals- 3

Abstracts- 7

Full paper under preparation- 1

Dr. E. Rajapaksha

Department of Veterinary Clinical Sciences
Faculty of Veterinary Medicine and Animal Science



Publications from the grant

Abstracts	02
Refereed Journals	01
Manuscripts in Preparation	02

Dr. Eranda Rajapaksha obtained his BVSc degree from the Faculty of Veterinary Medicine, University of Peradeniya, MSc degree in Applied Animal Behaviour and Welfare from University of Edinburgh, UK and the PhD degree in Animal Biology from University of California Davis, USA. After completion of his postgraduate studies and companion animal behaviour residency program at the University of California, Davis, he returned to Sri Lanka and assumed duty as a senior lecturer at the Faculty of Veterinary Medicine. Dr. Eranda's expertise are animal behaviour and animal welfare and he is involved in research that contributes to improve health and welfare of dairy, pet, wild animals. Dr. Eranda is a Diplomate in the American College of Animal Welfare and the American College of Animal Behaviour. He is also interested in One Health concepts and conducted several collaborative projects with UC Davis faculty and students involving human animal conflict and captive elephant welfare. He established a research laboratory in animal behaviour and welfare at the Department of Veterinary Clinical Science at Faculty of Veterinary Medicine at Peradeniya, Sri Lanka and seek active research collaborations to develop the animal behaviour and welfare sector in Sri Lanka and the Asian region.

Introduction of Pet Facilitated Therapy (PFT) to correctional institutions in Sri Lanka

Project Period: January 2014 - December 2017

Grant Amount: LKR. 1,340,000.00

Pet facilitated therapy (PFT) is an applied science that uses animals to assist in human life. This is widely used in elderly homes and correctional institutes of developed countries and this study is the first to introduce PFT to Sri Lanka.

Objectives

1. Introduction of PFT to Elderly homes and correctional institutions in Sri Lanka.
2. Determine the therapeutic and vocational benefits gained by the participants from PFT.
3. Determine the barriers, challenges and long-term outcome of PFT in Sri Lanka.

Materials and methods

Elderly Home Study: Healthy vaccinated dogs were selected and trained according to the guidelines of pet assisted therapy. A survey was conducted among 157 elders in Colombo, Gampaha and Kandy to identify perception of elderly population about pet animals. Six elderly homes from these districts were selected and 95 elders were included in the study. Six PFT sessions were conducted within a 12-week duration.

Correctional Institute study: Participants were selected from the Pallekelle rehabilitation center. Study duration was 10 months and was aimed at supplying inmates with vocational skills for employment and to develop a personal bonding between the inmate and the animal. Twentyfive healthy and vaccinated dogs were selected. Detailed clinical examinations of the animals were carried out at weekly intervals throughout the program. Animals were socialized and trained and the animals' temperament was regularly monitored. Selection of inmates was done on a strictly voluntary basis for interested inmates. Inmates were assessed to ensure their suitability and commitment to the program. Participants were selected under the supervision of officials and medical officers.

In both studies psychological status of the participants was analyzed using interviews and questions before and after the implementation of the PFT.

Results and discussion

Elderly Home Study: Survey on human animal interaction revealed that 80 % of the sampled elder population prefers pet dogs and 65% of them owned a pet dog. Majority (83%) of elders believe that having a pet is a way to reduce boredom. There was reduction of anxiety score in treatment

group after AAT (8.22 ± 1.22 , $P = 0.01$) and no difference in control group (0.83 ± 1.92 , $P = 0.34$) From the participants 61% mentioned AAT made them very much happy while 39% indicated moderate happiness. In addition, 72% mentioned that AAT very much helpful for reduce their loneliness and improved their quality of life.

Correctional Institute study: Program identified more than 90% of the participants can be categorized in to one or more psychological disorders. Anger and stress induced anxiety was common. There was significant reduction in anxiety ($P = 0.03$) and depression scores ($P = 0.04$) among the participated prisoners and it was revealed that the compliance level, friendliness improved in participated prisoners. Ten puppies were trained by the prisoners and they effectively learned dog care, training and grooming during the study. This proved the potential of using PFT as vocational training route for prison inmates.

Conclusions: Sri Lankan elders and prison inmates have positive outcomes by implementation of PFT program. Pet Facilitated Therapy is culturally adaptable and enrich psychological condition of the inmate long term care facilities in Sri Lanka. Several logistical barriers were identified and these can be clarified with awareness and detailed planning.

Co-Supervisors/ Collaborators:

1. Prof. Indira D. Silva, Department of Veterinary Clinical Science, Faculty of Veterinary Medicine and Animal Science
2. Mr. Thushra Kamalaratne, Department of Sociology, Faculty of Arts, University of Peradeniya

Acknowledgments:

The support given by the administration, staff and the inmates of Pallekelle rehabilitation centre was highly acknowledged. The assistance provided by the staff and the participants of the Moratuwa Social Service Society's Home for Elders and the volunteers who granted permission to involve their animals in the PFT program are greatly appreciated. Infrastructure and financial support provided by the International Research Centre and Department of Veterinary Clinical Sciences, Faculty of Veterinary Medicine and Animal Science of University of Peradeniya is also hereby acknowledged.

Research student:

Dr. Dimuthu Angage (BVSc), MPhil, Faculty of Veterinary Medicine and Animal Science

Miss. Madushi Weerasinghe (BSc Agriculture)

Mr. Kaveendra Senanayake (BSc Animal Science)

Introduction of Pet Facilitated Therapy (PFT) to correctional institutions in Sri Lanka

Introduction of Pet Facilitated Therapy (PFT) in Sri Lanka

Elderly Homes Study : Ninety Five Elders from Six elderly homes in Colombo, Gampaha and Kandy districts were selected. Six PFT sessions within 12 weeks were conducted using trained dogs with one handler.

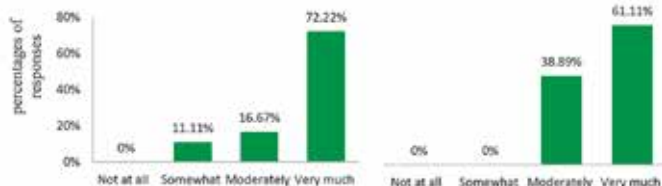


Figure 1a. Ability of PFT to improve elders' social activities and reduce loneliness

Figure 1b. Ability of PFT to improve elders' happiness

- There was reduction of anxiety score in treatment group after AAT (8.22 ± 1.22 , $P = 0.01$)
- 72% mentioned that AAT very much helpful for reduce their loneliness and improved their quality of life

Correctional Institute study : Participants were selected from the Pallekelle rehabilitation center. Study duration was 10 months. Aimed at supplying inmates with vocational skills and to develop bonding between the inmate and the animal

Animals were socialized and trained and the animals' temperament was regularly monitored. Participants were selected under the supervision of officials and medical officers.

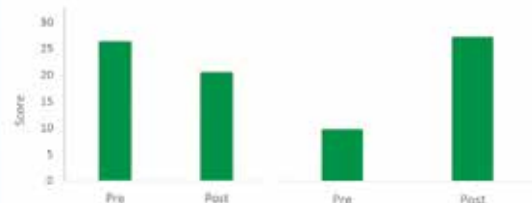


Figure 2a. Change in Depression and Anxiety Scale scores before and after PFT program

Figure 2b. Change in cognitive dissonance Scale scores before and after PFT program

- Program identified more than 90% of the participants had one or more psychological disorders. Anger and stress induced anxiety was common.
- Ten puppies were trained and inmates effectively learned dog care, training and grooming

InRC/IRG/13/23

Dr. (Mrs). S. Wickramasinghe

Department of Basic Veterinary Sciences
Faculty of Veterinary Medicine and Animal Science



Publications from the grant

Abstracts	02
Manuscripts in Preparation	02

Dr. Saumya Wickramasinghe obtained her BVSc degree from Faculty of Veterinary Medicine, University of Peradeniya, MS degree in Animal Science from Oklahoma State University, USA and the PhD degree from University of California Davis, USA. Her expertise is on Molecular biology and Genetics. She has mastered a broad range of biomedical research techniques including next generation sequencing, microarray, high throughput genotyping, cell culture, bacterial adhesion techniques, real time quantitative PCR, gene targeting vector construction and bacteria transformation. Dr. Saumya is a firm believer of the One Health concept and actively involved in several One health related projects. She has published several manuscripts in high impact factor journals and has a h-index of 10 with 672 google scholar citations.

Genotyping of bovine milk protein genes using the tetra-primer ARMS-PCR technique

Project Period: January 2014 - December 2017

Grant Amount: LKR. 1,500,000.00

Main goal of the dairy cattle breeding is to improve the quality and quantity of milk in the resultant progeny. Single nucleotide polymorphisms (SNPs) which are identified in genes encoding milk proteins have showed an association with production and reproduction traits. Hence, they are widely used as genetic markers for improvement of livestock production traits in selective breeding programs in many developed countries. This study was performed using blood samples of 200 Ayrshire and 200 Holstein Friesian (HF) cows in two large commercial farms and total of 112 cows (HF, Jersey and their crosses) from six medium farms in Central province, Sri Lanka. The predominant SNP genotypes in *CSNS1*, *CSN2*, *CSN3* and *ALA* genes were identified using tetra-primer ARMS-PCR technique. Association of these SNPs with average daily milk yield (calculated for five phases per each lactation), age at 1st heat and age at 1st calving was analyzed using UNPHASED software. Association analysis was performed only using the two large farms in which they were treated as unrelated populations. Results were described with 0.05 of significance level.

All farms have studied three genotypes of *CSN3* (AA, AB, BB) and *ALA* (AA, AB, BB) except for *CSN2* gene (AA, AB). All three genotypes of *CSNS1* gene (BB, BC, CC) were present in HF population in the large farm whereas the whole studied Ayrshire population was monomorphic for BB genotype. The predominant genotype of *CSNS1* in any farm was BB. The beneficial AA variant of *ALA* gene was absent or very low in both large farms and most of the medium farms except in farm 2 (30%). The predominant allele of the *CSN2* gene among any farm was allele A. *CSN3*-BB genotype and the B allele were very low in both large populations whereas most medium farms exhibited relatively high frequencies which may be due to the resulted significant superiority of allele B in *CSN3* gene in Jersey and crossbred populations compared to the HF population in medium farms. Chi square test revealed that the distribution of the genotypes of *CSN2* and *ALA* genes in the Ayrshire population and that of all the loci in the HF large population and most of the medium farms agree with the Hardy-Weinberg equilibrium ($p > 0.05$). All the loci tested in both large populations showed low or intermediate heterozygosity suggesting low or intermediate genetic diversity. Wright's fixation index (F_{is}) revealed excess heterozygosity in all the analyzed loci except *CSNS1* in both large populations which indicates out breeding. Positive F_{is} of *CSNS1* in HF population indicated a deficiency in heterozygosity due to inbreeding. Contrasting results of F_{is} and heterozygosity tests could be due to the selective breeding practiced in the large populations. In association analysis, statistically significant results were found only in *CSN3* gene with average daily milk yield in both large populations and *CSNS1* gene with age at 1st heat in HF large population. Higher additive values indicate a positive association between of *CSN3* AA and AB genotypes with average daily milk yield and *CSNS1* BB variant with older age at 1st heat suggesting a positive association of *CSN3* allele A with the greater milk yield and *CSNS1* allele B with the older age at 1st heat.

The distribution of superior alleles of *CSNS1*, *CSN2* and *CSN3* genes and the scarcity of the superior allele of *ALA* gene in the studied farms highlight the importance of implying genotyping studies to increase the beneficial alleles to improve the dairy industry in Sri Lanka. Further association studies need to be carried out in a larger population to identify the relationship of variants in the milk protein gene on economically important production and reproduction traits.

Co-Supervisors/ Collaborators:

1. Prof. Syril Ariyaratne, Department of Basic Veterinary Science, Faculty of Veterinary Medicine and Animal Science
2. Dr. Anoja Wanigasekara, Department of Basic Veterinary Science, Faculty of Veterinary Medicine and Animal Science

Acknowledgments:

The guidance and support by the Head of the Department of Basic Veterinary Sciences at the time of project, Dr. L.J.P.A.P. Jayasooriya and Dr. D.M.S. Munasinghe is highly acknowledged. The support given by Dr. P.G.A. Pushpakumara, Dr. L.G.S. Lokugalappatti, Prof. P.A.B.D. Alexander, Dr. B.R. Fernando, Dr. K. Nizanantha, Dr. W.M.T.D. Rathnakumara, Dr. Y.S.P.N. Kumara and Dr. N.I.U.B.G. Ranasinghe in sample collection and laboratory analysis is greatly appreciated. The assistance given by the Technical staff at Department of Basic Veterinary Sciences, Department of Veterinary Public health and Pharmacology and Department of Pathobiology, Faculty of Veterinary Medicine and animal sciences and all the staff members and the owners of the dairy farms is hereby acknowledged.

Research student:

Ms. Ruwini Rupasinghe - Completed MPhil

Genotyping of bovine milk protein genes using the tetra-primer ARMS-PCR technique

Main goal of the dairy cattle breeding is to improve the quality and quantity of milk in the resultant progeny. Single nucleotide polymorphisms (SNPs) which are identified in genes encoding milk proteins have shown association with production and reproduction traits.

This study was performed using blood samples of 200 Ayrshire and 200 Holstein Friesian (HF) cows in two large commercial farms and total of 112 cows (HF, Jersey and their crosses) from six medium farms in Central province, Sri Lanka. The predominant SNP genotypes in *CSNS1*, *CSN2*, *CSN3* and *ALA* genes were identified using tetra-primer ARMS-PCR technique. Association of these SNPs with average daily milk yield, age at 1st heat and age at 1st calving was analyzed.

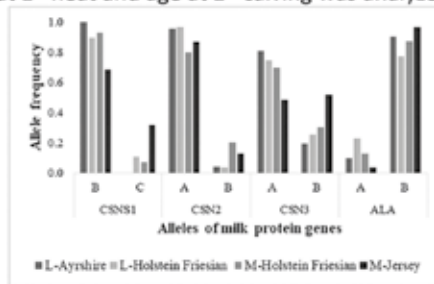


Figure 3. Allele frequencies of *CSNS1*, *CSN2*, *CSN3* and *ALA* milk protein genes among large and medium populations.

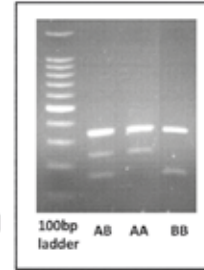


Figure 1. Gel images of three genotypes obtained by ARMS-PCR technique

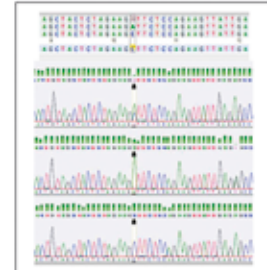


Figure 2. Chromatograms of three genotypes AA, AB, BB in kappa-casein gene

Results showed high frequency of superior alleles of *CSNS1* and *CSN2* genes and a low frequency of the superior allele of *ALA* gene in the studied *Bos taurus* populations. Superior genotype of *CSN3* gene is established in the medium farm Jersey population.

This study revealed a positive association of *CSN3* AA/AB genotypes with the average daily milk yield and *CSNS1* BB variant with older age at 1st heat. Thereby it can be stated that a positive association of *CSN3* allele A with the greater milk yield and *CSNS1* allele B with the older age at 1st heat.

These results imply that genotyping studies can be utilized to establish selective breeding programs to improve the dairy production in Sri Lanka

InRC/RG/13/24

Prof. J.B. Ekanayake

Department of Electrical and Electronic Engineering
Faculty of Engineering

Publications from the grant

Refereed Journals	02
Manuscripts in Preparation	03
Patents in Preparation	01



Prof. Janaka Ekanayake received his BSc degree in Electrical Engineering from the University of Peradeniya, Sri Lanka and received his PhD from UMIST, UK. Currently he is the Chair Professor of Electrical and Electronic Engineering of the University of Peradeniya. He is also a visiting professor at the Cardiff University, UK and Universiti Tenaga Nasional, Malaysia. His main research interests include renewable energy generation and its integration and smart grid applications. He has published more than 75 papers in refereed journals and has also co-authored six books. He is a Fellow of the IEEE, USA; IET, UK and IESL. He was awarded as the most outstanding Senior Researcher in the field of Engineering through CVCD Excellence Awards in 2018; NSF Research Awards for Scientific Excellence in 2018; many Presidential Awards for Scientific Research; the Commonwealth Fellowship; and the Royal Society of UK Research Fellowship.

The investigation of the use of smart transformer for a dynamic Volt-Var Control (VVC)

Project Period: January 2014 - June 2016

Grant Amount: LKR. 1,250,000.00

In response to climate change, many governments have set ambitious targets to increase the use of renewable energy in electrical power generation. Due to the intermittent nature of these renewable energy sources, the control of voltages within statutory limits across distribution networks becomes a challenge. Also maintaining the supply-demand balance and the system frequency within limits will become difficult. In order to address these issues, an electronically controlled transformer embedded with active voltage regulation and demand management mechanism based on conservative voltage reduction is developed. Two transformer topologies based on serial injection and parallel compensation were studied for their relevant merits. Simulation studies of both topologies were conducted with open loop and closed loop controllers. Based on the simulation results, the series compensation approach was selected for further research. Experimental results obtained from a 1kVA laboratory system were shown to confirm the validity of the design procedure and the effectiveness of the chosen series compensation approach.

Further in this research, it was identified that the demand side participation (DSP) through voltage control is an ideal solution to provide frequency support to the system. Constant impedance loads such as incandescent lights, resistive water heaters, stovetop and oven cooking loads, and kettles; and constant current loads such as welding units reduce their power consumption with the reduction of voltage. Further, in loads involving magnetic circuits (such as transformers), iron losses are reduced when voltage is lowered. Therefore, DSP can be provided by manipulating the consumer end voltages.

In order to provide DSP, a frequency following controller was developed and incorporated with the electronically control transformer. Using this transformer, it is possible to control the LV side voltage continuously based on the system frequency, thus creating a load that follows the frequency all the time. The flexibility that is introduced to the load this way helps the system operators to schedule moderate reserve services to mitigate the variability of renewable energy sources. Detailed circuit arrangement of the series compensated frequency following transformer is shown in the following figure.

A patent application was submitted to protect this idea. Based on the prototype and results obtained from this project, a grant was acquired to go beyond the research stage to the research and development stage. A real scale product is under development with the World Bank funding and in collaboration with the Lanka Transformers Ltd.

Co-Supervisors/ Collaborators:

1. Dr. P.J. Binduhewa, Department of Electrical and Electronic Engineering, Faculty of Engineering, University of Peradeniya
2. Prof. S.G. Abeyratne, Department of Electrical and Electronic Engineering, Faculty of Engineering, University of Peradeniya

Acknowledgments:

The financial and technical support provided by LTL Holdings (Pvt) Ltd, Sri Lanka is hereby acknowledged. The support and the assistance provided by the Head and the staff of the Department of Electrical and Electronic Engineering are greatly appreciated.

Research student:

Ms. R.R.L.L. Wijeratne/ MPhil

Smart Distribution Transformer

Issues of high penetration of solar PV

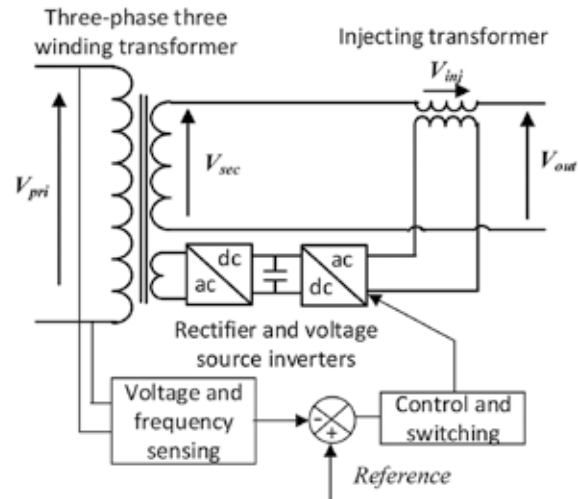
1. Increase in local voltages
2. Difficulty of maintaining second-by-second balance of supply and demand

Possible solutions

1. Using an on-load tap transformer at 33 kV/400 V level → More number of tapping with the variability of solar thus short life
2. Maintaining a large reserve → Expensive

Proposed Solution

- An electronically controllable transformer that can address issues 1 and 2
- Smart control algorithms for overcomes the issues



Prof. A. Senaratne

Department of Geology
Faculty of Science



Publications from the grant

Abstracts	04
Full Papers	02
Refereed Journals	01
Manuscripts in Preparation	01

Prof. Atula Senaratne was the Vice-Chancellor of the University of Peradeniya during the period of 2012 - 2015. He has served as the Chairman of the Water Resources Board of Sri Lanka, Director of the Atomic Energy Authority of Sri Lanka, member of the Presidential Task Force on “Natural Hazards” and President of the Geological Society of Sri Lanka (2001-2002). Prof. Senaratne has been awarded numerous Fellowships by institutions such as the University of London and the Johannes Gutenberg University, including the Alexander von Humboldt Research Fellowship/Germany in 1996/97. In 2013, he was awarded the prestigious Ananda Coomaraswamy Medal for his outstanding contributions to the knowledge of Geology of Sri Lanka. In 2017, he was awarded the NRC merit Award for Scientific Publication in 2015. Prof. Senaratne has also served as the Chair Professor of Geology of the University of Peradeniya.

Investigation of graphene production from Sri Lanka vein graphite and applications of graphene

Project Period: January 2015 - September 2016

Grant Amount: LKR. 1,520,000.00

Above Research Project involves the conversion of raw graphitic minerals into value-added products such as expanded graphite, graphene oxide and graphene for a wide range of applications, notably, as counter electrodes in dye-sensitized solar cells. This work has many implications: First, to add value to readily available Sri Lankan vein graphite and limit exporting of the raw form without value-addition. Secondly, to use such value-added graphite products for applications through further advanced research. Although the work conducted as a part of project deals mainly with solar cell applications, value added products will find uses in many local industries.

This study is the first attempt to understand the characteristics of the floated graphite in de-ionized water. A simple flotation technique has been introduced to float fine graphite particles on the surface of de-ionized water and flotation has been affected with the aid of shaking by a glass rod. This technique does not require any froth formers or flotation aid chemicals and as such it is industrially highly viable. The ball-milled and ball-milled floated graphite samples have some differences in their crystallite sizes, morphologies, and purities. Flotation has resulted in shrinking of crystallite size due to the removal of mineral inclusions within the interlayer spaces. Number of defects has been increased in floated graphite and both samples have some C-O-C ether bonds in slightly higher amount in the floated graphite. The number of layers present in crystallites has been remarkably decreased in floated graphite when compared to that in ball-milled graphite that did not subjected to floating in water. The flotation technique can remove some impurities which are present as mineral inclusions in graphite to some extent. The flotation aids the remarkable enhancement of carbon content in graphite samples and is more prominent when the original samples are impure with lower carbon percentages.

Practical applications of dye-sensitized solar cells have been hampered due to several reasons and the cost of platinum counter electrode is one such factor. Replacement of platinum by low-cost materials is state-of-the-art research and carbon based materials are best choices. We developed a simple technique for graphite enrichment in which we have used a simple floating technique to remove impurities present in ball-milled Sri Lankan vein graphite. The use of ball-milled and floated Sri Lankan vein graphite as counter electrode material in dye-sensitized solar cells give the best efficiency of 6.47%. Though this efficiency is less than that obtained with platinum based dye-sensitized solar cells, as per cost considerations lower efficiency with a cheap DSC may be more viable for practical applications than expensive DSC with higher efficiency.

Co-Supervisors/ Collaborators:

1. Prof. R.M.G. Rajapakse, Department of Chemistry, University of Peradeniya
2. Prof. H.M.T.G.A. Pitawala, Department of Geology, University of Peradeniya
3. Dr. N. Gunawardhana, Director, InRC, University of Peradeniya

Research student:

Dr. G.R.A. Kumara, Senior Research Fellow, Department of Chemistry, University of Peradeniya

Graphical abstract

Sri Lankan natural vein graphite



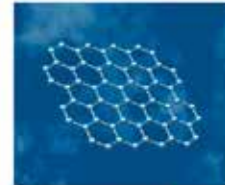
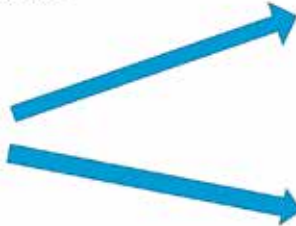
Exporting of the raw form



Value-added products



Super expanded graphite



Graphene



Counter electrodes
for solar cells

Citations of the full papers published from the grants

1. InRC/RG/13/01 - Dr. P.C.G. Bandaranayake

- I. Abeygunasekara, A.V.C., Pushpakumara, D.K.N.G., Samarasinghe, W.L.G. and Bandaranayake, P.C.G. (2017). Habitat loss of *Oryza rhizomatics* Vaughan in Sri Lanka over five years, *Wildlanka* **5**(4): 164-179.

2. InRC/RG/13/03 - Ms. S.T. Sudeshika

- I. Nawarathna, N.G.P.D., Herath, H.M.D.R., Wickramaratne, D.B.M., Sakeena, M.H.F., Gunawardhane, C.B. and Sudeshika, S.H.T. (2017). Awareness of usage of sunscreens among school children in Kandy, Sri Lanka. *Int J Pharm Pharm Science*. **9**(1): 311-314. DOI: <http://dx.doi.org/10.22159/ijpps.2017v9i1.11863>.

3. InRC/RG/13/04 - Prof. D.B.M. Wickramaratne

- I. Wickramaratne, M.N., Wickramaratne, D.B.M. (2016). In-vitro alpha amylase inhibitory activity of the leaf extracts of *Adenanthera pavonina*. *BMC Complementary and Alternative Medicine* **16**(1): 466.
- II. Sanjeeawani, N.A., Fernando, P.H.P. and Wickramaratne, D.B.M. Toxicological evaluation of aqueous leaf extract of *Adenanthera pavonina* (AEAP) to use as a hypoglycemic agent. *Journal of Diabetes Investigation* **10**: 34.
- III. Sanjeeawani, N.A., Fernando, P.H.P. and Wickramaratne, D.B.M. Hypoglycemic potential of the water extract of leaves of *Adenanthera pavonina*(L) in rats. *Journal of the Japan diabetes society*, **59**: S-176.

4. InRC/RG/13/06 - Dr. M.M.P. Perera

- I. Perera, M.P. and Nianthi, K.W.G.R. (2016), The Impact of Agro-well Development on Floral Diversity in Tank Cascades in the Dry Zone of Sri Lanka, *International Journal of Science and Research (IJSR)*. **5**(6), DOI: 10.21275/vsi6.NOV164764.
- II. Perera, M.P., Nianthi, K.W.G.R. and Madduma Bandara C.M. (2016), Agro-well Development and its Impact on Groundwater Table Depletion in Tank Cascades in the Dry Zone of Sri Lanka, *International Journal of Arts and Commerce*, South Shields, United Kingdom **5**(5) <http://www.1929-7106 www.ijac.org.uk> 66-77.
- III. Perera, M.P., (2016), Development of Agro-well Lands and Its impact on Soil Salinity in the North Central Dry Zone of Sri Lanka, *International Journal of Science and Research (IJSR)*, **5**(7), DOI: 10.21275/vsi7.ART2016217 .

- IV. Perera, M.P., (2017), Stream Reservations are at Risk?: A Case Study on the Agro well Development in the Dry Zone of Sri Lanka, *International Journal of Science and Research (IJSR)*, **6**(6), D01: 10.21275/ART20174619 .
 - V. Perera, M.P., (2017), Groundwater Extraction through Agro-wells and its Impact on Groundwater Availability of Tank Cascades in the Dry Season: A Case Study in the Dry Zone of Sri Lanka. *International Journal of Scientific Research and Innovative Technology, Kent, United Kingdom* **4**(6): 50-62.
 - VI. Perera, M.P., (2017), Evolution of Tank Cascade Studies of Sri Lanka. *Saudi Journal of Humanities and Social Sciences (SJHSS)*, **2**(7): 597-610. DOI: 10.21276/sjhss.
 - VII. Perera, M.P., (2017), Groundwater Exploration for Agro-well Development in Sri Lanka and the Current Status, *International Research Journal of Human Resources and Social Sciences (IRJHRSS)*, **4**(8): 359-373.
5. InRC/RG/13/07 - Dr. (Mrs.) L. Seneheweera

Publish as a Nurthi songs CD
 6. InRC/RG/13/12 - Prof. W.D.M.T.L. Dassanayake
 - I. Dassanayake, T.L., Ariasinghe, D.I. (2019) Sex-, age-, and education-adjusted norms for Cambridge Neuropsychological Test Automated Battery in literate Sri Lankan adults. *The Clinical Neuropsychologist*. **33**:106-24.
 7. InRC/RG/13/15 - Prof. N.S. Kalupahana
 - I. Kalupahana, N.S., Albracht-schulte, K.D., Ramalingam, L., Wijetunge, S., Rosairo, S., Kotakadeniya, R., Ratnayake, R.M.C., Moustaid-Moussa, N.. Serum resistin is associated with adipocyte hypertrophy, inflammation and metabolic complications of obesity in South Asian women. *Obesity Reviews*. **17**: 19-20 Kembra .
 - II. Albracht-Schulte, K.D., Kalupahana, N.S., Ramalingam, L., Rosairo, S., Wijetunge, S., Kotakadeniya, H.M.S.R.B., Ratnayake, R.M.C.J. Moustaid-Moussa, N. Metabolic Changes Underlying Interactions between Obesity and Non-Alcoholic Fatty Liver Disease in South Asian adults. *The FASEB Journal* **30** (1 Supplement), 667.2-667.2.
 8. Prof. V.S. Weerasinghe
 - I. Kahathuduwa, C.N., Dassanayake, T.L., Amarakoon, A.M.T. and Weerasinghe, V.S. (2017). Acute effects of theanine, caffeine and theanine-caffeine combination on attention. *Nutritional neuroscience* **20**(6): 369-377.
 - II. Kahathuduwa, C.N., Dhanasekara, C.S., Chin, S.H., Davis, T. VS Weerasinghe, V.S., Dassanayake, T.L. and Binks, M.(2018) l-Theanine and caffeine improve target-specific attention to visual stimuli by decreasing mind wandering: a human functional magnetic resonance imaging study. *Nutrition Research* **49**: 67-78.

9. InRC/RG/13/20 - Dr. (Ms). S.C.K Rubasinghe

- I. Rubasinghe, S.C.K. and Ruklani, N.C.S. (2017). Biogeography of Sri Lankan bryophytes: the present status. *Ceylon Journal of Science* **46**(5).
- II. Ruklani, N.C.S., Rubasinghe, S.C.K. and Villarreal, J.C. (2016). Two new records of Sri Lankan hornworts, *Notothylas iavanica* (Notothyladaceae) and *Meguce* (Dendrocerotaceae). *Cryptogamie, Bryologie*. **37**(4): 435-444.
- III. Ruklani, N.C.S., Rubasinghe, S.C.K. and Long, D.G. (2015). Morphological diversity or Complex thalloid liverwort genera of Sri Lanka. *Ceylon Journal of Science (Bio. SC1)*. **44**(2): 27-44.
- IV. Ruklani, N.C.S. and Rubasinghe, S.C.K. (2020). *Thalloid Liverworts (Marchantiopsida) of Sri Lanka. Phytotaxa (accepted to be published)*.

10. InRC/RG/13/21 - Prof. S.H.P.P. Karunaratne

- I. Weeraratne, T.C., Surendran, S.N., Walton, C. and Karunaratne, S.H.P.P. (2018) Genetic diversity and population structure of Malaria vector mosquitoes *Anopheles subpictus*, *Anopheles pedtaeniatus* and *Anopheles vagus* in five districts of Sri Lanka. *Malaria Journal* **17**: 271 (DOI 10.1186/s12936-018-2419-x).
- II. Weeraratne, T.C., Surendran, S.N. and Karunaratne, S.H.P.P. (2018) DNA barcoding of morphologically characterized mosquitoes belonging to subfamily Culicinae from Sri Lanka. *Parasites & Vectors* **11**:266 (DOI 10.1186/s13071-018-2810-z).
- III. Weeraratne, T.C., Surendran, S.N., Reimer, L.J., Wondji, C.S., Perera, M.D.B., Walton, C. and Karunaratne, S.H.P.P. (2017) Molecular characterization of Anopheline (Diptera:Culicidae) mosquitoes from eight geographical locations of Sri Lanka. *Malaria Journal* **16**: 234 (DOI 10.1186/s12936-017-1876-y).

11. InRC/RG/13/24 - Prof. J.B. Ekanayake

- I. Wijayarathne, L., Binduhewa, P.J., Abeyratne, S.G., and Ekanayake, J.B. (2016). Dynamic voltage control of a smart distribution transformer, *Control and Intelligent Systems*, **44** DOI: 10.2316/Journal.201.2016.3.201-2756.
- II. Wijayarathne, R.R.L.L., Binduhewa, P.J., Abeyratne, S.G. and Ekanayake, J.B. "Investigation the use of an Intelligent Transformer for a Volt-Var Control", Transactions of the Institute of Engineers Sri Lanka, 2014, pp 263-271.

12. InRC/RG/14 /01 - Prof. A. Senaratne

- I. Jayaweera, E.N., Kumara, G.R.A., Pitawala, H.M.G.T.A., Rajapakse, R.M.G., Gunawardhana, N., Bandara, H.M.N. Senarathne, A., Ranasinghe, C.S.K. Hsin-Hui Huang and Yoshimura, M. Vein Graphite-based Counter Electrodes for Dye-sensitized Solar Cells. *Journal of Photochemistry and Photobiology A: Chemistry*, **344**: 78-83.
- II. Rajapakse, R.M.G., Kumara, G.R.A., Pitawala, A. Gunawardhana, N., Senaratne, A. and Gunawardana, N. (2017). A simple and low-cost flotation technique for Graphite Concentration and Crystallinity enhancement. *The 28th International Symposium on Transport Phenomena*.
- III. Kumara, G.R.A., Jayaweera, E.N., Pitawala, H.M.T.G.A., Malikaramage, A.U., Wickramasinghe, G.K., Senaratne, A., Gunawardhana, N. and Rajapakse, R.M.G. (2017). Low-Cost Dye-Sensitized Solar Cells Utilizing Expanded Graphite in Dye-Sensitized Solar Cells For Efficient Power Generation. *The 28th International Symposium on Transport Phenomena*.

Postgraduate degree awarded from the grants

1. InRC/RG/13/01 - Dr. P.C.G. Bandaranayake

Ms. A.V.C Abhayagunasekara

Degree: PhD (In reading)

2. InRC/RG/13/02 - Dr. R.P. Illeperuma

Mr. W.M.K.M. Bandara

Degree: PhD (in reading)

3. InRC/RG/13/04 - Prof. D.B.M. Wickramaratne

N.A. Sanjeewani

Degree: MPhil

Thesis title: Determination of Hypoglycemic Toxicological Evaluation and Formulation of Capsule using Leaf Extract of *Adenanthera pavonina (L)*.

Year: 2019

4. InRC/RG/13/10 - Dr. (Mrs). S.R. Herath

S. A.S.P. Sathurusinghe

Degree: MPhil in Engineering

Thesis title: Effective Properties of Some Heterogeneous Materials Using Homogenization Theory

Year: 2017

5. InRC/RG/13/011 - Dr. (Mrs.) H.K. Nandalal

S.K. Epasinghe

Degree: MSc in GIS and RS

Thesis title: Flood Risk Analysis using Geographic Information Systems Case Study- Lower Kelani River Basin.

Year: 2017

S.S. Kosgolla

Degree: PG Programme in Sustainable Built Environment

Thesis title: Change Detection of Forest Cover / Tree Cover with Slope in Kandy Municipal.

Year: 2019

S.P. Ranatunga

Degree: PG Programme in Sustainable Built Environment

Thesis title: Spatial and Temporal Analysis of Rainfall Patterns in Mahaweli System H.

Year: 2019

M. Ratnayake

Degree: PG Programme in Sustainable Built Environment

Thesis title: Flood Inundation due to Possible Loggal Oya Dam Failure

Year: 2019

6. Prof. V.S. Weerasinghe

Dr. Chanaka Kahathuduwa

Degree: MPhil

Thesis title: Assessment of Cognitive Function using Reaction Time, Evoked Potential And Event-Related Potential Studies in Neurological Disorders

Year: 2017

7. InRC/RG/13/20 - Dr. (Ms). S.C.K. Rubasinghe

Ms. N.C.S. Ruklani

Degree: PhD

Thesis title: Taxonomy, Biogeography and Evolutionary Relationships of Thalloid Liverworts and Hornworts of Sri Lanka.

Year: 2018

8. InRC/RG/13/21 - Prof. S.H.P.P. Karunaratne

Ms. T.C. Weeraratne

Degree: PhD

Thesis title: DNA Barcoding, Genetic Diversity, Genetic Structure and Age Structure of Selected Mosquito species of Sri Lanka

Year: 2017

9. InRC/RG/13/22 - Dr. E. Rajapaksha

Dr. Dimuthu Angage

Degree: MPhil (In Reading)

10. InRC/RG/13/23 - Dr. (Mrs). S. Wickramasinghe

Ms. Ruwini Rupasinghe

Degree: MPhil

11. InRC/RG/13/24 - Prof. J.B. Ekanayake

Ms. R.R.L.L. Wijeratne

Degree: MPhil

Thesis title: Investigating the Possibility of using a Smart Transformer for a Dynamic Volt-Var Control

Year: 2018

12. InRC/RG/14 /01 - Prof. A. Senaratne

Dr. G.R.A. Kumara

Degree: Senior Research Fellow



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