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Matara 81000, Sri Lanka

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Foreword

The 3rd Ruhuna International Science and Technology Conference, RISTCON 2016 was organized by the Faculty of Science, University of Ruhuna, Sri Lanka. The abstracts arisen from research work in diverse disciplines of Science & Technology have been peer-reviewed prior to acceptance. The abstracts have been edited to maintain language accuracy and page limits. An official electronic PDF copy of the book will be available at http://www.sci.ruh.ac.lk/conference/ristcon2016 of University of Ruhuna website. Responsibilities of the content text of the abstracts included in this publication remain with the respective authors. No part of this serial publication will be reproduced in any form.

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Editors
3rd RISTCON 2016

Message from the Vice Chancellor, University of Ruhuna

It is indeed gives me a great pleasure to send this message for the proceedings of the "3rd Ruhuna International Science and Technology Conference (RISTCON – 2016)" organized by the Faculty of Science, University of Ruhuna. It is inspiring to note that the International Conferences have now become annual events in almost all faculties of the University of Ruhuna, fostering and nurturing a research culture among the academics. The conferences provide an opportunity for academics to transmit the knowledge generated through their research to the scientific community and the industry. Further, conferences are considered as a vital part of academic programmes of any good university. As the Vice Chancellor of a university committed to academic excellence and high quality research, I am proud to witness a remarkable improvement in quantity and quality as well as the relevance of research conducted by our staff. I am also glad to learn that many academics and scholars especially from Asian continent are expected to participate in this conference. It indicates that this conference will provide a good platform for our academics to share their knowledge in the fields of Science and Technology with the rest of the world. Therefore, I believe that the publication of research findings presented at the RISTCON-2016 will be an incentive to our academics for future evaluations in their areas of expertise. I take this opportunity to offer my heartiest congratulations to Dean of the Faculty of Science and the organisers of RISTCON-2016 for their efforts to make this event a success. I wish all the best for all paper presenters and participants of RISTCON-2016.

Senior Professor Gamini Senanayake
The Vice Chancellor
University of Ruhuna
Matara 81000
Sri Lanka

Message from the Dean, Faculty of Science, University of Ruhuna

It is with great pleasure that I issue this message for the 3rd Ruhuna International Science and Technology Conference, RISTCON-2016, which is a continuation of the Science Symposia of Faculty of Science held since 2002.

The objective of the conference is to provide a platform for researchers to share their latest research findings on various themes in Science and Technology providing a broad knowledge on current research activities to the participants, especially to young scientists in the country. Further, presentations and the proceeding of the conference would provide a guidance for undergraduates to focus their research projects next year.

It is a well-known fact that the research done by public sector, universities and research institutes, funded by governments of developed countries, had benefitted tremendously for the development of technology and industries contributing to economic advantages of those countries. In the contrary, Sri Lanka is yet to realize the importance of research outputs of Universities and Research Institutes in the country and to formulate a long term plan and funding mechanism for nationally important research for the benefit of the country. A country cannot be fully developed only by imported technology. The knowledge of science and technology and energy of young scientists and graduates need to be wisely channelled to focus on research for local needs and economic development of the country, which is the duty of policy makers and their advisors. Especially for a country like Sri Lanka, having a vast range of natural resources and a rich traditional knowledge, both fundamental scientific knowledge as well as their application for real world problems must be utilized wisely towards development.

I would like to take this opportunity to thank members of the organizing committee chaired by Prof. W. T. S. Dammini Premachandra, for their devotion and untiring effort during last few months to make this event a success.

Prof. W.G.D. Dharmaratna
Dean, Faculty of Science, University of Ruhna
Senior Professor of Physics
2016.01.28

Message from the Chairperson- RISTCON 2016

On behalf of the organizing committee of 3rd Ruhuna International Science and Technology Conference-RISTCON-2016, it is a very great pleasure for me to add this message. RISTCON-2016 is an excellent forum for exchanging research findings nationally and internationally on wide range of themes related to Science and Technology. One of our main aims is to develop future research collaborations nationally and globally. I am happy to mention that RISTCON-2016 contains several oral and poster presentations of foreign participants, in particular, from Asian region. Besides, the conference is rich with keynote and invited speech delivered by two renowned foreign scientists. The ultimate objective of the conference is to uplift the Faculty of Science at the University of Ruhuna to a highly recognized faculty around the world. As the chairperson of the organizing committee, first and foremost, I take this opportunity to extend my sincere gratitude to Senior Professor Gamini Senanayaka, the Vice Chancellor of the University of Ruhuna for accepting our invitation as the Chief Guest. I am very much thankful to Senior Professor W.G.D. Dharmaratna, Dean, Faculty of Science for his excellent guidance for the success of the conference. I thank all Heads of the Departments, academic and non-academic staff members of Faculty of Science, Assistant registrar and the staff of the Dean's office for their great cooperation. I express my heartfelt thanks to the keynote speaker, Professor Söeren Köepke from Germany who accepted our invitation in a short notice. Also, my sincere thanks goes to the invited speaker Dr. G.D. Khedkar from India. I extend my deep gratitude, in particular, to two joint secretaries, advisory board and the editorial board and to the rest of organizing committee for their hard work and devotion. On behalf of the conference organizing committee, I am highly thankful to the authors who submitted papers with novel research findings. Their willingness to openly discuss their achievements, share experiences and confront their concepts is highly appreciated. Finally, I wish to extend my great thanks to our sponsors, especially, Harischandra Mills PLC, who made financial contribution in connection with RISTCON-2016.

Professor (Mrs.) W.T.S. Dammini Premachandra
Chairperson - RISTCON 2016

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Keynote speech

Facing Future Challenges: Assessing the Role of Science and Technology in Climate Change Mitigation and Adaptation

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It is 2016, and climate change has become a dramatic and often bitter reality in many places. The years 2011-2015 were the warmest five-year period on record. Over the last months, anthropogenic climate change combined with a strong El Niño – the weather anomaly that originates in the Pacific – has driven up temperatures worldwide. According to the WMO, the world has now reached a symbolic 1°C above the mean temperatures of the pre-industrial age.

The warming of the planet translates into disaster in many locales: In May and June 2015, India and Pakistan were struck by heat waves. The Californian mega-drought had reached historic proportion. Brazil was also confronted with extreme drought conditions that plunged the 20-million megapolis, the city of São Paulo, into the worst water crisis in 80 years. At the same time, heavy precipitation and flooding posed serious problems to many societies and their economies. In January 2015, Malawi in South East Africa was hit by heavy floods, while in late July, Myanmar and Bangladesh suffered from flooding and landslides. Apart from the direct loss of human lives, these extreme-weather conditions manifest as increased poverty, temporary displacement, and the heightened likeliness of the outbreak of epidemics.

It is known that anthropogenic climate change and weather extremes are closely connected. This means that the extreme weather events the world has seen in the last few years may just be a preview of future catastrophes.
There should be no doubt: Anthropogenic climate change is among the greatest challenges that humanity faces in the 21st century. The looming climate catastrophe is reminiscent of the threat of nuclear apocalypse in the era of the Cold War. In a business-as-usual-scenario, continuing greenhouse gas emissions at present levels will lead to a situation where large parts of the planet may become virtually inhabitable by the end of the century. Even more worrying, scenarios based on state-of-the-art computer modelling indicate that with current emission levels, it will be very hard to keep mean

temperatures below 2°C above pre-industrial times, as is the stated goal since the 2009 Copenhagen conference on climate change (UNFCCC COP15). Not only would climate change devastate whole regions, but, according to a host of geographers, economists and political scientists, it would increase the conflicts over vital resources like water or arable land by large degrees.

It takes political will to reverse these trends. The good news seems to be that the international community has understood the dangers of climate change. At the COP 21 climate summit in Paris in December 2015, the nations of the world have agreed to a new treaty for climate change, effective from 2020. The Paris Agreement has both met harsh criticism and enthusiastic support. The former is directed against the fact that the emission targets set in the agreement are voluntarily and that the pathway to the new 1.5°C goal remains relatively vague. The latter celebrates the decisiveness and unity that the Paris agreement is supposed to embody.

Whatever the opinion on the outcome of COP 21 may be, it is clear that science and technology have a key role in paving the way. Both the decarbonizing of our industries, economies and lifestyles, and the adaptation to inevitable climatic changes that are already on the way, require great efforts in terms of research and technological innovation.

Without these, the battle against climate change is already lost. The scientific community must be wholeheartedly devoted to the mission of decarbonizing modernity and adapting to climate change. This is a magnificent and urgent task, however, it has many pitfalls. If scientists and engineers lose track of the human scale, they will not solve the vast problems associated with dangerous climate change. I will elaborate what I mean by this in the following.

Human beings use technology to alter and shape natural landscapes. This has happened at least since the advent of sedentary farming in prehistoric times. But even in the paleolithic age, when hunter and gatherer societies used advanced weapons for hunting, they at least contributed to the extinction of the dominant large mammal species, and ecosystems where altered forever.

The political ecology approach is based on one essential question: Who profits and who loses out from interactions between humans and nature? This question is also extremely relevant when talking about climate change mitigation and adaptation, and the technologies that are used for these

purposes. From the critical theoretical perspective of political ecology, it has to be acknowledged that most technologies are not, and can never be, politically neutral.

As mentioned above, a number of scholars worry about the potential of climate change to destabilize societies and cause conflicts over natural resources. There is a heated debate in the conflict and peace studies community whether the link between climate change and conflict is valid and straightforward, and which factors play into the equation. Nevertheless, one aspect is mostly missing: That climate change mitigation and adaptation measures also have the potential to cause conflict on a massive scale. I will provide a number of examples, namely hydroelectric mega-dams, nuclear power, carbon capture and storage (CCS), biofuels, and genetically modified organisms.

Hydroelectricity is promoted as a source of "clean" energy in order to justify the large-scale impacts that mega-dams have on the environment. The 20th century was marked by a construction boom of large dams, many in developing countries like India and China, that followed a developmentalist modernization agenda. Construction of dams was often associated with displacement and forced resettlements of local populations, which made them highly conflictual to begin with. While it is true that the operation of hydroelectric power plants, unlike coal plants, does not require the emission of carbon dioxide, large dams are not carbon-neutral. First of all, the gigantic dimensions involved in the construction process use up huge amounts of greenhouse gas emissions. What is more, the flooding of forests lead to anaerobic processes and eventually, large amounts of methane are released, which itself is an extremely potent greenhouse gas. The most prominent example of a controversial dam construction site is Bela Monte at the Xingu River in Pará state, Brazil, which is designed to be the third-largest dam on Earth. The construction of the Belo Monte Dam faces fierce resistance by environmentalists and indigenous people, who live on the land which is to be flooded. To date, Belo Monte's construction is not finished; it is scheduled to start operation in 2019.

Recent research emphasizes that construction of large dams may not only have socio-economic and environmental side-effects; the endeavours are at times also not economically feasible, for example in the earthquake-prone regions of Nepal. Also, dams tend to become subject to sedimentation after some decades, which heavily obstructs their functionality. Finally, the above-mentioned droughts impair the operation of large dams, as rivers run dry.

Another, equally controversial large-scale technology is nuclear power. To many, even to dedicated environmentalists, climate change provides a strong argument for the resurgence of nuclear power. Nuclear power is able to produce large quantities of energy without emitting significant amounts of carbon dioxide. Therefore, some hail it as a future technology; the Obama Administration has made it a dedicated part of its plan to combat climate change. However, there are several reasons why nuclear energy is not the way out. First of all, the operation of nuclear power plants is associated with unforeseeable risks. The nuclear disasters of Chernobyl in 1986 and Fukushima in 2011 have shown that accidents do occur, and they may result in the radioactive contamination of large areas, extremely heightened cancer risks to neighbouring populations, and radioactive poisoning of water resources. The second big problem is waste disposal, as the storage of highly radioactive waste is a problem that is to be taken very serious. After usage, fuel rods are emitting radiation not for decades or centuries, but for many thousands of years; therefore, nuclear waste has to be stored safely, a technological puzzle that has not been solved yet. The third problem is the security dimension; civilian nuclear power always holds the potential of being a smokescreen for the acquisition of nuclear weaponry, as the prolonged controversy over Iran's nuclear ambitions have illustrated. Proliferation of nuclear material is an issue. A fourth issue is the high, often runaway costs associated with the construction of nuclear power plants. Without massive state investments and subsidies, nuclear power plants cannot be built. This illustrates that nuclear power is hardly an option for Least Developed Countries, which are in dear need of cheap and reliable energy. Finally, the mining of uranium is a dirty business, with immense potential of negative impacts on ecosystem, local populations and worker's health. Also, some uranium mines are in fragile states, which heightens the potential of violent resource conflicts.

The world's most important source of energy, and the single biggest contributor to climate change, is the burning of coal. It produces around one third of the world's primary energy supply. It fuels most of China's economic boom, and is equally important to most industrial countries. Coal resources are abundant and may last for some more centuries. However, apart from the dramatic effects on the global climate, coal mining and coal burning cause water pollution, air pollution and health hazards for urban populations. Carbon capture and storage (CCS) is a pilot technology that aims to offset the negative sides of burning coal. Carbon dioxide is captured from emissions and then pressed underground in deepgeologicalformations. Again, this technology is extremely costly. Also, there is an unknown danger of leakages. The IPCC points towards knowledge gaps in the

understanding of the implementation of CCS technology. If the stored carbon dioxide escapes and reaches the atmosphere, it could even speed up global warming. The main political problem is that the promises of "clean coal" by ways of CSS allow the coal industry to further operate on their current model, while there is an urgent need to discontinue the widespread use of coal-fired power plants in the near future.

Biofuels have been promoted as a possible alternative to fossil fuels, as fuels made from plants – mostly Biodiesel and Bioethanol - are supposed to be carbon-neutral. For some time, USA, Brazilian and EU policies have actively promoted the use of biofuels in order to reduce energy dependencies on oil-producing nations. However, over the last few years, biofuel production has been subject to heavy criticism from environmentalists and advocacy groups. Investments in arable land for the purpose of biofuel production has been associated with forced evictions of local, often indigenous populations, and in consequence, with land conflicts. Under the current agribusiness production model based on mechanization, chemical fertilizers and potentially hazardous pest controls, even the carbon neutrality of biofuels is in question. There also is an ethical question, since biofuel has very likely driven up food prices during the 2008-11 food price crisis. There seems to be some promising research into second-generation biofuels – fuel made from waste and other non-foods – but this technology is not ready for mass production yet.

Luring are the promises of agribusiness and life sciences companies to end world hunger through genetically modified organisms (GMO). However, the chances that GMO could provide a universal adaptation mechanism to climate change in agriculture are quite low. First, today's GMO, like Roundup-ready Soy, are associated with the dramatic and potentially harmful use of pesticides such as glyphosate. Also, resistances are a problem. Secondly, GMO are expensively developed; small-scale farmers in many places will not be able to afford GMO seed. Thirdly, environmentalists still worry about unforeseeable consequences of GMO to human health, ecosystems and biodiversity; in the EU, under the precautionary principle, large-scale production of GMO food remains strictly controlled. Overall, GMO can be assessed as a very expensive technology with many associated problems; alternative models of climate-smart food production are preferable.

Nuclear power, large dams, biofuels: Like fossil fuel, these technologies are part of an out-dated economic model. They symbolize the pathways of accelerated modernity that created the situation the world is in today. It is

preferable to phase out the use of these technologies instead of presenting slightly modified, newer versions as solutions to climate change.

The alternative, however, is not a deindustrialization, an end to technological development. There is no going back to an allegedly better past. Without the progress humanity has made in agriculture, medicine, engineering, and transportation technology over the last centuries, the world would be a much bleaker place, and many millions more would be threatened by death through starvation and disease.

Humanity must shed thoughtless megalomania. What is called for are more locally adapted, smart technologies. These technologies must be cost-effective and energy-effective, they must be easy to maintain, to repair and to deconstruct, and they must be built to scale. Climate change urges humanity to a new culture of innovation – one that favours sustainability over profitability.

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Molecular identification of 'Candidatus Phytoplasma cynodontis' associated with Bermuda grass white leaf disease in Sri Lanka

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Bermuda grass, *Cynodon dactylon* (L.), is a grass of the family Poaceae. Bermuda grass white leaf (BGWL) caused by a phytoplasma belonging to the 16SrXIV group, has been reported from many countries including Asia. *C. dactylon* plants were observed in Matara and Monaragala districts showing symptoms similar to Bermuda grass white leaf disease caused by BGWL phytoplasma. Affected grasses are exhibited whitening of leaves, bushy growing habit, small leaves, shortened stolons/rhizomes, stunting, proliferation of auxiliary shoots and death. Plants exhibiting typical BGWL symptoms and apparently healthy (symptomless) plants were collected and DNA was extracted from leaves using CTAB method. DNA was assayed in a nested-PCR with phytoplasma universal rDNA primers P1/P7 and R16R2/R16f2n to amplify the 16SrRNA gene of phytoplasma. DNA extracted from all symptomatic plants produced PCR products of 1250bp and were not produced in DNA from symptomless plants. The phytoplasma 16SrRNA region was sequenced directly with primers and compared by BLAST analysis with those of other phytoplasma sequences in the Gene Bank. The highest sequence homology (99%) obtained was that of '*Candidatus* Phytoplasma cynodontis' belongs to the BGWL 16SrXIV. This is the first molecular identification of '*Candidatus* Phytoplasma cynodontis' (16SrXIV group) associated with Bermuda grass white leaf disease in Sri Lanka.

Keywords: Bermudagrass, Phytoplasmas, Sri Lanka

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Effects of Soil Moisture Stress on the "Free Proline" and "Chlorophyll a" Contents of Selected Tomato (*Solanum esculentum* Mill.) Cultivars in the Sandy Regosols

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Moisture deficit is often the major factor inhibiting crop yields in semi–arid and arid regions. An induction of moisture stress in plants is known to trigger several biochemical changes. Free proline accumulation and changes in the chlorophyll content of leaves are some of the important biochemical responses to moisture stress. A study was conducted to investigate the effect of moisture stress on "free proline" and "chlorophyll a" contents of selected tomato cultivars. Tomato cultivars 'KC 1', 'Roma' and 'Thilina' were used for this study. The experiment was arranged in a 3 × 2 factor factorial Randomized Complete Block Design with six treatments, which replicated four times. Moisture stress was imposed for the 'KC 1', 'Roma' and 'Thilina' cultivars of tomato for a period of six days in treatments one, three and five. Regular watering was practiced for treatments two, four and six of the above cultivars at two days interval to Field Capacity. The "free proline" and "chlorophyll a" contents were determined for the stressed plants on the 6th day from the commencement of the stress. Moisture stress significantly increased the "free proline" content but reduced the "chlorophyll a" content of leaves of all the tomato cultivars. The highest amount of free proline content (6.2 mgcm^{-2}) was obtained in the 'KC 1' tomato cultivar followed by 'Roma' (4.3 mgcm^{-2}) and 'Thilina' (3.1 mgcm^{-2}). Similarly, the highest amount of "chlorophyll a" content (11.7 mgg^{-1} fresh weight) was observed in the 'KC 1' tomato cultivar followed by 'Roma' (7.3 mgg^{-1} fresh weight) and 'Thilina' (4.6 mgg^{-1} fresh weight). Based on the "free proline" and "chlorophyll a" contents, it could be concluded that 'KC 1' tomato cultivar was able to resist drought comparatively better than 'Roma' and 'Thilina'.

Keywords: Chlorophyll a, Free proline, Moisture stress, Tomato cultivars

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Morphological, Anatomical and Biochemical Characterization of *Salacia reticulata* and *Salacia oblonga*

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The genus *Salacia* belongs to family Hippocrateaceae and consists of climbing woody plants. *S. reticulata* plays a significant role in Ayurveda medicine due to their anti-diabetic properties. However, due to depletion/overuse of *S. reticulata*, now it seems that materials of *S. oblonga* are available in open market. Moreover, due to similar appearance of these two species, it is difficult to identify them correctly. Hence, use of this species for medicinal purposes correctly is a difficult task. Therefore, this research was conducted for characterization of both *Salacia* species using morphological, anatomical and chemical characters for easy identification. For morphological characterization, characters of the leaf (maximum width, maximum length, apex, base, shape, margin, and arrangements), the stem (color, appearance, presence of lenticels and lichens), roots (color), and the fruit (fruit shape, number of seeds present in a fruit, seed size and fruit size) were used. For anatomical characters, stem sections of both species were stained and examined under light microscope. For biochemical characters, leaf, stem and roots extracts with different solvents were used for Thin Layer Chromatography (TLC) and separated compounds were detected by viewing their natural color, Iodine vapor test, Vanillin test and UV visualization. Resulted dendrograms from statistical analysis using those characters showed that these two species were separated into two clusters according to species. According to the morphological characters, root color and fruit shape can be applicable for field identification accurately. Pigmented cells in hypodermis in *S. reticulata* and specific cellular arrangements in between vascular rays in *S. oblonga* were useful for anatomical differentiation of two species. Different patterns with TLC were observed for differentiation of both species. In this context, these discoveries on morphological anatomical and chemical methods lead to accurate identification of *S. reticulata* and *S. oblonga*.

Keywords: Anatomical, Chemical and morphological methods, *S. oblonga, S. reticulata*

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Morphological and Anatomical responses of *Rhizophora mucronata* Lam. to water stress under green house condition

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Importance of mangrove restoration has been recognised all over the world due to the ecological services and products derived from them. Nevertheless, higher failure rates in restoration attempts are recorded in many parts of the world. Therefore, the objective of this research was to study the impact of two common stress factors, physical drought *i.e. water deficiency in soil* and physiological drought *i.e. difficulty in absorbing water due to high salinity*, on the growth and survival of *Rhizophora mucronata* Lam. (Rhizophoraceae) seedlings. The propagules of *R. mucronata* planted in pots (one propagule per pot), were maintained in a plant house under three physiological stress levels, i.e. high salinity (35±1psu), moderate salinity (15±1psu) and fresh water (0psu) and under three levels of physical water stress, i.e. ~25%, ~50% and ~100% of Water Holding Capacity (WHC). There were three replicates per treatment. The growth performances of seedlings were measured considering the morphological responses and anatomical features once a two week and once a month respectively for six months of period.

Leaf curling, wilting and necrosis and a significant reduction in leaf area and cumulative shoot height were observed in seedlings under high saline condition and, at 50%WHC treatments. None of the seedlings survived at 25%WHC level. Stomatal density, vessel density and vessel grouping index were significantly higher while width of stomata and vessel diameter were significantly lower in high and 50%WHC treatments compared to the other treatments. Variations in anatomical features revealed that the secured and safety adaptations in mangrove seedlings to avoid the formation of air bubbles inside vessel elements have been increased under high stress levels. The best performances were observed in seedlings under moderate salinity, and under 100% WHC with fresh water, respectively. The results imply that the physiological and physical drought could be major reasons for higher failure rates in mangrove restoration attempts. However, a field study must be conducted to confirm the effect of physical and physiological drought on mangrove seedlings in order to formulate recommendations for mangrove restoration.

Keywords: Anatomy, Mangroves, Restoration, Water stress

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Applicability of *Allium cepa* test system in toxicity characterization of used lubricant oil contaminated soil

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Contamination of soil with used lubricant oil is an emerging environmental problem in most of the cities across the world. Accidental spills, illegal dumping and careless handling of used lubricant oil have been significant sources of environmental pollution. *Allium cepa* test system is a simple sensitive and rapid bioassay widely used as a standard method for the biomonitoring of environmental contaminants. The present study was carried out to assess the applicability of *Allium cepa* test system in the toxicity characterization of used lubricant oil contaminated soils. Inhibitions in root growth and number of roots of *Allium* bulbs exposed to a range of used lubricant oil contaminated soils were recorded as phytotoxicity end points. Further, the calculated mitotic indexes and the observed different types of chromosomal aberrations in the root meristematic cells were considered as genetic end points. Chromosomal aberrations were detected by staining the root meristematic cells with toluidene blue. The tested soils exerted toxicity for all the evaluated end points with the dose dependent manner. Chromosomal aberrations were observed in all the phases of mitosis of root meristematic cells of *Allium cepa*. Chromosomal bridges were most prominent in the anaphase and the telophase of the cell cycle and abnormal chromosomal arrangements and nuclear buds were also observed. Thus the results highlighted the applicability of *Allium cepa* test system not only for phytotoxicity characterization but also for the characterization of potential cytotoxicity and genotoxicity of the used lubricant contaminated soil.

Keywords: *Allium cepa* test system, Toxicity, Used lubricant oil

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Land-use changes over past two decades in Rekawa lagoon region in Sri Lanka

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The mangrove cover in Sri Lanka is rapidly decreasing due to continuous anthropogenic interferences. Among the highly threatened mangrove ecosystems, Rekawa lagoon ($06^0 03´N–80^0 50´E$), situated in the intermediate climatic zone of Sri Lanka, with high species diversity was selected for the present study. The main objectives of the research were to investigate the land-use changes in Rekawa lagoon region during the past two decades and to determine the possible consequences of human impacts on the mangrove ecosystem. The data on land-use changes were determined by field observations coupled with questionnaire survey. The study on the spatial changes over the past two decades were based on the GIS-based map produced by Dahdouh-Guebas et al. (2005) depicting the situation in 1994 together with 2015 Google Earth imagery with the current mangrove cover in Rekawa lagoon.

The total area of the land use that has been changed was 0.9933 km^2 (19% of the total land cover) and the total mangrove area that has been disturbed was 0.002 km^2 during the past two decades. Moreover, human interference i.e. land claimed for hotel constructions, acquiring to use as a private property, waste disposal and clear-felling of mangrove species for housing, fencing etc. and the invasion by exotic species were identified as the major factors that led changes at the study site. Besides, cryptic ecological degradation as a result of intrusion by invasive plants including *Acacia auriculiformis*, *Chromalaena odarata* and *Lantana camara* which are co-occurring with true mangrove species and mangrove associates at the buffer zone threaten the natural vegetation at Rekawa lagoon. Higher anthropogenic impacts on Rekawa lagoon region over the past two decades have reduced the mangrove cover in the area, thus we strongly recommend active intervention in a scientific way to minimize threats on this fragile ecosystem.

Keywords: Human interference, Invasive species, Land-use, Mangroves, Rekawa lagoon

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The current status of *Hemidesmus indicus* (SARIVA) sold in Sri Lanka

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Hemidesmus indicus (L.) R. Br. is a well known medicinal plant referred as Sariva in Sanskrit and Iramusu in Sinhala, which plays an important role in the preparation of Ayurvedic drugs in Sri Lanka. These plants grow wild in dry regions of the island. However, country's needs are mainly satisfied by material imported from India. The average annual requirement of the raw material of Sariva is around 40000kg. Due to the high demand for roots of this species, there is a known tendency for deliberate adulteration and substitution, by two other plants namely *Cryptolepis buchananii* Roem. & Schult. and *Ichnocarpus frutescens* (L.) R. Br. in Sri Lanka.

Therefore, the present study was conducted to evaluate the purity of crude raw material sold as Sariva in the market. Raw material collected from ten dealers in six districts counting five samples from each (altogether sixty samples), were used for this study. Morphological and anatomical characters were compared with those of authentic *Hemidesmus indicus*, *Cryptolepis buchananii* and *Ichnocarpus frutescens.* According to morphological, organoleptic and anatomical characters such as ridges and wrinkles of surface, smell, taste, starchy texture, colour and bark to wood ratio, presence of mechanical elements like stone cells with concentric rings, high abundance of pigment filled cells and the availability of secretary cells and prismatic crystals, market samples could be divided into two categories. One group was identical to *H. indicus* and the other was different from authentic *H. indicus*. The purity of samples studied ranged from 66% - 46%. The highest purity was observed in samples collected from Rathanpura district. This clearly indicates the timely importance of setting proper guidelines providing a fast tool of raw material identification and authentication at the point of purchasing.

Keywords: adulteration, SARIVA, substitution

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Potential of substituting wheat flour with 'Kiri-ala' (*Xanthosoma sagittifolium*) flour in bread making

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Bread made with imported wheat flour plays a vital role in typical Sri Lankan diet. To reduce wheat importations, there is a trend of using locally available underutilized crops as a substitute. This study was aimed to evaluate the potential of utilizing 'Kiri-ala' **(*Xanthosoma sagittifolium*),** Sri Lankan underutilized tuber crop as a partial substitution for wheat flour and to evaluate its nutritional value. 'Kiri-ala' flour blends were analyzed for proximate, antioxidant and rheological properties.

Proximate chemical analysis of 'kiri-ala' flour revealed that it contains protein, crude fibre, carbohydrate, fat, moisture and ash 4.32±0.03%, 2.29±0.17%, 81.62±2.68%, 1.28±0.02%, 6.96±0.15% and 3.53±0.06% respectively. Total phenol content, total antioxidant capacity, free radical scavenging capacity and reducing power were 8.79±1.07 garlic acid equivalent (GAE mg/g), 80.13±7.17 ascorbic acid equivalent (AAE mg/g), 3.6±0.95% and 8.16±0.55% equivalent inhibition of ascorbic acid respectively. Wheat-'kiri-ala' flour blends were prepared by incorporating 10%, 20%, and 30% 'kiri-ala' flour in wheat flour. Blends were evaluated for rheological properties. Mixing behavior of the blends was determined by Farinograph. Water absorption, development time and arrival time increased with the increase in substitution, while dough stability was decreased after 10% substitution level. As conclusion 'Kiri-ala' substitution level is possible up to 20% without alternating original wheat dough properties.

Keywords: Antioxidant properties, Bread, Composite flour, Kiri ala (*xanthosoma sagittifolium*), Rheological properties

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Formulation and Evaluation of Instant Herbal Porridge Mixtures from Ranawara (*Cassia auriculata* Linn) Leaves

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Ranawara (*Cassia auriculata* Linn) based herbal porridge is a well reputed dietary remedy for treating diabetes among Sri Lankans. Studies were conducted to develop instant herbal porridge which containing Ranawara leaves, rice, garlic, onion, pepper and coconut by using dehydration method. Each ingredient was separately dehydrated until the moisture content reduced up to 6%. Dehydrated ingredients were ground, sifted and powder form of ingredients was blend according to the pre prepared formula based on traditional knowledge of Ayurvedic medicine and sensory properties. Two formulations were prepared with and without coconut powder and they were evaluated for physio chemical properties, antioxidants, sensory properties and shelf life.

Formulated recipe without coconut powder contains Ranawara leaves 38.86%, crushed rice 45.97%, garlic 9.45%, onion 4.09% and pepper 1.64%. Similarly, formulated recipe with coconut powder contained 46.84% coconut powder in dry weight base. The products without coconut powder contains, moisture 4.28 (SD 0.04) %, fat 4.83 (SD 0.12) %, ash 3.07 (SD 0.04) %, protein 10.80 (SD 0.03) %, fibre 6.39 (SD 0.05) % and carbohydrate 74.91 (SD 1.66) %. Total phenolic content and total antioxidant capacity of the product without coconut powder was 476.24 GAE mg/g and 715.52 AAE mg/g respectively, whereas the product with coconut powder was 240.14 GAE mg/g and 452.30 AAE mg/g respectively. Sensory results indicated there were no significant differences ($p < 0.05$) among homemade, commercial and formulated products in terms of overall acceptability. The vacuum sealed LDP pack appeared to be an appropriate packing method for both products as the changes in water activity, moisture and pH were minimum. Both products did not exceed safe peroxide level (20 mEq/kg) and FFA level (1.2%) within two months of period from the production date. In conclusion, organoleptically acceptable instant herbal porridge mixtures from Ranawara leaves can be prepared with minimum two months of shelf life.

Keywords: Ranawara (*Cassia auriculata* Linn), Herbal Porridge, Dehydration, Antioxidant, Proximate compositions

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Correlation between gelatinization percentage and viscosity of gelatinized rice flour using FIR source

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Rice flour based food processing industries pay more attention on the parameters which affect the final quality of the product. In this context gelatinization and viscosity are the two main quality parameters needed to be concerned more to increase the final product palatability and consumerbility. Gelatinization causes physical and chemical changes in the starch granule where water will be absorbed by the granules as a result of breaking hydrogen bonds in amylose and amylopectin. Far-infrared (FIR) is a heating technique, getting more popularized in food processing sector in worldwide because of its bounteous advantages. Research on gelatinization of rice flour by FIR is not reported elsewhere and is a new attempt.

The polished rice (*Oriza sativa indica*) was grinded and sieved through 150µm sieve and gelatinized by using three ceramic coated FIR elements each having 650W by changing the combination of FIR intensity (17125.1, 14123.5 and 11254.3 W/m^2) and FIR exposure time (1, 2, 3, 4, 6, 8, 9 and 10 seconds). FIR intensity was measured with a pyranometer. The degree of gelatinization percentage of rice flour was measured with the Iodomatric method as guidelines given by Wootton and Kensington (1989). Viscosity measurements were taken for 55% gelatinized starch solution using No 2 spindle, while shear rate was set up at 60 rpm throughout the experiment.

The viscosity of gelatinized rice flour increases with gelatinization percentage linearly with a correlation coefficient (R^2) of 0.9548. The increase of FIR intensity and exposure time with the gelatinization percentage, cause water absorption which results in viscosity incremental effect. There is a strong relationship between gelatinization percentage and viscosity, thus viscosity can be used as an alternative measurement for gelatinization.

Keywords: Far-infrared, Gelatinization, Viscosity.

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In vitro regenerative efficacy of different explants of sandalwood (*Santalum album* L.)

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Sandalwood (*Santalum album L.*) is a commercially and culturally important plant species, known for its fragrant heartwood and oil. Due to the high value of heartwood and oil, this species is illegally harvested in large numbers leading to possible extinction. The present study was aimed to determine the *in vitro* regenerative efficacy of different explants of sandalwood. Six types of explants namely, shoot tips, stem segments, immature entire leaves, mature leaf segments, petiole segments, and single nodal segments were excised from the healthy stem cuttings of sandalwood seedlings (two years old). The sterilized explants were separately cultured on MS medium containing 0.5 mg/l BAP. The results revealed that *in vitro* response percentage of the cultured explants showed significant difference ($p<0.01$) among the tested explants ranging from 13.3% to 56.6%. The immature leaf explants showed the highest *in vitro* response (43.3%) and survival rate (65%) at four weeks of culture. Shoot tips exhibited higher (80%) survival but low *in vitro* response (33.3%). Mature leaf explants were subjected to browning. Petiole and mature leaf explants failed to show *in vitro* response and had lower survival rates among the tested explants of sandalwood. Therefore, immature entire leaves would be the more effective among the tested explants with the given medium constituents.

Keywords: Explants, Santalum album, Shoot tip, Petiole, Single nodal segment, in vitro response

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Genetic diversity of scalloped spiny lobster (*Panulirus homarus*) populations of southern coast of Sri Lanka

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Genetic variability of wild scalloped spiny lobster; *Panulirus homarus* populations of Southern Sri Lanka was evaluated using four microsatellite markers. A group of 120 individuals belonging to four wild populations; Kirinda (KIR), Godawaya (GOD), Weligama (WEL) and Hikkaduwa (HIK) were screened. The number of alleles per locus ranged from 3 to 4. The average observed and expected heterozygosity values ranged from 0-0.950 and from 0.435-0.926 respectively. Polymorphism information contents (PIC) were ranged between 0.489 and 0.679, and the averages values for each population were as 0.564 (GOD), 0.552 (HIK), 0.577 (KIR) and 0.596 (WEL).

The calculated genetic diversity parameters and PIC values indicated middle level polymorphism and genetic variations in the four populations. According to the results of the analysis of molecular variance (AMOVA), high genetic variation within population (72.38%) and low variation among populations (1.56%) were observed. The reduction of effective number of alleles was observed which may have been caused due to the overexploitation and environmental degradation. On the basis of the genetic relationships, analysis of Unweighted Pair Group Method with Arithmetic mean (UPGMA) dendrogram indicated that the four sampled geographic locations could be grouped into two broader distinct populations; South East (KIR and GOD) and South West (WEL and HIK). The results are significant as this is the first population genetic study conducted for *P. homarus* using microsatellite markers. This information provides basis for selective breeding programs and constructing suitable management guidelines for conservation of this species in Sri Lanka.

Keywords: Microsatellite, *Panulirus homarus*, Population genetic, Spiny lobster, Sri Lanka

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Production of biodiesel at room temperature from palm olein oil

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In order to reduce the demand and negative environmental impacts of petroleum based fuels, it is necessary to develop an economically viable and environmentally friendly alternative energy source. Biodiesel is a mixture of monoalkyl esters of long chain fatty acids and it is normally produced by transesterification of triglycerides in vegetable oils. Although biodiesel is a potential alternative fuel, its production cost is high because of high temperature (60-65^{o}C) and lengthy procedure. This work was carried out to identifying a process of reducing the production cost by developing a method which requires less energy consumption and less time. Palm olein oil was used as the vegetable oil because many Asian countries use it to produce biodiesel and Sri Lanka produces palm olein oil. In this study, biodiesel was produced by transesterification of palm olein oil using methanol and NaOH. To increase the efficiency of the reaction, miscibility of reactants was increased using acetone as a cosolvent. The reaction occurred at room temperature (27-29^{o}C). The yield was determined under different reaction conditions. The best conditions were methanol:oil (9:1), cosolvent:oil (5:1), 0.5 % NaOH (by weight) and 2 h. reaction period. The yield was 92%. The methyl esters of fatty acids present were oleic (60.28%), linoleic (13.14%) and palmitic (11.84%). Density, acid number, kinematic viscosity, flash point and calorific value agree with ASTM international standards. It is found that this method is economical because of less energy consumption and less time required.

Keywords: Biodiesel, Cosolvent, Palm olein oil, Transesterification

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Appropriate strategy to overcome potential problems in natural rubber latex processing

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Property variations with maturity time and storage conditions have been a potential problem in compounding and processing of natural rubber (NR) centrifuged latex. Concentrated NR latex needed to be stored for 21 days of maturity period prior to processing in order to achieve acceptable level of properties and this is a problem in production operations. The main objective of this study was to investigate the property variations of natural rubber centrifuged latex with different maturity time and with different storage conditions (aerobic and anaerobic). During the experiment, changes in properties of high ammonia (0.7% w/w) NR centrifuged latex were evaluated at different maturity stages (0, 5, 10, 20, 30, 40, 50 and 60). The samples were stored at room temperature (28±2^{o}C) and Volatile Fatty Acid (VFA) Number, Mechanical Stability Time (MST) and Potassium Hydroxide (KOH) Number were studied. Another two sets of samples were kept under aerobic and anaerobic storage conditions for 21 days and variation of the same properties were evaluated. Concentrated natural rubber latex properties have changed significantly ($p<0.05$) with the maturity time. There was a significant difference in MST and KOH number with storage condition, while VFA number was not affected, significantly. It is found that optimum latex properties could be achieved in less than 20 days by keeping under aerobic storage condition which was identified as a great achievement with respect to the production operation process of NR latex.

Keywords: Maturity Time, Mechanical Stability, Potassium Hydroxide Number, Storage Condition, Volatile Fatty Acid Number

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Structural analysis of green adhesives synthesized by coir fiber lignin substitution in phenolic resol resins.

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This research investigated the possibility of substituting coir fiber lignin in synthesis of bio-based phenolic resol resins. Coir fiber was subjected to alkaline soda process from which the lignin was recovered. The optimum conditions were found to be at 100 ^{o}C with coir/water (1:8 w/w) and at pH=11 where the lignin yield attained ca. 26% with a purity of ca. 83%. By simultaneously reacting with phenol followed by formaldehyde in a condensation polymerization catalyzed by sodium hydroxide the coir fiber lignin has been subjected to hydroxymethylation reaction for the introduction of hydroxyl groups into its structure, to enhance the reactivity. For more complete exploitation of coir fiber lignin in the partial replacement of petroleum based phenol, a series of phenol-lignin-formaldehyde resins was prepared. Here polyblended bio-based resol resins were synthesized by varying the coir lignin (w/w) % ratio in the 0-50 range. Structural analysis of the resulting resins was determined by Fourier transform infrared spectroscopy (FTIR), ultraviolet – visible (UV-vis) absorption measurements and gel time measurement. A dramatic decreasing effect of the gel time in the copolymer system was observed with gradual increment of the (w/w) % lignin. By analyzing the FTIR and UV-vis spectroscopic data, the optimum conditions to achieve lignin hydroxymethylation could be deduced. The obtained analytical results proved the powerful potential of coir fiber lignin as a natural polyphenol.

Keywords: coir fiber, lignin, alkaline soda process, black liquor, eco-friendly materials.

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Metal Complexes of Phenanthroline-Based Polyphenylenes via "Phenblue"

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A novel family of phenanthroline-based compounds were synthesised *via* a [2+4] Diels-Alder cycloaddition reaction between specifically designed cyclopentadienone based synthons that incorporate the already fused phenanthroline moiety 11b-Hydroxy-1,3-diphenyl-1,11b-dihydro-7,8-diaza-cyclophenta[*l*]phenanthrene-2-one (**1a**) and 11b-Hydroxy-1,3-di(4-*tert*-butylphenyl)-1,11b-dihydro-7,8-diaza-cyclophenta[*l*] phenanthrene-2-one (**1b**) and various di-substituted acetylenes. These systems have been found to display tuneable fluorescent capabilities, which make them promising material for application in optoelectronics as well showing excellent metal coordination potential.

Keywords: Cyclodehydrogenation, HBC, fluorescent, Luminescent, PAH

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Cationic ruthenium hydride catalysed and chelate assisted C-O bond cleavage of 2-acetyl-aryl ethers: A model compound for lignin de-polymerization

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2-Acetyl containing a neighbouring aromatic ether group regioselectively reacts with the cyclopentene in the presence of cationic Ru-H catalyst $[(C_6H_6)(PCy_3)(CO)RuH]^+BF4^-$ in aromatic hydrocarbon solvents. The alkyl moiety of ether can be any of cyclic, methyl, butyl, benzyl, phenyl and allyl groups. Chelation plays a key role in regioselectivity directing the C-O bond cleavage reaction. The reactions of 2-acetyl derivatives of aryl-ethers under these conditions affect the corresponding products having onlyphenol -OH group at the aromatic ring. Cleavage of the sp^3 C-O bond occurs selectively rather than sp^2 C-O bond. The method has successfully extended to C-O bond cleavage of flavanone biomolecule and strongly possible to extend regioselectively depolymerize lignin biomolecules.

Keywords: C-O bond cleavage, Lignin depolymerization, Ru-H catalyst, regioselectivity

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Association between admission serum high sensitivity C-reactive protein concentration and risk of developing complications following acute myocardial infarction, in men admitted to a tertiary care centre

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Elevated high sensitivity C-reactive protein (hs-CRP) levels are associated with coronary artery disease, and raised basal hs-CRP concentration is associated with higher risk of complications of acute myocardial infarction (AMI). The aim of this work was to find out the relationship between hs-CRP and complications of AMI in our setting. Two hundred and six males; 103 patients with first acute ST-elevation myocardial infarction (STEMI) admitted to Coronary Care Unit, Teaching Hospital Karapitiya and 103 controls without coronary artery disease were studied. The complications of STEMI, occurred during the hospital-stay were recorded. Serum basal hs-CRP was estimated by turbidimetry. Continuous variables were compared with two sample-*t* test, and binary logistic regression was used in the analysis of predictors of in-hospital complications. During the hospital stay, 50 (48.5%) patients developed complications, but no deaths were reported. Heart failure was the most common in–hospital complication with 34 (33.0%) patients affected. There were 18 (17.4%) patients with rhythm abnormalities of which four (3.9%) had ventricular fibrillation, nine (8.7%) patients developed mural thrombus and four (3.8%) had cardiogenic shock. The hs-CRP concentration was significantly higher in patients with STEMI than in controls (3.7±0.84 mg/L vs. 1.7±0.60 mg/L, p=0.001). The hs-CRP concentration was higher in STEMI patients with complications compared to those without complications (4.0±0.95 mg/L vs. 3.60±0.69 mg/L, p=0.016). On admission, basal serum hs-CRP (p=0.019, OR=1.85, 95% CI=1.11-3.08), serum cTnI (p=0.030, OR=1.01, 95 % CI=1.00-1.02) and left ventricular ejection fraction (p=0.001, OR=0.9, CI= 0.85-0.95) were strong independent predictors of STEMI complications. On admission (basal) serum hs-CRP concentration was significantly higher in patients compared to controls and was suitable for predicting the complications of STEMI during the hospital stay.

Keywords: Complications, High sensitivity C-reactive protein, Myocardial infarction.

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Generative behavior and psychological health among older people in Galle, Sri Lanka

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Depression and cognitive impairments in older people are vital public health issues in Sri Lanka. Stress plays a major role in developing such chronic ill-health conditions in people. Little is known about generative behavior and its effect on psychological well-being of older people in the country. The study aimed at assessing generative behavior, psychological health and possible associations between the two constructs in older people aged 60 years and above in Galle. Seventy seven (77) men and 46 women were surveyed using an interviewer administered questionnaire. Loyola Generatively Scale (LGS) and Kessler Psychological Distress Scale (Kessler 10) were used. The average LGS score is 40-41 for the older people in many countries and those who got Kessler 10 score greater than 25 are likely to have moderate or severe mental disorders. The mean scores of the LGS were 48.6 (*SD=7.01*) and 48.7 (SD=7.08) for the women and men respectively. The mean scores of the Kessler 10 were 16.7 (*SD=5.81*) and 15.06 (*SD=4.62*) for the women and men respectively. The older people participated in the study were found to be engaged in generative activity behavior more frequently than older people in many other settings. Negative correlation (*r= -0.16*, *p=0.08*) was found between LGS Scores and Kessler 10. Thus, those who were frequently engaged in generative activities were less likely to experience psychological distress. The desires to be generative and generative activities seem to be important behaviors associated with psychological well-being of the older people in Galle, Sri Lanka.

Keywords: Depression, Generative activities, Mental disorders, Psychological well-being, Stress

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Practice of self-medication among the nursing students of a college of nursing in the northern part of Sri Lanka

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Self-medication is defined as the use of medications by a patient on his own initiative or on the advice of a pharmacist or a lay person instead of consulting a medical practitioner (WHO 2008). Self-medication practice is more common in healthcare students. This study was aimed to find the indications for self-medication, and the reasons which arose them to go for self-medication, to seek medical advice after the self-medication and for not taking self-medication.

A cross sectional, descriptive, questionnaire-based study was conducted among first, second, and third year nursing students of College of Nursing, Jaffna. The SPSS 16 was used to analyze the data.

Among the 185 students, 83.3% have the self-medication practice. Among them, 85.7% (n=132) were female and 14.3% (n=22) male, and the mean age is 24.6±1.7 years. Indications for the self-medication practice included Infection 65.6%, headache 62.3%, Pain 61.7%, and fever 60.4%. The reasons for opting for self-medications included previous experience of self-medication (81.2%), and get emergency relief from the illness (50.6%). 26% (n=40) sought medical advice after self-medication. The main reasons for seeking subsequent medical advice were "problem may be serious" (50%), "symptoms were not reduced" (45%), and "symptoms were worsened" (37.5%). 16.7% of the study population did not practice self-medication. Major reasons for not practicing self-medications were "using self-medication is dangerous" (67.7%), "there is risk of adverse effects" (61.3%), and there is "risk of misdiagnosis" (51.6%).

Practice of self-medication fairly common among nursing students in Northern part of Sri Lanka which is a common finding in rest of the World, too.

Keywords: Fever, Head-ache, Pain, Self-medication.

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Assessment of possible risk factors for Metabolic Syndrome among selected students of Faculty of Science, University of Ruhuna

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The purpose of this cross sectional study was to assess possible risk factors and susceptibility for Metabolic Syndrome (MS) among undergraduates of Faculty of Science, University of Ruhuna and to examine the prevalence of risk factors for MS. Data were collected through interviews, discussions and questionnaires after taking the ethical approval from ethic committee, Faculty of Medicine, University of Ruhuna. A volunteer sample of 450 students (281 females; 169 males) was recruited to the study at all study levels. Data were analyzed using descriptive statistics and correlation test. Frequency of risk factors for MS associated with male students was higher than female students. The prevalence of risk factors varies highly between different sex, age groups and the study levels. According to the results, 59.33% and 16.66% of total population were in non-desirable Obesity and Central Obesity respectively. 20.89% and 20.44% were not having Ideal Systolic Blood Pressure and Ideal Diastolic Blood Pressure respectively. Further 81.11% and 20.89% of the studied population were having low exercise and insufficient sleeping respectively. 20.67% were spent more than 180 min/day for computing and 82.88% were having non-vegetarian diet patterns. 37.87% of males used to consume alcohol. 16.66% of females and 17.49% of males were at high risk for MS. Pearson correlation test indicated that Obesity was significantly correlated with Gender, Central Obesity, Systolic & Diastolic Blood Pressure, Alcohol Consumption, Computing time and Exercise Levels. Exercise Level showed a significant correlation with Obesity ($r= -0.709$: $p<0.05$), Systolic Blood pressure ($r=0.813$: $p<0.05$) and Diastolic Blood Pressure ($r=0.731$: $p<0.05$). These findings suggest that many of the students in the studied population need lifestyle changes in order to avoid the possible development of MS.

Keywords: Metabolic Syndrome, Obesity, Risk Factors, Susceptibility

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Effect of intensity control of Bharathanatyam dance training on pulmonary function

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Breathing is one of the critical bodily function which the lungs deliver oxygen to the blood, and expire carbon dioxide out of the body. Dance training can help to strengthen and make this system more efficient. The objective of this study was to examine the effect of intensity control of Bharathanatyam dance training on pulmonary function. To achieve the purpose thirty (N=30) female students were randomly selected from Jaffna, Sri Lanka as subjects and their mean age were between 17 ± 1.3 years. They practiced Bharathanatyam dance 60±10 min / day for 3 days / week over the period of twelve weeks. Ten percent rule was used to increase intensity in every two weeks from sub maximal level. Data were collected on their Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV_1), Peak Expiratory Flow (PEF) by PC based USB Spirometer before and after the training period. The collected data were statistically treated by using paired sample 't' test, 0.01 level of confidence was fixed to test the significance. The results show that, intensity control of Bharathanatyam dance training significantly improves FVC (t: 21.23), FEV_1 (t: 11.83) and PEF (t: 13.14). Furthermore, percentage of improvement shows as FVC (48.16 %), FEV_1 (18.22 %) and PEF (24.17%) respectively. Hence it was concluded that, Bharathanatyam dance training optimistically influence on pulmonary function.

Keywords: Bharathanatyam dance, FEV_1, FVC, PEF

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Cage culture of GIFT fish in Sri Lankan conditions; mono sex or mixed sex?

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Mono sex tilapia fish (males) culture is gaining more concern over mixed sex fish in variety of culture systems due to faster growth and larger size than their counterpart. Mono sex culture of tilapia is not practiced in commercial basis in Sri Lanka and the present study aimed to determine the suitability of mono sex male tilapia to introduce into cage culture in Sri Lanka by comparing the growth performances of mixed sex tilapia culture. Mono sex and mixed sex fry having initial mean weights (1.23 ± 0.23g and 0.93 ± 0.25g , respectively), were stocked in 2 m^{-3} cages, at 25/m^{-3}, 50/m^{-3}, 75/m^{-3} and 100/m^{-3} densities, each in three replicates. Fish were hand fed with 30% crude protein diet for 180 days. Weight of the fish in each cage (30% from the total) and physico-chemical parameters of water were recorded monthly. Growth parameters; mean final weight, mean weight gain, specific growth rate and feed conversion ratio showed no significant difference ($p > 0.05$) between mono sex and mixed sex GIFT in each density class from fry to post fingerling stage (approximately 60 days). Similar results were obtained for the growth indices for each density class of two groups, after the whole culture period of 180 days. Stocking density of 25 fish per m^{-3} in both groups indicated the highest value for all growth parameters while increasing stocking density had significant negative effect on all growth parameters. Present study reveals that culture of mono sex GIFT in cages has no significant difference in growth over mixed sex culture during fry to post advanced fingerling stages and up to sexual maturity.

Keywords: Cage culture, GIFT, Mixed sex, Mono sex, Specific growth rate

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Angiotensin converting enzyme (ACE) inhibition by flavonoid-rich defatted crude extracts of *Actinidia macrosperma* fruit

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Actinidia macrosperma which belongs to the genus *Actinidia* of the *Actinidiaceae* family is a non-commercial type kiwifruit. This plant has its reputation to treat various diseases within Chinese traditional medicine. Recent studies have shown that the different parts of *A. macrosperma* plant exhibit various biological activities. In this study, the potential application of antihypertensive activity of flavonoid rich defatted crude extracts obtained from *A. macrosperma* fruit was determined by *in vitro* assay using fluorescence based biochemical reaction. The different extracts obtained from *A. macrosperma* fruit were performed for the ACE inhibitory activity and results showed that they are moderately effective ACE inhibitors. Among the results obtained in the present study, it should be highlighted that the activity observed for the extract from 70% acetone by steeping method exhibited quite promising ACE inhibitory activity (lowest IC_{50} values), as compared to the other solvent extracts tested. Based on the experimental results, kiwifruit has potential use as a cardiovascular protective agent against high blood pressure. Investigating the ACE enzyme inhibition by kiwifruits generated valuable information for supporting the general concept that flavonoids rich kiwifruits have health effects.

Keywords: Angiotensin converting enzyme, Actinidia macrosperma, Flavonoids, Hypertension

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Taxonomic assessment of Puntius thermalis in Sri Lanka using DNA barcoding

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Puntius chola (*sensu lato*) Hamilton 1822, (family Cyprinidae) is a widely distributed fish species in the Asian region. The recent taxonomic revision of the genus *Puntius* revived the name *Puntius thermalis* (*sensu stricto*) Valenciennes 1844 for Sri Lankan specimens previously identified as *Puntius chola*. The use of DNA barcoding for the identification of species is now widely recognized, and a large number of taxonomic studies have used mitochondrial Cytochrome Oxidase I (COI) gene sequences to delineate fish species. The objective of this study was to use DNA barcoding to clarify taxonomic status of *Puntius chola* (*s.l.*) in Sri Lanka. DNA sequences of the partial mitochondrial COI gene region were produced, and alignment based comparisons were made with additional COI sequences for Indian *P. chola* and two selected out-group cyprinid taxa available from the Genbank. According to the derived phylogenetic tree, *P. chola* in Sri Lanka (4 locations) is clearly separated from Indian *P. chola*. The divergence levels between Sri Lankan and Indian *P. chola* ranged from 2.2% to 14.9%. There were no significant phylogenetic differences found among Sri Lankan *P. chola* sequences. It provides evidence for the presence of genetically diverged phylogenetic species in Sri Lanka closely related to the Indian taxon, and substantiates the recent taxonomic revival of the name *Puntius thermalis* for the Sri Lankan taxon. Further morphological studies with type specimens of Indian *P. chola* will be important to clarify these findings.

Keywords: Nucleotide divergence; Puntius chola; Puntius thermalis; phylogenetic species.

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An investigation of soil and litter macrofauna of different habitats in Mawarala MAB forest reserve in Matara

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A preliminary study was conducted to find out the diversity of soil and litter macrofauna in three different habitats namely natural forest area (NF), disturbed forest area (DF) and riverine forest area (RF) in Mawarala MAB forest situated in Matara district. Plots of 20m × 20m were selected in each of the three habitats. Soil and litter samples were collected randomly from five sub plots (20cm × 20cm ×10cm) from each main plot. Samples were collected once in a month and were separated using a set of sieves. The animals in each of the fractions (above 0.2mm mesh size) were sorted out and identified using the keys. Soil pH and organic content were measured by using pH meter and muffle furnace respectively. The highest diversity and the abundance of **litter macrofauna** (13 taxa and 29 individuals per m^2, Shannon – Weiner Index 2.225 and Evenness Index 0.843) were recorded in NF. Lowest diversity of **litter macrofauna** (9 taxa, Shannon – Weiner Index, 1.792 and Evenness Index 0.721) was found in RF. In **soil macrofauna** the highest diversity was observed in DF (Shannon – Weiner Index 2.104) and the lowest diversity was observed in NF (Shannon – Weiner Index 1.870). Common litter macrofouna taxons found in all the three habitats were Lumbricidae, Araniae, Isopoda, Chilopoda, Diplopoda, Coleoptera, Hymenoptera, Dermoptera and Hemiptera. Nematodes were found only in the DF. Mites (Acarina), Gastropods, Homepterans and Isopterans insects were only present in the NF. Eight taxons of soil macrofouna namely Lumbricidae, Araniae, Isopoda, Chilopoda, Coleoptera, Hymenoptera, Dermoptera and Isoptera were common to all habitats. Homopteran and Hemipteran insects were found only in DF, while nematodes belonged to family Mermithidae were observed in RF and DF. Total abundance of animals was higher in the litter than the soil. Litter layer in NF provides a rich habitat for different macrofauna that decompose litter to form organic matter. The lowest diversity recorded in soil macrofauna in the NF area indicates that, not only the organic matter but also some other factors may involve in resulting the abundance of organisms in the soil. Thickness of litter layer was ≥4cm in NF area, may act as a barrier for aeration and light penetration that could make soil less suitable habitats for different organisms dwelling in the soil.

Keywords: Diversity, Habitats, Litter, Macrofauna, Soil.

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Amplification refractory mutation system (arms) for sex identification of Asian elephants (*elephas maximus*) using dung as non-invasive sample

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There is a demand by field biologists to establish molecular techniques to identify the sex of elephants using non-invasive samples. The present study applied a molecular method, Amplification Refractory Mutation System (ARMS), for sex identification of Asian elephants (*Elephas maximus*) using their dung samples. This technique focused on allele specific identification, targeting the zinc finger (*zf*) region in X and Y-chromosomes. Based on the unique nucleotide present in the *zfx* and *zfy* gene sequences in the intron *zf* region of Asian elephants, two sets of primers were designed manually. DNA was extracted from dung samples collected from 12 males and 16 females and PCR method was performed to amplify DNA using designed primers. To confirm the results, one step RT-PCR (Applied Biosystems) was performed using SYBR Green dye (QuantiTech-Qiagen).

The PCR method yielded 118bp and 130bp products for X and Y genes respectively. For male DNA samples both 118bp and a 130bp bands were observed while it was only 118bp band for female DNA samples. The Melt curve analysis (MCA) of one step RT-PCR method support the above results by resulting two separate peaks plotted at 74°C Tm for male samples and at 77.6°C Tm for female samples. The result concludes that the designed primers based on the Zinc finger protein encoding region of X and Y-chromosomes are highly specific for sex identification of Asian elephants using their dung as non- invasive sample.

Keywords: Asian elephant, Dung, Sex identification

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Forecasting of weekly demand for a daily newspaper in Sri Lanka

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Uncertainty in the demand for a newspaper is a major problem that newspaper companies come across because the printing process of a newspaper highly depends on the newspaper demand. Better forecast is very essential to print a newspaper because the quantity of printing will be decided based on the forecasted value. Having an appropriate forecast of weekly total demand is essential to take important business decisions like budget planning and inventory controlling in newspaper industry. In this study, an analysis was carried out by using weekly data of demand from January 2013 to July 2014 for a daily newspaper. The main objective of this research was to fit a suitable model for forecasting the weekly demand of daily newspaper. The data set was divided into two parts; one for model fitting and other for model validation. Different Auto Regressive Integrated Moving Average (ARIMA) models were fitted for the data and best model for forecasting was identified by using minimum Mean Absolute Percentage Error (MAPE) value. ARIMA (2, 1, 3) model was identified as the best model for weekly demand forecasting. MAPE value for weekly demand is 11.84%. The fitted ARIMA models were efficient in weekly demand forecasting for the newspaper since the maximum error percentage for fitted values were about 8%. The proposed model was found to perform well in predicting the weekly demand for the selected newspaper. Furthermore, the proposed model with minor adjustments can be used for weekly demand forecasting for any daily newspaper in Sri Lanka by applying the same procedure.

Keywords: ARIMA, MAPE

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Prediction of dengue fever cases in Sri Lanka using time series model

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The number of dengue fever, one of the most dangerous mosquito viral infection, cases has dramatically increased in recent years. Since the first reported case of dengue fever in 1965, there had been occurrences on and off until the recent. Previous studies based on meteorological factors and the epidemiological pattern of cases are recommended for effective control programmes. Consequently, several programmes are conducted Island wide to control the cases. A mechanism is needed to estimate the number of cases and thus this study will provide support to forecast them. Therefore, the objective of the study is to develop a time series model to predict the dengue fever cases in future.

Statistical tests are used to construct Auto Regressive Moving Averages (ARMA) models to predict the number of dengue cases. At preliminary stage, graphs of Auto Correlation Function, Partial Auto Correlation Function and Augmented Dickey Fuller test is used to test stationary of the series. For model selection, coefficient of determination, Durbin-Watson statistics, Akaike information criterion and Schwartz's Bayesian criterion are used. Diagnostics tests on residuals are also carried out. Mean Absolute Percentage Error (MAPE) statistics is used to measure the accuracy of the model.

The results reveal that 4 cases per day are recorded in Sri Lanka. Further, it shows that in two seasons: December- January and June- July; the cases are very high. The accuracy of the fitted model shows more than 75%. Therefore, the proposed model can be used to forecast the number of dengue cases in Sri Lanka.

Keywords: Dengue, Prediction

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Predicting mathematics performance of secondary level students in Matara educational zone: A case study

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Students' mathematical achievements in secondary school have an influence on their performance in higher studies and their future careers. Having a solid background in mathematics helps students develop sophisticated perspectives and offer more career options. The importance of mathematical learning has repeatedly been emphasized by educators. Therefore, this research developed a model to explain mathematics performance. In this study, secondary level students' mathematics examination marks were analyzed with a particular focus on students at grade ten in Matara educational zone. This examination was held by Ministry of Education. This research trot out, how important are the school and student level variables in explaining differences in mathematics performance, what characteristics of schools and students are linked to the mathematics achievements and are there any indication of differential effectiveness within school and between schools. Multilevel linear modeling was employed to analyze the data. Seven variables at the student level and two variables at the school level were used to build the two-level hierarchical linear model in order to predict the status of students' mathematics performance. The final model reveals that one variable at the school level which is school type is significant predictor of students' mathematics performance. At the student level, doing homework, mother's education, student living area and student gender are significant factors. The results reveal that school level account for 27% of the overall variance in mathematics performance while 73% of overall variance was captured by student level within schools. This study further suggests that within school differences are far larger than between school differences.

Keywords: Grade ten, Matara educational zone, Mathematics performance, School level, Student level

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Implementation of algorithm for Vogel's approximation and the modified distribution methods using MATLAB

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In the field of operations research, modelling of transportation problems is fundamental in solving most real life problems as far optimization is concerned. It is clear that a lot more effort has been put in by many researchers in seek of appropriate solution methods to such problems. Vogel's Approximation Method (VAM), among the class of algorithms provided to solve the Initial Basic Feasible Solution (IBFS) proved to be the best. Likewise, Modified Distribution Method is testing the optimality of the IBFS. However, for some time now, manual calculations and LINDO are the tools used by most researchers in the application of these efficient proposed techniques.

No MATLAB function has been written to handle this problem, although is now obvious that more scientist in the scientific world are into the usage of MATLAB environment. In this study, a MATLAB function, that is, vogelModi.m was developed to implement the Vogel Approximation Method, which helps get the IBFS and Modified Distribution Method, which also test for the optimality of the IBFS based on the assumption that the problem is balanced.

It was observed that this program will aid most Operation Researchers modeling large transportation problem and wish to use Vogel's Approximation method and the Modified distribution method as its solution techniques for arriving at an optimal solution with less effort.

Keywords: Cost Matrix, MATLAB, Modified Distribution, Transportation Model, Vogel's Approximation

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Cooperative and competitive ACO-PSO hybrid version for Travelling Salesman Problem

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After the concept of Swarm Intelligence was introduced in late eighties and became known as a distributed solution for complex tasks, a variety of Swarm Intelligence heuristics were initiated. Swarm Intelligence heuristics are often used in solving combinatorial problems such as Travelling Salesman Problem (TSP). Even though there are numerous attempts to solve TSP, yet there is space in improving the solution quality for solving large scale TSP instances. Among Swarm Intelligence algorithms, Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO) algorithms have taken much of the interest of researchers since of their simplicity, effectiveness and efficiency in applications. The objective of this study is to attempt a reduction in delay in convergence while maintaining an acceptable accuracy in solving large scale TSP instances by hybridizing PSO and ACO. In this proposed ACO followed PSO approach, influences of cooperation and competition of swarm populations were adapted and fine-tuned to increase the solution quality. The experimental results show an error less than 2.5% when converging to the optimum for TSP instances not more than 3038 nodes. Further the experimental results demonstrate that the attempt of reducing the delay in convergence is successful while maintaining an acceptable solution quality when the proposed approach is used in solving instances of moderate scale Travelling Salesman Problems.

Keywords: Ant Colony Optimization, Combinatorial Optimization, Particle Swarm Optimization, Travelling Salesman Problem

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Noise level exposure in school classrooms

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Noise exposure inside classrooms may affect several ways to school children and teachers. According to the literature, high noise levels in classrooms minimize a wide range of attainments and performances in the areas such as literacy, mathematics, attention and memory of students. Main objective of this study is to investigate the noise level and its frequency spectrum in class rooms. Noise levels in classrooms of ten schools in urban area of Matara city in Sri Lanka were measured during a two-month period using B&K Type-2250 hand held analyser. A weighted averaged noise level descriptor, L_{Aeq} (dB), with 1/3 octave band centre frequency from 6.3 Hz to 20 KHz was monitored. The noise level in a classroom depends whether the teacher is present or not in the class. The noise level in the classrooms with the presence of the teacher, L_{Aeq}, and absence of the teacher, $*L_{Aeq}$, were recorded. The analysis was performed under four categories of classes, grades 1-5 (Cat. I), grades 6-8 (Cat. II), grades 9-11 (Cat. III) and grades 12-13 (Cat. IV), respectively.

The noise levels inside the classrooms while teaching were lower in higher grades (Cat. IV: L_{Aeq} = 65±2 dB(A)), and higher in lower grades (Cat. I: L_{Aeq} = 72±3 dB(A)). However, when the teacher is absent, the noise levels are higher than the above values but shows the same pattern, $*L_{Aeq}$ = 73±2 dB(A) for Cat. IV and $*L_{Aeq}$= 81±2 dB(A) for Cat: I. The highest noise level in the frequency spectrum was found to be in the range of 315 Hz to 1 kHz and from 160 Hz to 4 kHz while teaching and the teacher is absent, respectively. The ambient noise level inside the school halls and outside the halls were found to be in the range 50-60 dB(A) and 70 – 80 dB(A), respectively, after the school hours. All noise levels, ambient noise level inside as well as outside the classrooms, and the noise level inside the class while teaching are found to be higher than WHO recommended values in all schools studied. Therefore, teachers have to speak louder than in a normal speech (50 dB(A)) to maintain at least 15 dB(A) above the background noise to maintain the required signal-to-noise ratio of a speech. These results clearly indicate that the speech intelligibility in all classrooms is adversely affected by the background noise. The problem is worse in primary classes than in higher grades.

Keywords: Noise exposure, School children, Signal-to-noise ratio, WHO recommendation, L_{Aeq}

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Testing astronomical optical standards of locally made parabolic mirrors for Newtonian Reflecting Telescopes

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A study of mirror making was initiated with the aim of designing a Newtonian reflecting telescope. Parabolic mirror of 15 cm aperture and 1.49 m focal length was made utilizing two identical Soda-lime glass disks. One side of a flat glass disk (one selected for the mirror) was grinded into the parabolic concave shape using series of Silicon Carbide (SiC) and Aluminum Oxide (Al_2O_3). The grinded mirror was polished using Pitch (Phenols, Polycyclic aromatic hydrocarbons) and Ferric Oxide (Fe_2O_3). Focal length of the mirror was measured after each grinding process. Uniformity of the concave shape figured in the mirror was tested using Foucault knife-edge test. Deviations from the required parabola were investigated by employing Millies-Larcroix method. It was found that the parabolic shape of the glass is satisfying astronomical optical standards confirming the quality of mirror prepared by this method.

Keywords: Glass disk, Silicon carbide, Foucault knife-edge test, Millies-Larcroix method, Parabolic shape

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Effect of soil moisture stress on the Indole-3-Acetic acid (IAA) Oxidase Activity of three selected chilli (*Capsicum annuum* L.) cultivars during the flowering stage and its impact on fruit yield

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IAA oxidase is the enzyme to oxidize IAA to Methylene Oxindole which is an inactive form of auxin. During abiotic stress, auxin content decreases in plant system because of high IAA oxidase activity. The present study was conducted with the objectives of estimating IAA enzyme activity in selected chilli cvs. viz., MI 2, KA 2 and '*Arunalu*' in response to moisture stress and to determine the extent of stress tolerance in these cvs. based on this enzyme activity. All the chilli cvs. were grown in polyethylene bags filled with sandy regosols. Two levels of moisture (stress and control) were used. Moisture stress was imposed by withholding water at once from the initiation of flowering up to 15 days during the flowering stage. Control plants were watered to Field Capacity at 5 days interval. Gypsum blocks were used to assess the moisture levels of plants. Moisture stress significantly increased the IAA oxidase activity of the three chilli cvs. The highest IAA oxidase activity (lowest un-oxidized auxin) was found in 'MI 2' where as the lowest IAA oxidase activity (highest un-oxidized auxin) was found in '*Arunalu*'. 'KA 2' showed significantly higher IAA oxidase activity than '*Arunalu*'. The IAA oxidase system is proved to influence plant growth by regulating the concentration of endogenous IAA. Plant tissues capable of rapid growth have been found to exhibit low IAA oxidase activity. From the above results, it could be stated that '*Arunalu*' was able to maintain growth and development better than 'KA 2' and MI 2' chilli cvs. despite a severe stress situation. As such, '*Arunalu*' exhibited better stress tolerance than 'KA 2' and MI 2'. Moisture stress significantly reduced the fruit yield of all the chilli cvs. The highest yield was obtained in '*Arunalu*' and the lowest one was found in 'MI 2' under moisture stress condition. The stress tolerance feature of '*Arunalu*' characterized by high accumulation of auxin; other words, low IAA oxidase activity would have influenced plant growth by regulating the concentration of endogenous IAA. Thus, '*Arunalu*' was able to thrive and produce well under water deficit situation.

Keywords: IAA Oxidase, Soil moisture stress, Stress tolerance, Yield

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Effect of Different Preservatives on Nutritional, Sensory Qualities and Shelf life of Papaya Fruit Bar

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Papaya fruit is an excellent source of vitamin C, carotene, minerals and other nutrients. The fruits are susceptible to decay and spoilage due to their perishability. Therefore, proper preservation techniques need to be adapted to extend the shelf life of papaya fruits. Accordingly, a research was conducted to assess the effect of different food preservatives on the quality and shelf life of papaya fruit bars. Ripened papaya fruit pulp, sugar, citric acid and 5% corn flour mixture was heated to get the Total Soluble Solids (TSS) content of 50˚Brix. The pulp was cooled and 1000 ppm of three different preservatives such as sodium benzoate, potassium metabisulphite and potassium sorbate were added separately. The blend was spread into 2cm layer and dried in a solar oven at 50˚C for 20 hours. The dried pulp was cooled, cut into rectangular bars and stored in plastic boxes at 30˚C and 75-80% RH for 6 weeks. The fruit bars were subjected to nutritional and sensory evaluations at weekly intervals during storage. Nutritional analysis revealed that there was a declining trend in ascorbic acid, total soluble solid and total sugar and an increasing trend in titrable acidity during storage. Fruit bar treated with potassium metabisulphite showed high retention of nutritional parameters such as 0.64% titrable acidity, 51.8 mg/100g ascorbic acid, 10.1˚Brix as total soluble solid and 25.1% total sugar at the end of the storage period. Sensory evaluation showed that the papaya fruit bar preserved with potassium metabisulphite had the highest overall acceptability compared to other treatments. Based on the results of this study, papaya fruit bar could be preserved using 1000 ppm of potassium metabisulphite for period of 6 weeks without any significant changes in the quality attributes.

Keywords: Chemical preservatives, Papaya fruit bar, Quality assessment, Shelf life.

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Utilization of Soymilk Residue for the Production of Nutritionally EnrichedHigh-Fiber Biscuits

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Soymilk residue is a by-product of soymilk and tofu production having a loweconomic value. It contains high protein and fiber as well as various minerals and phyto-chemicals. The objective of the present research studywas to substitute soymilk residue for wheat flour in biscuit production in order to enhance value of soy milk residue and increase protein and fiber content of the biscuits. The biscuits were prepared from blends of the wheat flour and soymilk residue. The different ratios of soft wheat flour to Soy milk residue used were 100:0, 90:10, 70:30 and 50:50 (w/w), respectively. The different biscuits produced were nutritionally analyzed. It was observed that all the samples contained desirable proportions of protein (12.9-30.6%), fat (0.83-2.16%), fiber (0.26-0.92), and digestible carbohydrates (38.8-67.6%). Protein, fat, fiber and digestible carbohydrate contents increased with theincrease in the amount of soy milk residue added. Sensory evaluation results indicated that all the biscuits had high sensory ratings for all the attributes evaluated. The sensory evaluation showed no significant ($p>0.05$) differences between the whole wheat flour biscuits and the 30% soymilk residue supplemented product in terms ofthe sensory attributes of aroma, internal texture, taste and overall acceptability, but differences were significant ($p<0.05$) in shape and crust texture. The result also showed that the biscuits substituted with 30% soymilk residue were the most acceptable ($p<0.05$) and its protein and fiber content increased up to 24.2% and 0.72%, respectively. Soymilk residue obtained could be utilized to substitute wheat flour up to 30% in the biscuits production to increase protein, fat and fiber content with high consumer acceptability.

Keywords: High-fiber biscuits, Nutritional enrichment, Quality evaluation, Soy milk residue.

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Evaluation of antibacterial activity of Sequential Soxhlet extracts of three types of Sri Lankan tea using the broth microdilution assay

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Tea is a beverage with medicinal properties, produced from the immature leaves of *Camellia sinensis*. Tea is categorized into black and green tea depending on whether it undergoes fermentation or not. Tea waste is produced during the black tea manufacturing process as a waste product. The objective of the present study was to determine antibacterial activity of extracts of black tea, green tea and tea waste of Sri Lanka against multidrug-resistant *Staphylococcus aureus* (MRSA) and *Mycobacterium smegmatis*. From the preliminary antibacterial assays black tea (grade BOP), tea waste and green tea (grade Fannings) were selected for this study. Sequential Soxhlet extracts were prepared using hexane, chloroform, dichloromethane, methanol and ethyl acetate as solvents. Broth microdilution colorimetric assay was used for the determination of minimum inhibitory concentrations (MIC). The range of the concentration of extracts which tested were 0.62 -10 mg/ml. Methanol was the best solvent which gave the best extraction yield in mg/ g 110.88, 146.08 and 68.68 for black, green and tea waste respectively. Extracts in methanol and ethyl acetate had higher antibacterial activities compared to extracts in hexane, chloroform and dichloromethene. The value of 2.5 mg/ml was the best antibacterial activity shown by the methanol extracts of green and black tea against MRSA. Methanolic extracts of the green tea yielded 2.5 mg/ml MIC value against *M. smegmatis* while black and tea waste yielded 5 and 10 mg/ml respectively. With the hexane and chloroform extracts, a few dichloromethane extracts and one ethyl acetate extract, MIC values were not obtained in the tested region (>10 mg/ml) due to low antibacterial activity. From tested samples, green tea was the best followed by black and tea waste for antibacterial activity against MRSA and *M. smegmatis*.

Keywords: Antibacterial activity, black tea, green tea, "factory discarded" tea, broth microdilution assay.

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Physico-chemical and microbiological quality of some consumer preferred plain set yoghurts sold in matara municipal area of Sri Lanka

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As yoghurt is a very popular food item, assessment of quality of commercialized yoghurt during storage in refrigerators is needed. Lack of data on quality parameters of different brands of yoghurt in Sri Lanka poses a risk on consumer safety. This study assessed the changes of physico-chemical and microbiological parameters during the shelf life of some plain set yoghurts sold in Matara municipal area of Sri Lanka.

Five different brands of plain set yoghurt with highest consumer preference were selected for the present study. From each brand, fifteen samples were collected and kept under refrigerated condition (4 °C) for the analysis. Those samples were analyzed for the physico-chemical properties (syneresis effect, pH, titratable acidity, total protein content, calcium concentration) and microbial composition (total plate count, total yeast and mould count) by using three replicates of each sample at 4, 7, 14, 21 and 28 days intervals from the production date and the results were compared with local and international standards.

All microbiological parameters and total protein content of all the five yoghurt brands were not within the permissible range for local and international standards. Only the titratable acidity was in the permissible range of local standards. Except calcium concentration, all the other physico-chemical parameters and microbiological parameters of collected yoghurt samples were changed with the storage time. Furthermore, this study revealed that physicochemical and microbial parameters are varied also among different brands of set yoghurt. The results of the study suggest to introduce to quality standard for set yoghurts and producers should motivate to follow standards.

Keywords: Physico-chemical and microbiological parameters, Plain set yoghurt

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Morphological variation among five *Kuru Wee* traditional rice accessions

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Five *Kuru Wee* rice accessions collected from plant genetic resources center, Gannoruwa, Peradeniya were characterized on the basis of 12 agronomic traits in a field experiment in *Maha* season 2013/2014. The aim of the study was to understand whether the selected *Kuru Wee* traditional rice accessions are significantly differed in their morphological traits from each other or not since they were distinguished with different accession numbers in PGRC catalogue. Ten days old seedlings of all the accessions were transplanted in rows with 15 x 20 cm gaps, according to a randomized complete block design, in triplicates, having 3 rows per replicate and 20 plants per each row. Plant height, days to flowering, number of tillers/plant, number of fertile tillers/plant, panicle length, panicle weight, filled grains/panicle, total grains/panicle, filled grain percentage, 100 grain weight, total grain weight/plant and biomass/plant were recorded according to the Standard Evaluation System for Rice. Harvest index was also calculated considering the biomass and grain yield. The data were analysed by principle component analysis followed by factor analysis using SPSS. Three principal components exhibited more than one Eigen value showed about 95 % of the cumulative variance. The PC 1, 2 and 3 showed 40 %, 29.1 % and 25.8 % variance for the traits respectively. Five *Kuru Wee* accessions were grouped into 4 clusters at 18 minimum distances. *Kuru Wee* accessions 3465 and 3982 were morphologically similar while three other accessions were significantly differed from each other. Existence of four rice accessions in *Kuru Wee* group is confirmed in the present study while accession numbers would be duplicated in 3465 and 3982. This must be confirmed by SSR markers.

Keywords: Accessions, Morphological characters, Principal component analysis, Traditional rice

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Extraction and Quality Evaluation of pectin from some fruit wastes in Sri Lanka

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The present study was to evaluate selected fruit wastes as a source of pectin. Pectin was isolated from fruit wastes (peel of mango, lime, passion fruit, jackfruit, sidaran, papaya, banana and pineapple, press cake of wood apple and golden apple and cashew fruit) and yield was evaluated. Based on high pectin yield, jackfruit (***Artocarpus heterophyllus***) and sidaran (*Citrus aurantium*) were selected for further analysis. The effect of different maturity stages of jackfruit and sidaran on pectin yield was studied.Chemical and physical properties and sensory analysis were done for pectin(s) obtained from jackfruit rind and, sidaran peel and the values were compared with that of commercially available pectin.

Sidaran peel had the highest pectin yield (3.00±0.06%) while golden apple press cake had the lowest (0.03±0.01%). Matured Stage of sidaran peel (3.00±0.06%) and jackfruit rind (1.65±0.10%) had highest pectin yield. Chemical properties including moisture (%), ash (%), pH, methoxyl content(%), equivalent weight, acetyl value(%), anhydrouronic acid (AUA) (%) and degree of esterification (DE) (%) of jackfruit and sidaran pectin were 10.15±0.80, 0.86±0.12, 2.80±0.03, 8.58±0.04, 746.61±19.59, 1.59±0.04, 62.69±0.29, 77.67±0.67 and 10.47±0.22, 0.86±0.11, 2.68±0.00, 6.26±0.06, 607.31±4.24, 1.94± 0.04, 50.33±0.52, 70.63±0.20 respectively. Physical properties including gel strength (%), gel color, setting time (s), setting temperature (˚C) and gel grade of jackfruit and sidaran pectin were 15.63±0.23, light brownish, 125.67±7.77, 67.33±2.08, 110 and 26.27±0.44, light greenish yellow, 184.33±2.08, 51.33±1.53, 90 respectively. There was no significant difference in texture, taste and overall acceptability of pectins extracted from jackfruit, & sidaran when compared with commercial pectin in jam ($p< 0.05$). Owing to these results, jackfruit rind and sidaran peel were rich source of pectin and jackfruit pectin can be classified as high methoxyl rapid set pectin and sidaran pectin can be classified as low methoxyl pectin.

Keywords: Fruit waste, jack fruit (*Artocarpus heterophyllus*), sidaran (*Citrus aurantium*), analysis, pectin

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Fungi diversity in the rhizosphere of selected rice varieties under drained and water logging conditions in the low country wet zone of Sri Lanka

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Rhizosphere is the soil adjecent to plant root system. It is a region of intense microbial activity where root exudates allow the development of microorganisms around the roots.

The objective of this study was to investigate the diversity of fungi in the rice rhizosphere of the low country wet zone of Sri Lanka under drained and water logging conditions. Water logging creates anaerobic condition in soil while the soils of drained paddy fields create aerobic condition. In this study, fungi were isolated from the rhizospheres of Bw 367, Bw 372 and Bw 272-6B rice varieties grown under drained and water logging conditions of paddy fields in the low country wet zone. The spread plate technique was used to isolate and purify all the isolates on Potato Dextrose Agar medium. A total of 41 fungal isolates were observed in the rice rhizosphere under drained condition**.** Out of these 41 isolates, 18, 12 and 11 fungal isolates were associated with the rhizospheres of Bw 367, Bw 372 and Bw 272-6B rice varieties respectively. Out of 32 fungal isolates recorded in the rice rhizozphere under water logging condition, 13, 08 and11 fungal isolates were isolated from Bw 367**,** Bw 372 and Bw 272-6B rice varieties respectively. Accroding to the results, fungal diversity of the rice rhizosphere depends on the rice variety and the aerobic or anaerobic nature of the paddy soil.

Keywords: Rhizosphere, Rice, Water logging

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Nutritional composition of Sri Lankan Finger millet (*Eleusine coracana*) varieties

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Finger millet (*Eleusine coracana*) is commonly cultivated and consumed in Sri Lanka since ancient times. Considering the scarcity of scientific information on Sri Lankan finger millet varieties (FMV), including their nutritional composition, this study was undertaken to quantify the proximate and mineral compositions of locally grown FMV, namely Ravi, Rawana and Oshada. Samples were collected from Field Crop Research and Development Center, Mahailluppallama. Moisture, ash, protein, fat, crude fiber and mineral (Ca, Mg, Na, K, P, Fe and Zn) contents were determined according to AOAC (2012) methods. Significant differences ($p<0.05$) in ash percentages were observed, ranging from 2.95 ± 0.04 to 3.22 ± 0.06. Protein, fat, crude fiber and total carbohydrate percentages ranged from 8.13 ± 0.13 to 8.74 ± 0.71, 1.40 ± 0.06 to 1.42 ± 0.07, 3.77 ± 0.19 to 3.84 ± 0.03 and 86.92 ± 0.78 to 87.24 ± 0.22 respectively, with no significant differences ($p>0.05$). Significant differences ($p<0.05$) were observed for Na, Mg, Fe, Zn and P contents which ranged from 10.26 ± 0.11 to 13.44 ± 0.01, 124.23 ± 2.46 to 161.34 ± 0.37, 3.29 ± 0.04 to 3.85 ± 0.06, 1.79 ± 0.02 to 1.96 ± 0.01 and 315.15 ± 4.17 to 336.79 ± 0.63 mg/100 g respectively, except for K and Ca which ranged from 404.31 ± 7.45 to 412.66 ± 5.75 and 340.32 ± 4.92 to 353.47 ± 1.44 mg/100 g respectively. These findings indicated that Sri Lankan FMV are good sources of protein, minerals and crude fiber when compared with rice.

Keywords: Finger millet, proximate composition, mineral contents

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Molecular identification of Citrus Tristeza Virus (CTV) and potential vectors in wet zone of sri lanka

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Citrus, comprising of mandarins, sweet oranges, grapefruit, limes and lemons are the most important fruit crops grown in Sri Lanka. Among virus diseases Citrus tristeza virus (CTV) causes drastic losses of yields. CTV belongs to the genus *Colesterovirus*, is a flexuous rod virus with dimensions of 2000 nm in length and 12 nm in diameter. Department of Agriculture has released few mandarin varieties. Among that "Indu" plays a major role in cultivation due to its more favorable characters. Identification of the vector of CTV for "Indu" is essential for the disease management. CTV infected "Indu" mandarin was indexed by direct antigen coating Enzyme-Linked Immunosorbent Assay (Dac-ELISA). Total RNA extraction was done by using silica fractionated method. CTV positive plant samples and the aphids which were fasted and fed with CTV infected leaves were amplified to Reverse Transcriptase Polymerase Chain Reaction (RT- PCR) by using reverse primer CTV_AR18R and for PCR, CTV_AR18F and CTV_AR 18R primers were used. These primers target polyprotein 18 gene of the virus genome. It was observed that optimum annealing temperature was 60^0C for both, plant samples and aphids. PCR products with approximately 570 bp were obtained on agarose gel. It showed that *Toxoptera auranti* is a potential vector of CTV in the wet zone of Sri Lanka.

Keywords: CTV, Dac-ELISA, RT-PCR

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Investigation of toxicity, proximate composition and antioxidant capacity of the leaves of "thebu", *Coctus speciouses* (Koenig) Sm

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Coctus speciouses (Koen.) Sm belongs to the family coctacea and is commonly known as "thebu" in Sinhala. The plant has been found to possess many pharmacological properties such as antibacterial, antifungal, anticholineesterase, antioxidant, estrogenic and anti-diabetic. Many investigations have been reported for chemical and pharmacological properties of the rhizome of the plants but very limited studies are available on the leaves of this plant. Therefore, this study was aimed to evaluate toxicity, analyse proximate composition and determine antioxidant capacity of the leaves.

Brine Shrimp Lethality Assay was carried out for aqueous extract of the leaves to determine any cytotoxicy effects and possible pharmacological effects of the leaves. Cytotoxicy was expressed in Lethality concentration and the results showed the LC_{50} of 3170 μgmL^{-1} for the aqueous extract of leaves. Standard procedures were followed to determine proximate composition and the results showed the presence of 67.9% of moisture, 11.9% of total ash, 9.7% of crude fibre, 3.7% of protein, 2.2% of lipid and 4.4% of carbohydrates in the leaves. Antioxidant capacity was determined using 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay and Ferric reducing activity power (FRAP) assay, and ascorbic acid was used as the standard. IC_{50} values obtained in DPPH assay were 730 $\mu g\ mL^{-1}$ and 40 $\mu g\ mL^{-1}$ whereas FRAP values were 23.3 mmol dm^{-3} and 880.5 mmol dm^{-3} for the leaves extract and ascorbic acid respectively. With this study it can be indicated that leaves extracts can be further evaluated for possible pharmacological activities, and that no significant calorific value and no high antioxidant power are associated with the leaves.

Keywords: Antioxidant, *Coctus speciosus*, proximate, toxicity

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Electrochemical behaviour of polythiophene films containing anthraquinone groups

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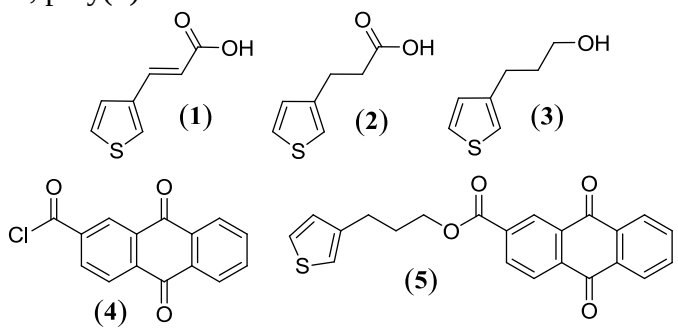
Electrochemical syntheses of conducting polythiophenes and polypyrroles received considerable attention. Unlike pyrrole based polymers, some 3-substituted polythiophene derivatives dissolve in common organic solvents. There are reports on preparation of 3-substituted polythiophene films and their applications such as field-effect transistors, chemical and biochemical sensors. 3-Substituted polythiophenes with long pendent redox groups in the polymer backbone act as electron transfer mediators. Electrodes modified with poly (pyrrole-anthraquinone) films catalyze the reduction of dioxygen. Therefore, it is of interest to examine the behaviour of its polythiophene analogue. In this communication, we report the synthesis of the monomer (**5**) and electrochemical behaviour of (**5**) and the resulting polymer, poly(**5**).



Perkin reaction of thiophene-3-carboxaldehyde with malonic acid gave 3-(3-thienyl) acrylic acid (**1**). Reduction of (**1**) with Na/Hg yielded 3-(3-thienyl) propionic acid (**2**). Further reduction of (**2**) with $LiAlH_4$ afforded the alcohol (**3**) as colourless oil. The acid chloride (**4**) was prepared by reacting 9,10-anthraquinone-2-carboxylic acid with thionyl chloride. The monomer (**5**) was obtained in good yield by reacting (**3**) with (**4**). Cyclic voltammetry of (**5**) showed two reversible peaks at E^o = –0.80 and –1.36 V. The electrochemical behaviour of poly(**5**) has been examined. These films were quite stable to repetitive scanning between 0 and –1.35 V. The neutral, hydrophobic poly(**5**) films show some resistance to swelling in acetonitrile media.

Keywords: Anthraquinone, Cyclic voltammetry, Electropolymerization, Polythiophene

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Comparative study on the sediment characters in selected seagrass meadows of Southern coast of Sri Lanka.

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Seagrass are the only marine angiosperm that adapted to the harsh marine environment. Sediments provide suitable substrate for the seagrass. Thus sediment characters are crucial factors which govern the growth and the distribution of the seagrass. Seagrass meadows are vital ecosystems which enhance the fish production as well as a tourist attraction. The facts finding sites were Ahangama, Dickwella and Dondra, located in the Southern coast of Sri Lanka which are famous for the fisheries and tourism. The species composition and the coverage of these seagrass meadow was estimated using Saitobe Atobe method (1970). Sediment sieve analysis was conducted and Total Organic Carbon (TOC) was measured using standard chemical methods. The highest seagrass cover was recorded from Ahangama seagrass meadow with three seagrass species, *Thalassia hemprichi* (33.39%), *Syringodium isoetifolium* (19.39%) and *Halodule uninervis* (7.78%). Dondra was the mono species seagrass meadow includes *Thalassia hemprichi* (24.63%). *Halodule uninervis* (54.21%) was the prominent species in Dickwella meadow with *Thalassia hemprichi* (4.79%). Fine sand particles showed positive correlation (r = 0.304) and the amount of mud particles in the sediments showed negative correlation (r = -0.049) with the species richness of the seagrass beds. Ahangama, Dondra and Dickwella observed high levels of fine sand. However, seagrass bed in Dondra revealed the highest amount of mud with high TOC. Therefore, research revealed that seagrass ecosystems are highly influenced by higher amount of fine sand particles and lower amount of mud with TOC. Hence, the seagrass sediments analysis is an appropriate method to measure the health of the ecosystem.

Keywords: Seagrass, Sediment

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Impacts of the *nursery bag colour* on mangrove growth at their nursery status.

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Replicate propagules (n=20) of three mangrove species were planted in black and transparent polythene bags filled with lagoon soil and were placed in open nursery beds supplying lagoon water once a day. The size of the bags, source and the volume of the soil in the bags, the source and the volume of water given for each bag were same for all the replicates while for each species, same sized propagules were selected. After 8 weeks, the stem weight, the stem height, the total height, the root weight, the total leaves weight, the total weight, the total root count, and the total root length were not significantly different between black and transparent polythene bags for *Ceriops tagal* and *Rhizophora apiculata* ($n=20$ $p>0.05$: Two sample t-test). However, *Rhizophora. mucronata* grown in transparent bags showed significantly lower values ($n=20$, $p<0.05$: Two sample t-test) for stem weight and stem height, (7.69±1.10g, 15.57±2.97cm, respectively) than those in the black bags (8.50±1.24g, 17.75±3.45cm, respectively). However, for the same species, significantly higher ($n=20$, $p<0.05$: Two sample t-test) root weight, (2.23±0.69g) was recorded in transparent bags than in black bags (1.82±0.39g). Among the used 3 species *R. mucronata* had the highest root biomass. Since the temperature in bag could affect the root growth of some species, the reduced root production of *R. mucronata* in black bags could be due to the negative effects of solar heat aggregated in the black bags. Thus, commercially available transparent bags seem more appropriate for the root growth of *R. mucronata*.

Keywords: Black, Mangroves, Nursery, Transparent

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Extraction of carotenoids from crude palm oil using silica based normal phase column chromatography

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Over several decades various methods have been used in order to recover carotenoids from Crude Palm Oil (CPO), which include saponification, selective solvent extraction, trans-esterification followed by molecular distillation and further purification by adsorption using synthetic resins, silica gel, reverse phase C18 silica, adsorption chromatography and membrane technology. However, it is found that the recovery of carotenoids from CPO is difficult, inefficient and at higher cost in most of the reported methods. In this research, carotenoids from CPO was successfully extracted by using normal phase column chromatography using commercially available silica gel as the adsorbent. Transesterification, saponification by 10% (w/v) methanolic KOH with and without solidification of fatty acids were used as chemical conversion methods prior to extraction. All three methods produced more than 90% carotene recovery. The highest carotene concentrates was achieved when 10% methanolic KOH was used for saponification. The optimum solvent system for the extraction of carotenoids from chemically altered CPO was found as 10% acetone in hexane. The characterization of the product was done by UV-visible spectroscopy considering the characteristic absorption bands at 448 and 472 nm for β-carotene. Here, it requires minimum amount of solvent for the extraction because the first elution component is carotenoid, which is an advantage compared to the above methods in terms of cost and time. Therefore, it indicates that the present method can be used as an efficient and economical way to recover carotenes from chemically altered crude palm oil.

Keywords: crude palm oil, carotene extraction, normal phase column chromatography

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Hypoglycaemic activity of *aponogeton cryspus* in normal rats

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This study investigates the oral hypoglycaemic activity of *Aponogeton cryspus* (kekatiya), an endemic protected aquatic plant commonly found in Sri Lanka. Fresh plant material was collected from two sources (Gampaha and Colombo districts) and pooled together. A combination of flowers with stalk (Combined F and S) of *A. cryspus* was boiled with water according to the conventional method used in Ayurveda. Different concentrations of the aqueous crude extract of Combined F and S were administered to healthy, overnight fasted Wistar rats (n=6 per group) at doses of 22.5, 45, 90 and 180 mg/kg. Rats were subjected to glucose challenge after 30 minutes and serum glucose concentration was determined two hours after the administration of the extract. The results showed that the extract possessed significant oral hypoglycaemic activity ($p<0.05$). Using a dose response curve, 90 mg/kg was identified as the maximally effective dose. Serum glucose reduction when compared with control group was 20.0%. Optimal time of action was investigated for Combined F and S using the maximally effective dose. Thirty minutes following administration of the extract, a glucose load (3g/kg) was given. Blood was collected 30min, 60min and 120min after the glucose load and serum glucose concentrations were determined. The highest reduction in the serum glucose concentration was observed 120 min after the administration of glucose. The hypoglycaemic activity of the crude aqueous extract of *A. cryspus* was found to be comparable to that of metformin.

Keywords: Aponogeton cryspus, Diabetes mellitus, hypoglycaemic activity, serum glucose

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Assessment of physical fitness of adolescent boys of Northern and Eastern provinces of Sri Lanka using AAHPER fitness test battery

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The aim of the study was to evaluate and compare the American Association for Health Physical Education and Recreation (AAHPER) youth fitness test scores of adolescent boys in Northern and Eastern Provinces of Sri Lanka. Adolescent boys of 14 years of age from North (n=400) and East (n=400) were randomly selected. AAHPER youth fitness test which included a 50 yard dash for speed, standing broad jump for explosive power, 1.5 miles run for endurance, sit-ups for abdominal strength, shuttle run for agility and pull-ups for arm strength were used. Cumulative score for the test battery was calculated for each participant. Results show that the scores were mostly below the 50th percentile in all fitness qualities assessed. It was concluded that the adolescent boys of Northern and Eastern provinces of Sri Lanka have poor physical fitness. Special fitness programs should be designed and implemented to improve the fitness of adolescent with poor fitness. National level common fitness norms should be constructed and standardized for fitness assessment.

Keywords: Adolescent, Fitness, Youths

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Anti-sickling property of selected fruit extracts

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Sickle cell disease is a genetic disorder and is a major health concern in many parts of India, Mediterranian and Africa. Sickling of red cell occurs due to the polymerization of mutant haemoglobin. As this being a disease commonly observed among the tribes or aborigines, they have developed ethno-medicinal practices to combat the disease. Based on the traditional knowledge, an attempt was made to verify the anti-sickling properties of certain commonly available fruits. Blood cells were obtained from sickle cell patients and the sickling of the blood cells was confirmed using the sodium-metabisuphite test. Aqueous fruit extract was prepared by homogenizing at a concentration of 10% (w/v) excluding the seed. To the sickle blood metabisulphite preparation, $5\mu L$ fruit extracts were added and observed for anti-sickling property. Controls were prepared by adding the fruit extract to normal blood metabisulphite preparation. Among the ten fruit extracts studied only *Rubes ellipticus* and *Solanum nigrum* shown to have anti-sickling property. *Rubes ellipticus* and *S. nigrum* are locally available common plants and are considered to have high medicinal property by the tribes dwelling in the Nilgiri hills. The result validates the usage of these plants and suggests detailed phyto-chemical evaluation to identify the active principle behind this and the mechanism of action.

Keywords: Anti-sickling, Ethnomedical practice, Phytochemicals, Sickle cell.

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First report of the presence of Haemoglobin D variant from the indigenous Badagas of the Nilgiris, Tamil Nadu, India

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Haemoglobin D (Hb D) is a haemoglobin variant mainly seen in the Punjab area of India and Pakistan and Xinjiang Uygur Autonomous region of China. Badagas are the indigenous peoples of the Nilgiri Hill in Tamilnadu, India. Though sickle cell was first observed in India from the Nilgiris, other haemoglobin variants were not yet reported. Present study reports the presence and co-existence of Hb D among the indigenous Badagas of the Nilgiris. The existence of Hb D was observed while assessing prevalence of sickle cell disease among various sub sects of the indigenous Badagas in the Nilgiris. Among 1800 samples analyzed, the disease was identified from a 50 year old sickle cell patient. The presence of the disease was confirmed by micro capillary analysis and the Restriction Fragment Length Polymorphism (RFLP) techniques. The normal case was confirmed by restriction digestion of 469bp amplified products to 201 and 268bp fragments, while mutant remains non-fragmented. The nature of the mutation was further confirmed by sequencing of the amplified product. The prevalence of this disease in India was estimated to 0.06% percentage only and the coexistence was reported is a rare clinical condition. Moreover, this is the first report of the existence of Hb D Punjab (also known as Los Angeles) and its co-existence with sickle disease in a southern Indian indigenous population raising many doubts in their origin.

Keywords: Badagas, Co-existence, Hb D Punjab, Sickle cell

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A study on life cycles of three Calliphorid fly species, *Chrysomya megacephala, Lucilia sericata* and *Lucilia cuprina* for the estimation of post mortem interval

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Calliphorid flies are the first to attack corpse, lay eggs on the openings and develops the evidence for medicolegal investigations. However, their use has been limited due to lack of species-wise thermo-biological profiles. In this investigation, duration of life stages of three Calliphorid fly species, *Chrysomya megacephala*, *Lucilia sericata* and *L. cuprina*, were determined in winter, summer and rainy seasons.

At first, Calliphorid flies were reared on the putrefied liver mixed with meat in cages under laboratory conditions. Identification of the flies was confirmed using taxonomic keys. Fly species were released separately in cages and allowed to lay eggs on the fresh liver-meat mixture. When maggots hatched, they were fed with the same mixture until the pre-pupal stage. The fully developed maggots stop feeding and moved to dry soil provided in the cages for pupation. The pupae were allowed to develop into adults in the same cages. Durations of life stages, temperature and humidity during the experimental period relating to three seasons were recorded.

The days required to complete the life cycle in summer, rainy and winter seasons for *C. megacephala, L. sericata* and *L. cuprina*, were 10, 14, 16, 9, 13 and 14 and 9, 14, 15, respectively. One day was required for the development of egg and Istinstar for all the species. A major difference was observed in pupation period during the three seasons. Warmer climate accelerated the rate of development. Temperature plays an important role in the development of these fly species. Hence, thermo-biological profiles are needed to be developed for different species of Calliphorid flies for accurate PMI determination.

Keywords: Calliphoridae, Forensic, Post mortem interval

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Knowledge-base approach for finding optimal series of reactions for organic compound conversions

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This paper aims to identify a suitable approach to find various possible paths to perform organic conversions, and to find an optimal path among them. For that this paper describes about the knowledge-base approach under three sections. They are; representing different organic compounds in the knowledge-base, representing different organic reactions in the knowledge-base and evaluating different searching strategies to find the conversion paths. Finally this paper proposes general logical representation mechanisms for different organic compounds and different organic reactions. Also experimental results show that the performance of the system depends on the number of rules in the knowledge-base, type of the reactant and the number of steps for the conversion.

Keywords: Alkyl Groups, Functional Groups

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Electrical Characterization of Cu_2O and Cu_2S layers deposited by electro-deposition method

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Cuprous oxide (n-Cu_2O) and copper sulfide (p-Cu_2S) layers were deposited on indium tin oxide (ITO) substrates using electro-deposition method. Also copper sulfide layers were deposited on cuprous oxide layers to form p-n junctions. Here, three-electrode electrochemical cell consisting of working electrode (WE), counter electrode (CE) and the reference electrode (RE) was used with the help of a potentiostat (HD HOKUTO DENKO HB – 301). In the deposition bath, 0.1M $NaOOCCH_3$ and 0.01M $CuSO_4$ solutions were used. The glass plate was used as the working electrode (WE), the platinum plate was used as the counter electrode (CE) and the doubled chamber saturated calomel electrode (SCE) was used as the reference electrode. Hot plate with a magnetic stirrer was used to maintain constant temperature of 60 $^{\circ}$C inside the deposition bath. The deposition voltage was -0.2V with respect to SCE. The electro-deposition was carried out for 45 minutes. The Cu_2O films were annealed at 200°C in air for 15 minutes. Electrical properties of the above layers were studied using current-voltage (I-V) characteristic measurements. The current-voltage characteristics of the as deposited and annealed n-Cu_2O layers on ITO substrates were compared. It was found that the annealed Cu_2O layers produce higher current than that of the as deposited Cu_2O layers deposited by electro-deposition technique.

Keywords: Current, Electrochemical, Electro-deposition

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Use of Online Search Tools for Locating Information Sources: A Pilot Survey at the Faculty of Science, University of Ruhuna

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In this information age, it is very much difficult to locate comprehensive, relevant and unbiased information. Selection of the search tool is an essential step in the search process for locating relevant research literature. Objective of this research was to assess the information-seeking patterns of academic staff members at the Faculty of Science, University of Ruhuna, with reference to their selection of online search tools. Study used a pre-tested structured survey questionnaire to collect data. Response ratio was 63%. Collected data were processed and analyzed using SPSS and Microsoft Excel.

According to the respondents, general search engines (80.6%) were more popular among academic staff members than journal databases (66.7%) and Online Public Access Catalogue (OPAC) (50 %). Only 5.6 % of the respondents were using Meta search engines and Subject gateways. Pearson Chi-Square test showed that there was a statistically significant association between use of search engines and online journal databases (χ^2=0.355, P=.551); and between use of search engines and OPAC (χ^2=0.177, P=.674). According to the results, there was no statistically significant association between teaching and research experience and selection of searching tools; online journal databases (χ^2=3.112, P=.375); OPAC (χ^2=1.267, P=. 737); and search engines (χ^2=4.026, P=.259). The survey showed that general search engine users were more likely to select databases and OPAC as a search tool. In conclusion, low use of online journal databases, subject gateways and OPAC for locating research and teaching information, demonstrates a need for meaningful promotion of online resources for locating reliable information and providing training to adapt to best utilize online information.

Keywords: Databases, Human computer interaction, Online searching, Search engines, Search process

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An android based disease identification system for farmers in Sri Lanka

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Agriculture is one of the major industries in Sri Lankan economy. However, the farmers in Sri Lanka face many problems with respect to information delivery from agricultural experts to rural farmers. There is no proper mechanism to obtain the agricultural information for their farming activities. One of the main issues they faced is lack of available information on identification of diseases/pests and treatments for them. Nowadays, we can see that most of the farmers are using smart phones and also few mobile-based applications are available for some aspects of agriculture, for example, to view and receive market prices and news in agriculture. In this study, we have proposed an android based disease identification system to help farmers as well as Agriculture Instructors (AIs). Through this system, farmers can identify the disease or pest attack in their farm and also suitable control methods and its usage based on the disease/pest. The interfaces of the mobile-based application are designed by considering the user-friendliness of its interfaces. The developed prototype system is validated internally using sample data and also checked the user satisfaction by getting the feedbacks from domain experts. The system was refined based on the feedbacks. This application is now available in English language and we have planned to develop it in Sinhala and Tamil languages in future.

Keywords: Agriculture, Mobile-based Application, Disease and Pest Control, Interface Design

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Electricity Consumption Patterns in Households in selected regions of Sri Lanka

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The electricity consumption patterns of 61 households selected from Matara, Anuradhapura, Rathnapura, Nuwaraeliya and Kaluthara were studied using the monthly meter readings and calculating the energy consumption of equipment using their power ratings. Data were collected from each household using a questioner filled by undergraduates through discussions with residents and monitoring. The software package "MINITAB" was used for the analysis of data.

About 90.2% of households use less than 120 kWh of electricity per month in a household of average four residents and average monthly usage of all 61 households is about 72 ± 5 kWh (93 kWh and 39 kWh with and without refrigerators). A significant fraction of energy is consumed (51 ± 3 kWh or 55%) by refrigerators. By selecting refrigerators with lower capacity (100-200 L in compared with 200-300 L) and defrost technology could save about 9% and 18.5% of energy consumption, respectively. Opening the door less number of times (less than 5 times a day in compared with 15 times) could save significant amount (17 %) of energy consumed by refrigerators. Keeping the refrigerator filled only with necessary things helps to reduce the wastage. Some consumers save about 33% of energy consumed by refrigerators by keeping them turned off 9 hours in the night time. LED TV could save about 26.6% of energy used by a CRT TV. Replacing all incandescent lamps in a household by CFLs save about 63% of lighting energy, however in the sample studied 35% of lamps used are still incandescent. Fans (10.3 kWh, 14.3%), Televisions (8.2 kWh, 11.4%) and Rice Cookers (7.5kWh, 10.4%) use more monthly electricity in compared with other household appliances in the sample studied, which has no Air Conditioner users. The study shows that there is a possibility to save significant amount of electrical energy used in a typical household.

Keywords: Household Electricity Consumption

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Improved greedy approach for travelling salesman problem to be used as a teaching tool

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The travelling salesman problem (TSP) is a NP-hard problem in combinatorial optimization. A solution to this problem can be successfully used in touring airports to find shortest routes through selections of airports in the world. The travelling salesman problem can be solved by using ant colony optimization, genetic algorithms, simulation annealing, etc. However, these approaches require advanced data structures and they are hard to implement using simple programming languages such as php and javascript. Furthermore, these conventional approaches use advanced mathematical concepts which cannot be understood by researchers without strong mathematical background. The greedy approach can also be used to find an approximation to the shortest route. The greedy strategy follows the heuristic that at each stage, visit an unvisited city nearest to the current city. However, the pure use of greedy algorithm may fail to produce optimal solution and get stuck in a suboptimal solution. The objective of this study is to provide a solution to overcome this drawback in the greedy approach in solving the travelling salesmen problem. First, the route is found using greedy approach. Then the route is modified at appropriate positions so that the length is reduced. The benefits of the proposed solution are threefold: (1) it reduces the use of computational resources and gives better results than using the pure greedy approach; (2) it uses the array data structure which can be easily implemented by using any programming language; (3) it can be easily understood and modified by researchers from non-mathematics background.

Keywords: Computational Geometry, Computer Graphics Programming, Euclidian Geometry, Greedy Approach, Travelling Salesman Problem

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Determination of surface tension of water and interfacial tension of water-kerosene interface by light diffraction

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Light diffraction by capillary waves, generated on the surface of a liquid is a very precise and none destructive method of finding the surface tension and other related physical parameters. In this research diffracted laser light patterns formed by the generation of surface capillary waves were used to find the surface tension of distilled water and the interfacial tension between thin kerosene films floating on distilled water as a function of film thickness. A pin attach to the diaphragm of a speaker was served as the exciter to generate surface capillary waves by the center of a dish which was filled with distilled water up to a certain level. A semiconductor laser (wavelength = 660 nm) was used as the coherent light source for the experiment. The diffracted light from the liquid surface was obtained on to a distant vertical wall, which served as the screen for the experiment. The diffraction patterns were observed by changing the oscillating frequency of the exciter pin. Obtained value of surface tension for distilled water was recorded as (0.0766 ± 0.0015) Nm^{-1}. By adding known amount of kerosene and following the same procedure the interfacial tension was calculated for several thicknesses (0.07, 0.14 and 0.21 mm) of kerosene film as 0.0470 ± 0.0022, 0.0404 ± 0.0025 and 0.0362 ± 0.0010 Nm^{-1}. The sudden drop in interfacial tension even for a slight kerosene film is observed and further study of film thickness against interfacial tension is proposed to model the effect of kerosene on natural water resources.

Keywords: Interfacial tension, Light diffraction method, Surface tension.

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Effect of extra work and variations to the project cost: empirical evidence from Sri Lankan road construction industry

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Extra work and variations are two most important concepts that closely related with construction industry. At present extra work and variations is a common incidence happening in the construction industry. Simply Extra work and variations can be understood as any other work other than that has mentioned at Bills of Quantities. Extra work and variations may occur due to various reasons. It is obvious it will directly effect at Project cost. Expenses and Time are the main reasons that have to be considered in a construction project. If more time has to be spent on extra work and variations, it may be a definite disadvantage to the overall project cost. To minimize extra work and variations is very important for large scale projects as the project risk is also high. Hence finding the root causes for these two anomalies is much important to the construction industry. The factors which will be investigate can be used to take preventive measures in minimize these two variables even though this problem cannot be kept at the zero point.

Keywords: Bills of Quantities, Extra work, Project Cost, Variations

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