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About Institute of Biology, Sri Lanka

Incorporated by the Act of Parliament No. 22 of 1984, the Institute of Biology, Sri Lanka (IOBSL) is the premier organization for Biologists in Sri Lanka where it brings together a membership of professionals engaged in research and teaching in biology and related subjects. It was founded in 1981 and over the years IOB has accumulated over 600 corporate members.

Institute of Biology is the authorized body to award the Chartered Biologist status to biologists who adhere to best practices and ethical conduct in the discipline and who has a proven track record of significant contribution to biology in its wide array of subspecialties. The membership of IOBSL is engaged in various activities related to biology and directly impact the country's economy and human capital development.

The objectives of the institute are:

1. To promote and advance the science of biology and its applications in Sri Lanka
2. To advise the government, and give counsel to public corporations, local bodies and other institutions on all matters connected with the application of biology to the progress and development of the country.
3. To promote acquisition, dissemination and interchange of biological knowledge by providing a forum for the presentation of original communications and discussions and maintaining libraries which publish matters of interest to the profession of biology.
4. To promote education in biology at all levels.
5. To promote, encourage and foster original research in biology.
6. To ensure the maintenance of high standards in the professional activities and the general conduct of its members.
7. To establish liaison with other scientific organizations
8. To establish and enhance the status of the profession of biology in Sri Lanka

Membership

Institute of Biology has a membership of more than 600 in its different membership categories working in industry, research, education and healthcare. Corporate membership consists of full members, chartered members and fellows. Life membership is awarded to individuals who possess a postgraduate degree in any field of biology.

Being the only institute with the authority to award chartered biologist status (C. Biol.), IOBSL awards chartered membership to scientists who have demonstrated high standards in research and teaching with a proven track record. The designation 'Chartered Biologist' endorses the high standards expected of biologists and is for international recognition as a hallmark of professional competence and ethical conduct. Furthermore, the institute accredits the chartered member for the ethical practice and competence in undertaking tasks related to the specialized area of expertise. IOBSL has guidelines for the conduct of a chartered member where strict adherence to such is mandatory to continue the status of the chartered biologist.

Within the 7 categories of membership, fellowship of the institute is awarded to scientists who have demonstrated exceptional services to the scientific community and general public in a specific area of biology.

IOB Journal

To widen the reach of IOBSL to the scientific community and with the objective of disseminating knowledge, IOBSL has launched a peer reviewed scientific journal. Sri Lankan Journal of Biology (SLJOB) publishes high calibre research articles, rapid communications, and review articles in many disciplines connected to biology. It is published twice a year after a rigorous peer reviewing process managed by an editorial board of leading researchers in Sri Lanka. In order to minimize the carbon footprint, SLJOB is published as an online journal. SLJOB is working towards being an indexed journal of recognition to promote and attract high quality research work.

Activities

The institute organizes workshops/seminars on current topics related to biology on a regular basis. It also plays an important role in biology education to a wider spectrum of participants ranging from those in the industry, those seeking self-employment, school children and general public. Details of events are posted on the IOB website. The institute website also gives information and advice on choosing a career in the biosciences for school children. The information provided on the web also keeps teachers informed on current events in the field of biology.

The Biology Olympiad Competition organized solely by the Institute of Biology is a hallmark event in the country which provides opportunities to students in Sri Lanka to become champions in biology both locally and internationally. Over 5000 students compete from all over the island at seven exam centers covering all provinces where they are assessed for gold, silver and bronze medals and certificates of merit. Winners of the national biology Olympiad are trained and prepared for the international biology Olympiad. IOBSL is proud to have supported the numerous students who have won medals and certificates representing Sri Lanka at the International Biology Olympiad.

The annual session provides a forum for both senior and junior biologists to present their research findings for a complex audience of scientists, policy makers and implementers. It is being continued for the 36th time this year. Most of the findings reported have direct impacts on taking policy level decisions in development of Sri Lanka and improving the wellbeing of the people. Annual scientific sessions provide biologists a platform to communicate and make valuable collaborations to further science in Sri Lanka.

Every year IOBSL undertakes programs to educate and engage communities to empower them. Expertise extended to “Vidatha” program to empower SMEs in rural communities is one such example. Furthermore, the workshops organised for organic agriculture, to educate about pollinators, and best practices in coconut farming has given knowledge and raised awareness in communities to make the best scientific judgements in their day to day practices. IOBSL continues to carry out these programs with the collaboration of corporate sector to liaise and extend their services to the community.

IOBSL continues to be the apex body for biologists, engaging and empowering them to uphold the ethical values, disseminating knowledge and developing the science for the future generations.

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PRESIDENTIAL ADDRESS

Frontiers in Biology

Inoka C. Perera, PhD, M. I. Biol

We live in an era where the boundaries between traditional disciplines are fading away. In biology, disciplines like Zoology and Botany are becoming more restricted to accommodate the burgeoning changes. Biology has become more of an exploratory science and more applied in nature with many tools to work with. This change is not only in research but also in pedagogy. Running in parallel to advances in biology is the only way that we, as a country of intellect, can uphold our status.

In such a changing global landscape, where does this island of ours stand? What are our hopes for the future and how could we stand high in contribution to the frontiers of biology?

Changing face of Biology

When molecular biology came into its formal existence in the 1930s, a number of disciplines including, biochemistry, organic chemistry and macromolecular crystallography had conglomerated in order to provide the tools in developing a subject which stands on its own today as a fundamental science in biology. It provides tools as well as the perspective to understand some of the classical subjects such as organismal, evolutionary, developmental, systems and immuno-biology. Hence the addition of "molecular" in front many of these disciplines is driving them away from the traditional perspectives and uniting the subjects at a different level.

This is inevitable along the lines that practices in science started moving away from descriptive to experimental a hundred years back and current times mark an epitome. We now have tools and knowledge to see the unseen side of biology. With the development of molecular biology, understanding of functional mechanisms underlying the gross observations have surfaced and the research in biology has largely skewed towards using molecular tools in explaining biological phenomena. From simple gel electrophoresis to macromolecular crystallography, the tools have branched in multi dimensions. Since science is always relative to the tools we have in hand to dissect nature, development of more sophisticated tools and innovative use of existing tools would lead to advances in science. The exponential growth of technology is providing scientists with improved accuracy and precision both in laboratory and in the field.

With the development of macromolecular crystallography, the biological building blocks are seen under a new light. Proteins, nucleic acids and their interactions are looked at with increasing accuracy and precision. When protein structures are in hand, they provide

molecular level resolution which shows the intermolecular forces that determine its conformation and function. Furthermore, the conformational changes upon interaction with small molecules, nucleic acids or other proteins can be clearly demonstrated. With advances in NMR spectroscopy, solution structures and their behavior could be observed under different conditions. Even the molecular mechanisms underlying enzymatic action can be now seen with high precision. These studies pave the path to identify the molecular mechanisms of interactions and serve as a guide for further investigations.

The following sequel exemplifies how such techniques were used in parallel with many classical techniques to dissect an interesting molecule and how that lead up to a path for new innovations.

Ligand responsive members of the MarR (multiple antibiotic resistance regulator) family of transcriptional regulators control a number of biological pathways in bacteria. They are involved in the regulation of biosynthesis of virulence factors and catabolism of environmental aromatic compounds, and many MarR homologs respond to antibiotics and oxidative stress. HucR, a transcriptional regulator from *Deinococcus radiodurans* was first described by Wilkinson *et al* in 2004 and the crystal structure was resolved by T. Bordelon *et al*. in 2006, which described its folding in fine detail. The two elegantly oriented DNA binding domains could perfectly fit tandem major groves without distorting the DNA strand at a site upstream of its own gene. There are two histidine imidazole rings stacked at its dimer pivot point which described the mechanism by which it becomes pH sensitive in its DNA binding.

When a co-crystal structure of HucR with its ligand Uric acid was not materializing, the binding pocket and contact residues were identified with *in silico* techniques. The above demonstrated that uric acid is held in the identified inner binding site with Trp20, Arg80, and Asp 73 residues and upon binding, the displacement of arginine 106 which anchors the DNA binding helix confers to its dissociation from the cognate DNA. A series of systematic mutational studies reveal the relevance of this model of interaction.

Most interestingly these identified residues are conserved in a number of other MarR family transcriptional regulators which lead to describing a new sub family of MarR homologs responsive to urate, UrtR (urate responsive transcriptional regulators). In further studies, validating this classification of proteins with and without UrtR signature were challenged with uric acid confirming the existence of this sub family of proteins. One such example of an UrtR is *Agrobacterium tumefaciens* PecS which controls pectinase synthesis for plant invasion.

Several years later HucR resurfaced with potential therapeutic and molecular biological applications from research groups all over the world. Amongst them were hydrogels to detect pathological concentrations of uric acid in blood, synthetic circuits to downregulate blood urate levels and uric acid inducible plasmids for protein synthesis.

What we need to understand from this series of research revolving around HucR is that when it was first identified and characterized, it was for the sheer interest of a research group and was largely unknown to the scientific community. It was identified in a quest to understand the extreme radiation resistance of *D*. *radiodurans*. However, it reached the limelight with the demonstration of its potential applications. Without basic researchers establishing the groundwork, no applied research would take place. Hence the emphasis on basic research must be taken seriously if a country needs to develop a research culture.
As mentioned earlier, the dissolution of boundaries of biology has given rise to many new disciplines. One such contemporary branch is synthetic biology which stems from blending the principles of biology with the fundamentals of engineering, such that it provides biologists a platform to apply their knowledge in engineering biological systems and engineers to engage in the most complicated machinery of biology. It provides a playground for innovation where standard tools and space to invent is available for scientists from many different fields. The later development of HucR usage in biological circuitry provides an on-off switch that responds to urate in the surrounding. A similar principle can be applied in circuitries built to identify environmental levels of toxic compounds. Since some of these transcriptional regulators, particularly in the MerR family, are responsive to minute amounts of ligands, they can be used to build systems for early detection of toxic pollutants in the environment and in humans in the form of biosensors.

Due to the increasing frequency of antibiotic resistance developed in bacteria, novel drugs and drug targets are vital. Antibiotic drug target discovery is moving towards more specific targets in the current era. Since some of these transcriptional regulators are specific in controlling a single gene and some are global regulators of bacterial physiology, they can potentially be used as drug targets. Using these transcriptional regulators, a novel avenue was conceptualized to investigate these transcriptional regulators as drug targets. To test this hypothesis, two transcriptional regulators from *Mycobacterium tuberculosis* and one from *Pseudomonas aeruginosa* were selected. These transcriptional regulators are from distinct families, GntR and MarR, but they are small molecular responsive in nature. This work would be a proof of concept for the exploration of transcriptional regulators as drug targets.
With the development of nanotechnology new opportunities have emerged for biologists. Nano-biology, nano-biotechnology and nano-toxicology are emerging as new subject areas. New avenues of research have opened up for biologists where they can utilize these tools to rethink biological processes. Most research in this area is aimed at developing new drug

candidates and targeted drug delivery. Some have explored the production of novel nanomaterials with microorganisms.

It is evident that frontiers of biology emerge from interdisciplinary research where it opens up new avenues and tools for biologists to explore. Thus, keeping an open mind about trends in biology and developing free thinking is pivotal for the progress of biology.

Biology Education

Since the inception of formal science education in Sri Lanka, science was taught like any other subject, only emphasizing on providing information. This approach has grossly neglected the core set of competencies science education should provide. Among many competencies identified today, critical thinking, problem solving, analytical thinking and technical skills are identified as the core competencies. Though many education systems worldwide realized this deficiency, change reached our education much later. Due to the fact that only about 16% of students in the student population could reach state universities, the fierce competition has lead the education system to neglect the value of science education as a whole. Unnecessarily complicated and lengthy syllabi surface solely as a filter to select the students into higher education through standardized testing. This numbs the drive to learn in students which is evident in students in higher education institutions. To bridge this gap, certain patch work was done, such as introducing research projects in school curricula, which is a failure in its execution.

It is time to have a holistic look at our science education and come up with an approach to reach the core competencies when a student exists from the formal education system. The unhealthy competition should be reduced with community education and educating students about the many career paths that they can take and that any one of them would take them to heights they expect. It is exciting to see that over the past few years a positive wave of changes have infiltrated in the midst of many barriers. After many rounds of curricular revisions in primary and secondary education, we now see a change towards developing their inquisitiveness in science. This is the drive that should be inculcated in the students in order to see a progress in science in Sri Lanka. School education should not kill the creativity in students but should celebrate and encourage creativity at all times to let their imagination flourish.

Teaching of science and science of teaching are being developed in parallel where some of the traditional ways of teaching may be restrictive to the learning process of new concepts. Problem based learning and inquiry based learning can make students think critically about the process of learning and make them active lifelong learners. Aid of audio visual tools, animations, online tools and even social media networks can be used to make students understand and create a dialog on science. One must be competent enough not to be enslaved

by technology or traditional methods, but to strike a balance between them for an optimum delivery. Thus, proper teacher training is vital to advance the learning process.

Where does Biology stand in Sri Lanka?

Biology is conceived as the most sought-after subjects by science students. More than 50% of science students follow biology for their advanced level examination hoping to get through to medical education. With that notion, sadly the emphasis for biology as a subject is left behind as most of them pursue many different career paths unrelated to biology. Although it is expected in any education system, what is lacking here is that those who do not get selected for the professional degree of medicine do not walk with accepted skills a science student should possess. Careful intervention is needed to curb this situation to uplift the future of biology education in Sri Lanka. After all biology education should be based on learning the science of what is happening around and inside you.

Emerging opportunities in the field of biology with the establishment of pharmaceutical, industrial, technological and research institutions should be popularized among the population and it should be emphasized that these opportunities are ample even outside Sri Lanka for students to excel.

Sri Lanka is a hotspot for field researchers. Within a small space a high richness in habitats, ecosystems and species make ample avenues for field biologists to root their research. In fact the majority of research published by Sri Lankan biologists are based on natural resources. Such richness should act as breeding grounds for field biologists in Sri Lanka and it is encouraging to see a new generation of field biologists immerging with a passion for field work. There is a lack of guidance for the young field biologists and the valuable data that they collect, rarely get translated into research publications. In science, what is not published was never done. These passionate youngsters must be guided and encouraged to explore the richness of our motherland.

Majority of Sri Lankans get their information from the media. Since there is “no” science journalism and science never reaches mainstream media, it has low appeal among the people. It is important to develop dialog in science as it unites people and improves their awareness. Since after the ordinary level exam, some students never get exposed to science and others never get exposed to humanities and arts, students should be exposed to both ends at least at university level to get them fulfilled with life competencies.

The attitudes towards biology need a radical change so as not to think of biology as a vehicle to reach some other destination but to appreciate it for its own merit. When the societal insular thinking change and our education system starts respecting the individuality of the students our country could take great leaps in science.

No innovation will happen without taking a risk

With adulthood, what we lose is the ability to accept failure. No innovation would happen without being ready for failure. In developing countries, funding for research is governed by direct economic benefits of the expected outcomes such that basic research is relatively less encouraged. One can never predict turns that basic research can take in the long run as I have discussed before. Seemingly unimportant findings bring up revolutionary changes whereas what is highly publicized can become an obsolete dead end. Engaging in biological research in developing countries like Sri Lanka is a challenge. For a research scientist to start a career is a daunting task amongst un-supportive infrastructure and in a non-research oriented culture which leads to inevitable brain drain. An intellectual's most valued asset is freedom of thinking. Frontiers in biology emerge from trusting and strengthening the freedom of thinking. I am hopeful that Sri Lanka would significantly contribute to the development of biology in a global scale where IOBSL would be a forthcoming partner in the quest of making it a reality.

FELICITATION OF
EMERITUS PROFESSSOR H. P. M. GUNASENA

Citation Presented by
Dr. Keerthi Mohotti *F. I. Biol. SL, C. I. Biol. SL.*
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It is indeed a great honor and privilege for me to present this felicitation note at this august gathering of biologists today, to honour Professor H.P.M Gunasena**,** Emeritus Professor, University of Peradeniya, my dear teacher, who is widely known for his substantial national and international contributions made in academic and research fields. He is an eminent scientist, excellent academic, experienced administrator, who counts for wide experience in agricultural education and research, practical knowledge in agricultural research management, resource allocation, programme budgeting, monitoring and evaluation, human resources development and fund raising for over 50 years. More importantly, he is considered as a local ambassador in the field of biology who has been influential in linking foreign agencies, donors, professionals, experts, private sector, government and non-governmental organizations to bring biological sciences in to practice. His investments count today with over thousands of postgraduate holders in universities, agriculture and plantation crop research institutes, initiation of infrastructure facilities and further developments in the fields of biology, agriculture, medicine and veterinary in addition to several publications in reputed journals

Professor H.P.M. Gunasena hails from a reputed farming family in Pannala North Western Province and was born on the 13th January 1937**.** He had his primary education at the

Pannala School, and then moved to Dharmaraja College in Kandy for his secondary education, where he had a very successful career, both in studies and sports. Prior to entering the university, he led the school as the College Captain. He earned his B. Sc Agric. (Hons) degree from the University of Ceylon. Then he joined the Faculty of Agriculture, University of Peradeniya as a Temporary Assistant Lecturer in Agriculture in August, 1962, and entered the permanent cadre of the then University of Ceylon as a Probationary Assistant Lecturer in Agriculture in December, 1963. He earned his Ph. D. in Crop Physiology from the University of Reading, UK. After successful completion of the Ph. D. degree, Professor Gunasena was appointed as a Lecturer in Agriculture in May, 1969 in the then Faculty of Agriculture and Veterinary Science and was promoted to the post of Senior Lecturer in Crop Science of the Faculty of Agriculture, University of Ceylon (Peradeniya Campus), with effect from May, 1975. Due to his superior academic performance both as a teacher and a researcher, he was promoted on merit as an Associate Professor in Crop Science in December 1975. He became a Professor in Crop Science in February, 1982 and Senior Professor in August, 1992. He retired from active service from the University of Peradeniya in 2002. Yet, he continues as a visiting lecturer of the Post Graduate Institute of Agriculture, Peradeniya in teaching his devoted subject of research writing.

Professor Gunasena has contributed tremendously to local and global agricultural education and research. He has authored over 275 research publications and scientific communications in agricultural research and education. Many of these have been published in international refereed and indexed journals and reflect their use in citations of other scientists. He has authored 30 text books on agriculture and related subjects. Some of these books are published locally while a few were published by foreign agencies. One of the books written in Sinhala, "Field Crop Production" won the Governor General's award for the best scientific publication in 1974. Recently edited books by himself such as 'Weligama Coconut Leaf Wilt Disease', 'Coconut Based Farming Systems in Sri Lanka', 'Organic coconut cultivation' and 'A guide to the preparation of research proposals' also received wide acceptance by both academics and practitioners. He has edited 60 proceedings of workshops/ conferences which serve as updates for researchers, policy makers and the public. He is also the Editor-in-Chief of the National Agricultural Society of Sri Lanka (NASSL) for the past 30 years. He holds membership of nine national and international professional associations.

Professor Gunasena served in many important administrative positions in the University system. He served in the capacity of the Head, Department of Crop Science, Faculty of Agriculture, University of Peradeniya, then, as the Dean, Faculty of Agriculture, University of Peradeniya. He was the Rector of the Wayamba Campus, University Proctor, Acting Deputy Vice-Chancellor, Director, Post Graduate Institute of Agriculture (PGIA), University of

Peradeniya, member of the University Grants Commission (UGC) and the Chairman of the Standing Committees on Agriculture and Veterinary Medicine and Animal Science and Postgraduate Education and Research of the UGC.

Professor Gunasena has held many prestigious national positions such as member of the Board of Governors of the Agrarian Research and Training Institute, Tea Research Board, Sugarcane Research Institute, Pelwatta and Hingurana Sugar Companies and National Institute of Plantation Management (NIPM), member of Consultative Committee on Research (CCR) and Scientific Advisory Committee (SAC) of the Tea Research Institute, National Coordinator of Highland Agriculture Development Network, and National Multipurpose Tree Species Network, Chairman of the Research Committee on Agriculture and Forestry of the National Science Foundation (NSF), Director of the University of Peradeniya-Oxford Forestry Research Institute Forestry Link Project and many other societies and advisory bodies of the Sri Lanka government. He has served as an Advisor to Minister of Agriculture from 2008 – 2009 and work involved developing grass root level programmes on seed production and distribution, farming systems development and promoting organic farming among rural farming communities to improve their social-economic wellbeing to reduce hunger and malnutrition and alleviate poverty.

In recognition of his exceptional services to the field of agricultural education and research, and noteworthy contribution to the establishment of new universities such as Uva Wellassa, Rajarata, Wayamba and Sabaragamuwa in the early 1990s, he was awarded three Honorary Doctorates (D. Sc.) from the Rajarata, Wayamba and Sabaragamuwa universities in 2003, 2004 and 2007 respectively.

At the national level, Professor Gunasena played a key role in formulation of the first ever Agricultural Research Policy of the Sri Lankan Government in mid-1990's, and functioned as the Chairman of the General Committee appointed by the then Hon. Minister of Agriculture. Professor Gunasena served as the Executive Director of the Council for Agricultural Research Policy (CARP) of Sri Lanka from 2002-2007.

He was the Chairman, Coconut Research Board of Sri Lanka from 2009-2015 where he was instrumental in redesigning the research agenda of the Institute (CRI) with the participation of coconut smallholders and private industry personal. He commenced international clinical research projects on health benefits of coconut products with special reference to neurologically degenerative diseases such as, Arthrosclerosis and Alzheimer's, which are currently coordinated by the Asian and Pacific Community (APCC), Jakarta, Indonesia. He

developed International links with ICRAF for coconut based agroforestry development to increase the productivity and profitability of smallholder coconut farmers. The links with Ministry of Agriculture and Cooperatives in Tanzania, Ministry of Agriculture, Republic of Cuba and the Coconut Research Institute, China were established to strengthen R&D of coconut. He also developed an International Training Manual on coconut production and processing, which is currently considered by the Asian and Pacific Coconut Community (APCC) for implementing in the coconut growing countries of the world.

He developed international links with several international research centers such as World Agroforestry Center, Kenya for agroforestry development, Indian (ICAR) and Nepal (NARC) councils for agricultural research to foster R & D. He also functioned as the National Coordinator of two foreign funded development project, FAO- TCP project on Biotechnology in 2006 and World Bank project on reviewing of the National Research and Extension System in 2006. Professor Gunasena has worked as a consultant in Agriculture/ agricultural education to the United Nations, FAO, World Bank, British DFID, NORAD, ADB and ICRAF. In total, he has successfully completed 53 consultancies in the fields of crop production, policy formulation, agricultural education and research. Amongst these, the major consultancies include the External Management Review of the World Agroforestry Centre, Nairobi, Kenya in 1995, UNDP consultancy on Reforming Agricultural Education in Pakistan in 1998 and the establishment of a Regional Genetic Engineering and Biotechnology Center in Qatar in 2009.

Professor Gunasena is well recognized nationally and internationally for this commitment and contribution to agricultural research and development. Based on merit, he was appointed as Chairman of the Asia-Pacific Association of Agricultural Research Institutes (APAARI) based in Thailand from 2004-2006, which has a membership of 47 countries. He also served as a member of the Global Fund for Agricultural Research (GFAR) from 2005-2007 and member of the Board of the Directors of the Global Horticulture Initiative and Global Non-Timber Forest Products Initiative from 2006-2007, both of which function under the auspices of the Food and Agriculture Organization (FAO), Rome. He was the chairman of the Asian Center for Underutilized Crops (ACUC), which operated a programme on development of less used crops in South Asian Countries covering India, Pakistan, Nepal, Bangladesh, Sri Lanka and Bhutan.

Professor Gunasena has won several Merit awards during his career as an Agricultural Scientist. He was a Senior Research Fellow of the East West Center, Hawaii in 1977/1978. He also received two merit awards, a Senior Traveling Fellowship from the Association of Commonwealth Universities (1985) and Commonwealth Foundation Fellowship, UK for

promotion of better understanding among the people of the Commonwealth (1985). In 1991, Professor Gunasena was recognized as a Fellow of the National Academy of Sciences, and in 1995 he received a gold medal acknowledging his massive contribution to the development in Agriculture in the Asia- Pacific Region from the Asian Agricultural Development Fund, based in Hong Kong. He received a Literary Award from Dharmaraja College, Kandy in 2004 and the Sabaragamuwa Sarasavi Keerthi Sri Award from the Sabaragamuwa University in 2006.

Professor H P M Gunasena can be considered as one of the great personalities in Agricultural Education and Research in Sri Lanka and elsewhere. On a personal note, he can be considered as a humble and friendly personality, but strict, strong in discipline and authoritative. Dear Sir, with great respect, to what you have done to the fields of biological sciences, agriculture and rural communities by dedicating most of your life, I take this precious opportunity to recognize your continued service by presenting a token of appreciation on behalf of the Council and members of the Institute of Biology, Sri Lanka. We wish you, Prof. Gunasena and your family all the very best for the future.

ABSTRACTS OF PAPERS

Parallel session 1

Determination of UV absorption properties of selected Serpentine flora, using *in-vitro* SPF assay

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Exposure to Ultra-Violet radiation (UVR; the electromagnetic radiation with wavelengths between 100 and 400 nm) has pronounced acute and chronic effects on the skin, including cancer. Natural substances extracted from plants have been recently considered as potential sunscreen resources because of their UVR absorption and antioxidant activities. The Sun Protecting Factor (SPF) is a worldwide standard for evaluating the effectiveness of a sunscreen product. SPF is defined as the UV energy required for producing a Minimal Erythema Dose (MED) on protected skin, divided by the UV energy required producing a MED on unprotected skin. SPF determination usually represents the first approach to evaluate the ability of sunscreens to prevent skin damage by UVR. The objective of the reported research was to determine the SPF values for some selected species of plants collected from Serpentine soil outcrops in the country. It was hypothesized that Serpentine flora, being subjected to extreme edaphic conditions in addition to direct exposure to high amounts of solar radiation throughout their life time, may possess natural sunscreen properties. Leaf materials of twenty plant species were collected from Ussangoda and Indikolapelessa serpentinites and were air-dried and powdered. These were extracted by soaking in 1:1 mixture of methanol and dichloromethane for two weeks and then concentrated, prior to the *in vitro* SPF assay. After re-dissolving the concentrated extract in ethanol to achieve a final concentration of 0.2 $mgml^{-1,}$ the absorption data were obtained in the range of 290 nm - 450 nm using spectrophotometer. SPF was determined using the Mansur equation. Of the samples analyzed, *Hugonia mystax*, *Fimbristylis ovata*, *Eupatorium odoratum*, *Toddalia asiatica* and *Pterospermum suberifolium* indicated high absorption in both UV-A and UV-B regions. *Fimbristylis ovata* showed the highest SPF value of 30.96 ± 0.02 (Mean ± SD of Mean) and *Maerua arenaria* showed the lowest SPF of 3.88 ± 0.02. *Chamaecrista nictitans*, *Euphorbia thymifolia*, *Evolvulus alsinoides*, *Hugonia mystax*, *Eupatorium odoratum* and *Toddalia asiatica* showed significant SPF values in the range 15 to 25. This investigation revealed the potential of some serpentine plant extracts to have sun protection properties.

Evaluation of antimicrobial properties of selected Serpentine plant species collected from Ussangoda and Indikolapelessa

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Serpentine soils derived from igneous or metamorphic rock, are generally characterized by low levels of plant macronutrients and high amounts of Mg, Fe, Ni, Cr, Co, low cation exchange capacities, high Mg:Ca ratio, high temperature and low moisture retention capacity. These features provide extreme environment for plant growth and Serpentine plants have both external and internal mechanisms to tolerate high metal concentrations and are adapted to survive under other adverse effects of the environment. Globally, serpentine flora species have been reported to possess a number of bioactive secondary metabolites that may be potentially beneficial to mankind. The objective of the reported study was to investigate the antibacterial and antifungal capacities of some serpentine plant species collected from Indikolapelessa and Ussangoda, two of the six serpentine sites in Sri Lanka. Air-dried and powdered leaf samples were extracted by soaking in 1:1 mixture of methanol and dichloromethane for two weeks and then concentrated, prior to re-dissolving the concentrated extract in 10% DMSO. Microtitre plate based Resazurin assay was used to screen the extracts for antimicrobial activity against *Escherichia coli*, *Staphylococcus aureus, Pseudomonas aeruginosa*, *Bacillus cereus*, *Candida albicans*, *C. tropicalis*, *C. glabrata* and *Fusarium oxysporum,* with 10% DMSO as the negative control and standard antibiotics as positive controls. Among 20 plants extracts used here only few extracts exhibited different degree of antibiotic activity. Only two plant species among 20 species collected from the two serpentine sites showed antimicrobial properties. *Azadirachta indica* and *Lantana camara* which were collected from Ussangoda serpentine site showed antibacterial and antifungal activities against all tested microorganisms. The other 18 plant extracts did not inhibit the growth of any of the tested bacteria or fungal strains under experimental conditions. Analysis of the extracts from the same plant species obtained from adjacent non-serpentine soils showed significantly higher antimicrobial activity compared to the extracts from the same plant species growing in the serpentine soil. Previous studies, and unpublished data of a parallel investigation have indicated that serpentine soils to be poor in microbial diversity and this feature may correlate with the low antimicrobial activities observed with the serpentine flora. It can be speculated that these plants may be producing low amounts of antimicrobial compounds due to low soil microbial diversity and high water stress faced by these plants.

Investigation of in vitro bioactivities, targeted isolation of bioactive compounds from Sri Lankan sea grapes, Caulepa racemose

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Sri Lankan coastal waters are richly endowed with marine flora especially seaweeds. Seaweeds are ecologically and economically significant living sources. However, bioactivities of the Sri Lankan seaweeds have been studied poorly and only a few reports were identified in the literature survey. In the present study, hexane, chloroform, Ethyl acetate and aqueous solvent fractions of 80% methanol extracts of green alga; *Caulepa racemosa* was extensively screened for their antioxidant, anti-inflammatory and anticancer activities. All the solvent fractions of *C. racemosa* including hexane (CRMH), chloroform (CRMC), Ethyl acetate (CRME) and aqueous (CRMW) showed strong hydroxyl radical scavenging activity (IC_{50} value of 0.040±0.002, 0.039±0.0002,0.047±0.004, 0.038±0.002 μgmL^{-1}) by electron spin resonance (ESR) spectroscopy. The Ethyl acetate fraction (CRME) indicated the highest DPPH and alkyl free radical scavenging activity (IC_{50} value of 0.756±0.066, 0.092±0.0007 μg mL^{-1}) compared to other fractions.The highest *in vitro* anti-inflammatory activity against the lipo-polysaccharide (LPS) induced nitric oxide (NO) production in RAW 264.7 macrophages were observed by the Ethyl acetate (CRME) fraction (IC_{50} value 15.77±1.22 μg mL^{-1}). The higest cancer cell growth inhibitory activity (IC_{50} value of 57.78±7.5 μg mL^{-1}) was determined by the chloroform (CRMC) fraction against human leukemia cells (HL-60). Based on the yield and screening results, CRMC fraction was subjected for purification from reverse phase (RP) (C18) thin layer chromatography (TLC), open column chromatography (OCC) and high performance liquid chromatography (HPLC) methods. Among the eluted methanol fractions from OCC, 70% methanol elution of CRMC fraction was estimated with the highest purity and the strongest anticancer activity against six cancer cell lines tested. Based on cell cycle analysis of the population of cells in sub G1 phase, the anticancer activities of 70% methanol of CRMC fraction was found to be resulting due to the induction of apoptotic body formation.

Anti-lipase and anti-cholesterol esterase activities and binding of bile acids by leaf extracts of *Aporosa lindleyana* Baill. (Kebella)

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Hyperlipidaemia is a group of metabolic disorders characterized by the elevated levels of serum triglycerides and cholesterol and considered as one of the five leading causes of death in the world. Hence, there is an imperative need of the search of novel anti-lipidaemic agents from natural sources. *Aporosa lindleyana* Baill. (kebella) is used as a leafy vegetable. An Ayurvedic pill, Kalashaka Yoga contains the leaves as an ingredient, reported to have anti-hypercholesterolemic activity. However, leaves are not reported for anti-lipidaemic effect to date. The present study, investigated anti-lipidaemic activity of leaves via anti-lipase (AL), anti-cholesterol esterase (AC) and bile acids binding (BAB: taurocholate, glycodeoxycholate and chenodeoxycholate bile acids) *in vitro.* Fresh immature leaves were collected from Maharagama, cleaned, oven dried at 50 °C, powdered and extracted with 95% ethanol and water separately. Different concentrations of both extracts were used to evaluate anti-lipase 62.5-1000 µg/ml: n=4; anti-cholesterol esterase 18.75-600 µg/ml: n=4 and bile acids binding namely taurocholate, glycodeoxycholate and chenodeoxycholate 1, 2, 3 mg/ml: n=4 *in vitro*. Both extracts of leaves had dose dependent anti-lipidaemic activities in terms of AL, AC and BAB. However, ethanolic extract showed significantly ($p<0.05$) high anti-lipase (21.41±6.77% inhibition at 1 mg/ml) and anti-cholesterol esterase (IC_{50}:720.07±26.81 µg/ml) activities compared to water extract (AL: 9.09±1.27% inhibition at 1 mg/ml; AC: 21.91±0.58% inhibition at 600 µg/ml). In contrast, water extract showed significantly ($p<0.05$) high BAB for studied bile acids compared to ethanolic extract (except taurocholate binding). The BAB of water extract for glycodeoxycholate and chenodeoxycholate were ranged from 35.75±2.31 - 67.57±1.91 and 27.60±1.49 - 62.09±10.14% respectively. Similarly, ethanol extract had 27.07±5.47 - 32.45±2.26 and 11.90±0.07 - 31.84±1.65% respectively. Further, both extracts showed similar BAB for taurocholate bile acid (% binding ethanolic extract: 12.49±0.53 - 40.95±0.55; water extract: 12.20±1.85 - 41.79±4.37). Both extracts showed high taurocholate binding, similar glycodeoxycholate and chenodeoxycholate binding and moderate anti-lipase activity compared to the reference drugs studied. In conclusion, leaves of *A. lindleyana* possess marked anti-lipidaemic activities in terms of AL, AC and BAB.

Antioxidant properties at different stages of maturity of widely cultivated tomato (*Lycopersicon esculentum)* varieties in Sri Lanka

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Tomato has high health benefits due to presence of biologically active molecules including antioxidants. The antioxidant properties (AP) of tomato vary with the variety and stage of maturity. In Sri Lanka, AP of cultivated tomato are not investigated to date. The present study evaluated AP of selected tomato varieties in Sri Lanka at different maturity stages. Identity confirmed five tomato cultivars, Bathiya, Maheshi, Rashmi, Tharindu and Thilina at 6 different maturity stages (1-mature green to 6-fully red stage) from each variety were studied. The methanolic extracts of tomato were evaluated for AP using lycopene content (LC), total polyphenolic content (TPC), ferric reducing antioxidant power (FRAP), 1,1-diphenyl-2-picryl-hydrazyl (DPPH) and 2-azino-bis (3-ethylbenzothiazoline-6-sulfonic) acid (ABTS) radical scavenging activity *in vitro* (LC n=5, other assays n=3 each). Results showed that AP varied significantly ($P<0.05$) among the varieties and stages of maturity. In all the varieties, maturity stage 1 had the least AP for all the assays tested. From maturity stages 1-6 there was an increase only in LC. In the rest of AP tested, there was no such pattern. In TPC, FRAP, DPPH and ABTS AP, maturity stage 5 exhibited highest activities in Tharindu, Thilina (except FRAP) and Bathiya (except TPC). In contrast, maturity stage 6 exhibited highest activities in variety Maheshi (except ABTS) and maturity stage 2 in Rashmi (except FRAP). Considering all varieties and stages of maturity, variety Tharindu exhibited the overall highest LC (852.65±14.75 mg/kg dw at stage 6), DPPH (373.94±9.56 mg/100g dw at stage 5) and FRAP (266.51±1.75 mg/100g dw at stage 5) whereas Thilina exhibited highest TPC (600.88±7.19 mg/100g dw at stage 5). Both Tharindu (1291.54±70.03 mg/100g dw at stage 5) and Rashmi (1302.65±4.03 mg/100g dw at stage 2) exhibited the highest ABTS radical scavenging activity. It is concluded that AP of the tomato varieties studied, varied with tomato variety and maturity. Variety Tharindu was the best among the varieties tested in terms of FRAP, DPPH and ABTS at stage 5 and LC at stage 6. For TPC, Thilina was the best variety at maturity stage 5.

Isolation and characterization of plant growth-promoting endophytic diazotrophic bacteria from traditional and new improved rice varieties grown under organic conditions

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Endophytic diazotrophic bacteria have a potential role in promoting plant growth through the production of Indole Acetic Acid (IAA), by phosphate solubilization and by nitrogen fixation. These endophytic bacteria can be used as a biofertilizer to improve plant growth. In this study, putative plant growth-promoting (PGP) endophytic diazotrophic bacteria were isolated from surface sterilized shoots and roots of BG359 and Kaluheenati rice varieties at two different growth stages of the plant (tillering stage (20 days after planting) and reproductive stage (75 days after planting)) grown under three levels of organic fertilizer in the soil (0, 10% (w/w), 20% (w/w)). Population size of these endophytic diazotrophic bacteria was enumerated by using Most Probable Number (MPN) technique. Isolated bacteria were characterized based on the morphological and biochemical features. Bacterial population in the shoots and roots of BG 359 and Kaluheenati rice varieties grown in the presence of organic fertilizer was found to be significantly high ($P \leq 0.05$) near tillering stage compared to the plants grown in the absence of organic fertilizer. A total of five putative plant growth-promoting (PGP) endophytic diazotrophic bacteria were isolated and found to belong to *Azospirillum* sp. (IS002), *Azoarcus* sp. (IS003), *Flavobacterium* sp. (IS008), *Enterobacter* sp. (IS009), and *Serratia* sp. (IS014). Among them, three bacterial isolates (IS003, IS008, and IS009) were obtained from Kaluheenati rice variety. Four bacterial isolates (IS002, IS003, IS009, and IS014) were capable of producing cellulose degrading enzymes but isolate IS008 tested negative for both cellulase activity and pectinase activity. All isolates were tested for their plant growth-promoting (PGP) activities. Bacterial isolates IS009 and IS014 indicated significantly high ($P \leq 0.05$) Indole Acetic Acid (IAA) production in the presence of tryptophan. Highest IAA production ($39.02 \times 10^{-6} \pm 1.91 kgl^{-1}$) was shown by isolate IS009. Four isolates (IS002, IS003, IS008 and IS009) were able to solubilize inorganic phosphate. Endophytic bacterial isolate IS009 with cellulase activity, IAA production and ability to hydrolyze mineral phosphate can be developed as a biofertilizer to enhance rice plant growth.

The effect of pH on the biocontrol activities of *Trichoderma* spp. under *in vitro* conditions

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Trichoderma spp. have effective antagonistic activities against many phytopathogenic fungi and these are facilitated by multiple mechanisms including mycoparasitism, antibiosis and competition for nutrients.Various chemical and physical factors are known to have an influence on such mechanisms as well as on the growth and sporulation of *Trichoderma* spp. As pH is reported to be a factor with such effects, this study was aimed at testing whether pH has an effect on the rate of sporulation, volatile antimicrobial metabolite production and growth inhibition of a pathogenic *Fusarium* sp. by a *Trichoderma* sp. that has been isolated from the soils in onion fields of Sri Lanka. The rate of sporulation of the *Trichoderma* sp. at different pH levels (i.e. pH 4, 5, 6, 7) was tested by placing a mycelial disc of *Trichoderma* sp. on PDA plates with amended pH values and the sporulation levels were estimated at7, 14, 21 and 49 day intervals. The results of three replicates were analyzed using two-way ANOVA. A significantly high ($P \leq 0.05$) rate of sporulation of 5×10^7spores/ml was observed at pH 6 after 49 days. However, a significant difference ($P \leq 0.05$) was not observed in the rate of sporulation between the pH levels upto 21 days. The dual culture assay was used to test the inhibitory effect of *Trichoderma* on the growth of a *Fusarium* sp. isolated from onion seedlings with damping off disease at different pH levels.The two cultures were inoculated to the two ends of each PDA plate and incubated for three days at room temperature and the diameters of *Fusarium* colonies were measured and percentage growth inhibition was calculated. There were 3 replicates for each pH value tested. The highest percentage inhibition of the growth of *Fusarium* was shown at the pH 6. This was significantly different ($P \leq 0.05$) from the growth inhibition at pH 4, 5 and 7. The levels of volatile metabolites production of *Trichoderma* at different pH levels was tested by evaluating the inhibition of mycelial growth of the pathogenic *Fusarium* sp. using a plate assay. In three replicates, the diameters of *Fusarium* colonies were measured and percentage inhibition was calculated. The highest percentage inhibition of the growth of *Fusarium* was shown at the pH values 5 and 6. This was significantly different ($P \leq 0.05$) from the growth inhibition at pH 4 and 7. The results showed that pH 6 was optimal for selected antagonistic activities of the *Trichoderma* sp.

Antibacterial activity and chemical analysis of fruit oil of *Trachyspermum ammi* Linn. Sprague

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In traditional medicine, the fruit of *Trachyspermum ammi* (Family: Umbelliferae), commonly known as Asamodagam in Sinhala; Omum in Tamil and Ajowan or Bishop's weed in English is used in gastro intestinal disorders (loss of appetite, dyspepsia, diarrhea, abdominal pains, abdominal distension and vomiting) and respiratory diseases (Bronchial asthma). The water distillate of fruits used to prepare oma water or asamodagam spirit which contains thymol as a major ingredient is used for stomach problems in children.The dried ripe fruits of *T. ammi* contain 4–6% of volatile oil. The oil has carminative and antispasmodic properties.It is reported that essential oil and the solvent extracts of fruits are active against *Salmonella typhi, Escherichia coli, Lactobacillus* sp.and *Bacillus licheniformis.* Theoil was therefore screened against 8 human pathogens: *S. aureus*NCTC 6571*, E. coli* NCTC 10418,*P. aeruginosa* NCTC 10662 and five wild strains of Methicillin resistant *S. aureus* (MRSA).The fruits were crushed and soaked in water for overnight to hydro-distil the volatile oil using Clevenger apparatus. The antibacterial assay of the oil was carried out using disc diffusion method. A broth suspension with turbidity equivalent to 0.5 McFarland standard was prepared from a pure culture of each of the test organisms.A Mueller Hinton Agar (MHA) plate was inoculated with 1 mL of the broth suspension and the plate rotated to allow even spreading of the inoculum. Sterile blank discs (6 mm) used as negative control placed on the seeded plate were impregnated with 5 µL of oil without dilution and *S. aureus*NCTC 6571*, E. coli* NCTC 10418 and *P. aeruginosa* NCTC 10662 used as positive control organisms in this assay. The plates were incubated at 37 °C for 24 h. After incubation the diameters of the zones of inhibition were measured.Three replicates were carried out for the entire procedure. The oil showed potent inhibitory activity (ZOI: 21–30 mm) towards all tested organisms. Gas Chromatographic analysis of the oil indicated the presence of 3 major compounds, thymol (60.7%), ρ-cymene (21.7%) and γ-terpinene (13.6%). As the oil has antistaphylococcal activity, it will be helpful to develop antiseptic creams or lotions for patients with staphylococcal infections.

Survival of Lactic Acid Bacteria isolated from Sri Lankan finger millet variety

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Potential Probiotics namely, *Enterococcus durans LO, Lactobacillus fermentum, Pediococcus acidilactisi* and *Lactococcus lactis subsp lactis KG 8* isolated from Sri Lankan varieties of finger millet were phenotypically, biochemically and genotypically characterized. Oral acute and chronic toxicity of the isolates were investigated in rat models. The criteria for the *in vitro* selection of bacteria to be used as probiotic ingredients in food and pharmaceutical preparations include tolerance (growth and multiplication) of the isolates in different concentrations/ limits of bile, acid, salt, phenol and temperature. Therefore the ability to tolerate different concentrations of acid (2, 3, 4 pH), bile (0.5%, 1%, 1.5%, 2% Porcine bile), simulated gastric juice (pH 2, 3, 4), phenol (0.1%, 0.2%, 0.3%, 0.4%, 0.5%), salt (5.5%, 6.5%, 7.5% NaCl) and temperatures (30 ^{0}C, 37 ^{0}C, 42 ^{0}C) were investigated *in vitro* by both spectrophotometric and colony counting methods. The results revealed that, *Enterococcus durans* could grow and multiply in the presence of tested different pH, phenol & salt concentrations, where it couldn't grow & multiply gastric juice below pH 4 and phenol above 0.2%. Whereas, *Lactobacillus fermentum* could grow and multiply in tested concentrations of salt and gastric juice. It can grow and multiply up to pH 3, bile 0.2% and phenol 0.2%. *Lactococcus lactis.subsp lactis KG 8* could grow and multiply concentrations of acid, salt and gastric juice tested. *Pediococcus acidilactici* could grow and multiply in concentrations of salts and gastric juice tested and can grow and multiply up to pH 4 and phenol 0.1%. Both *Lactococcus lactis.subsp lactis KG 8* and *Pediococcus acidilactici* did not demonstrate the growth and multiplication of cells in the presence of concentrations of bile tested. All the four isolates could grow & multiply up to 42 ^{0}C. Among the test isolates, *L. fermentum* demonstrated the highest *in vitro* probiotic attributes.

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Enumeration and characterisation of lactic acid bacteria from bovine milk collected from wet and intermediate zones of Sri Lanka

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Lactic acid bacteria (LAB) are a dominant population in bovine milk, prior to pasteurization. LABs' are generally recognized as safe and play an important role in food and feed fermentation and preservation. In Sri Lankan context, there are not much studies on the isolation and characterisation of LABs from dairy origin. Therefore, objective of this study was to isolate and characterize LABs present in bovine milk. Milk samples (20 cows and 20 buffaloes) were collected following the statistical methods of SLS 1404:2010, representing two climatic zones of Sri Lanka. Samples were cooled and transported within 3 hours to the ITI laboratory. M17 and MRS agars (Oxoid, UK) were used for selective enumeration of lactococci and lactobacilli respectively. The presumptive identification of LABs were based on, Gram's positive reaction, non endospore formation and negative catalase reaction. Arginine hydrolysis, MR-VP, oxidase, urease, nitrate, citrate tests, H_2S production and indole formation were carried out for biochemical characterization. The ability of the isolates to grow at 15, 37, 45 and 48 ^oC temperature levels, were also investigated. Pure white glistering, convex, small colonies (2-3 mm diameter) with entire margins (total; 235) were selected to obtain pure cultures. Forty isolates, matched the presumptive identification criteria hence, considered as LABs. All isolates were non-motile, negative for indole, urease, nitrate reduction, oxidase, H_2S production and MR-VP tests verifying their suitability to consider as LABs. Around 10% and 90% were identified as cocci and bacilli, respectively, 42.5% isolates produced ammonia from arginine, a reaction shown by very few homo-fermentative lactobacilli. Around 22.5% of the isolates were thermophilic; grew at 48 ^oC and 57.5% were mesophiles; grew at 15 -45 ^oC. Therefore, raw milk is a rich source for the isolation of LABs. Genotypic identifications, investigation of functional and safety attributes of these isolates will be carried out.

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Optimization of a low cost medium to enhance the growth of *Geobacillus stearothermophilus* for production of thermostable alpha amylase

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Industrial uses of amylases vary, ranging from food to textiles to detergents and the amylases used are mostly of microbial origin. This research was aimed at optimizing a more cost effective medium to grow the bacterium *Geobacillus stearothermophilus,* which produces thermostable α-amylase. A liquid medium was prepared using powdered sweet potato (*Ipomoea batatas*) {carbon source} and $(NH_4)_3PO_4$ {inorganic nitrogen source, to provide increased nitrogen for optimum metabolism}. The media were prepared as a series with varying levels of carbon and nitrogen sources. Nine C/N ratios used: 0:1, 1:0, 1:1, 1:2, 1:3, 2:1, 2:3, 3:1 and 3:2, with control as 0:0, in a basal medium comprised of KNO_3 2g/L, $MgSO_4.7H_2O$ 1g/L, NaCl 5g/L, $CaCl_2$ 2g/L.The carbon source was used in powder form: boiled and raw sweet potato. The series of media in triplicate was inoculated with 3 loopfuls of inoculum, incubated at 55°C for 2 days and the enzyme activity was assayed spectrophotometrically, using Dinitrosalysilic (DNS) assay. The sweet potato powder proved to be a good source of carbon and the enzyme activity was found to depend on the level of $(NH_4)_3PO_4$ present. The nutrient may or may not be immobilized in metabolic functions other than enzyme production. Pottassium nitrate alone could also be an effective nitrogen source. Overall, a carbon nitrogen ratio of 3:1 was the best combination for effective production of α-amylase in combinations tested, and more combinations are needed to be tested, to verify the above. In conclusion, the results imply that the boiled sweet potato powder could be used as a raw material to prepare a low cost medium to grow and induce α-amylase production from *Geobacillus stearothermophilus*.

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Isolation and partial characterization of plant growth promoting endophytic diazotrophic bacteria from selected rice cultivars

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Rice is the staple diet in countries where rapidly growing populations, coupled to limited amounts of land and rare resources. Nitrogen fertilizer is one of the most important factors in the generation of high yields from rice. To avoid shortcomings of industrial fertilizer, biological nitrogen fixation by diazotrophic microorganisms in rice can be implicated. In this study, an attempt was made to isolate Endophytic Diazotrophic Bacteria (EDB) from different rice varieties, to estimate their abundance and to determine their morphological and biochemical characteristics. Two traditional rice varieties (Herath Banda and Madathawalu) and two new improved rice varieties (BW 364 and BW 372) were used. Shoot and root samples were collected from each variety. They were surface sterilized and inoculated into nitrogen-free semi-solid Nfb and LGI media to estimate population size of EDB by using MPN (Most probable number). The pellicle forming bacteria were isolated onto the same corresponding solid media and morphological and biochemical characteristics were determined for all bacterial isolates. In biochemical characterization, mineral phosphate solubilizing activity and quantitative analysis of Indole Acetic Acid (IAA) production were most specifically tested. The highest EDB population (8.20×10^3 MPN per kilogram fresh weight) found in shoots of Madathawalu. Nineteen nitrogen-fixing bacteria were isolated from all the rice varieties, belonged to species *Enterobacter intermedius, Serratia fonticola, Azomonas insignis, Vibro campbellii, V. diazotrophicus, Azospirillum irakense, A. amazonense, A. brasilense, A. lipoferum, Azoarcus communis* and genera *Azovibro, Flavobacterium, Beijerinckia* and *Herbaspirillum.* Three diazotrophic isolates produced 2.08 to 63.87×10^{-6} kgl^{-1} of IAA in the presence of tryptophan. The highest IAA content was produced by the diazotrophic bacterium IN007 (*Enterobacter intermedius*) which was also the best mineral phosphate solubilizer among other diazotrophs isolated. Herath Banda, Madathawalu, BW 364 and BW 372 harbored 2, 9, 3 and 5 bacterial isolates respectively out of 19 isolates identified.

Isolation of *Salmonella* species in *Rousettus leschenaulti* fruit bats in Sri Lanka

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Salmonella species are frequently isolated from wild and domestic animals, but little is known about the occurrence of *Salmonella spp.* in chiropteran species. Despite the vast amount of scientific literature in other countries, concerning bats as carriers of pathogens, their propensity to serve as a reservoir host for emerging pathogens have not been investigated in Sri Lanka hitherto. Therefore the main objective of this study was to isolate *Salmonella spp.* from a cave dwelling fruit eating bat, *Rousettus leschenaulti* (Megachiroptera), which will be the first bacteriological study conducted on Sri Lankan bats. Ethical clearance for the study has not been obtained as the research method was ethically acceptable, non-invasive method. A total of 45 *Rousettus leschenaulti* were sampled in the study. Bats were captured using hand nets during the emergence at the roosting site. Rectal swabs were collected from bats in two locations; Sri Wijaya Dharma Pirivena, Maha Induruwa (n=15) (6°21'53.6"N 80°01'34.7"E) and Wavul Galge, Wellawaya (n=30) (6°43'00.0"N 81°03'00.0"E). The procedure for isolation of *Salmonella* from rectal swabs followed the ISO-6579: 2002 standard. Isolates were identified by a combination of colonial appearance and biochemical testing. Vial (2 ml) containing the fecal material was vortexed for 3 minutes. It was sub-cultured onto XLD agar using a calibrated wire loop. After overnight incubation at 37°C in air, plates were examined. Suspected colonies were sub-cultured onto Kligler Iron Agar. Indole test and Lysine decarboxylase test were performed for further identification. Biochemically confirmed samples from Wellawaya will be sent to Queensland University of Technology in Australia for 16S rRNA gene sequencing. Binomial test was performed to analyse the data. Two samples from Wellawaya were positive for *Salmonella* indicating high prevalence rate (prevalence rate 6.66%, 95% exact binomial confidence interval 0.008-0.220) when compared to the prevalence rate 0.33% previously recorded in Bangladesh. Presence of *Salmonella* in bat feces confirms the possible environmental contamination through defecation. As *R. leschenaulti* were located in close proximity of human dwellings, a possible inter-species spill-over events needs to be evaluated. Thus our research findings will provide the basis for future epidemiological studies on the occurrence of *Salmonella* species in Sri Lankan bats.

ABSTRACTS OF PAPERS

Parallel session 2

Morphological variation of *Nepenthes distillatoria* L. in Sri Lanka

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Genus *Nepenthes* belongs to the unigeneric plant family Nepenthaceae. *Nepenthes distillatoria* is the only *Nepenthes* species found in Sri Lanka which is endemic (Amarathunga, 1987). Opportunistic observations and specimen deposited in National Herbarium revealed that there were variations among the individuals of N*. distillatoria* in Sri Lanka. The specific objective of this study was identifying the morphological variations within the species N*. distillatoria* in Sri Lanka. To achieve the objective, one hundred and twenty six (126) individuals of N.*distillatoria* plants representing twenty two (22) sites in Sri Lanka were collected. Sample sites were selected based on the available literature and localities recorded in herbarium specimens. Fifty four vegetative (54) morphological parameters were recorded and data were analyzed using two cluster analysis (Unweighted Pair Group Method with Arithmetic Mean(UPGMA) and Neighbour Joining (NJ)) and Principal Component Analysis (PCA) methods with PAST version 2.17c. In both clustering and PCA methods, the individuals of N*. distillatoria* were grouped into two major clusters; one including individuals with aerial pitcher and the other including individuals with ground pitchers. This could be explained by the dimorphic nature of N*. distillatoria*. Thefurther divisionsof the two major divisions could be explained on their variations in pitcher colour and rib colour which varied inred, green and red and green mixed colour. Size of the pitchers varied between 8-20 cm in length. In some individuals, small pitchers with dense hairs around the rib could be identified while they were abscent in mature pitchers. Even the presence of hairs around the rib was recognized as a different morphology, it has not strong enough in analyze to grouping same individuals together. This type of fine scale variations would be easily revealed using molecular characters other than use of morphology and further research would be more suitable in confirming the findings.

A floral food formulation to improve vase life and postharvest quality of *Gerbera jamesonii* varieties 'Rosalin' (pink) and 'Kilimanjaro' (white) cut flowers

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Being perishables, the postharvest life of most cut flowers is relatively brief. However, different techniques can be used to prolong the vase lives of fresh cut flowers. Chemical preservatives mixed with vase water can extend the life of a cut flower significantly. Such substances include germicides, acidifiers, carbon sources, ethylene inhibitors, minerals, and any other chemical which can delay floral senescence. Though the cut flower industry in Sri Lanka has now grown to a relatively significant extent, the use and awareness of new technologies to enhance the postharvest vase life and quality of fresh cut flowers is much limited among the local flower growers and florists. The reported study aimed to develop a relatively low cost chemical preservative formulation that can be added to vase water to prolong the vase life and to reduce stem bending of Gerbera (*Gerbera jamesonii)* cut flowers, which probably is the most widely used cut flower species locally. A number of preservative substances individually and in different combinations were tested for the maximum vase life of two Gerbera varieties (*G. jamesonii* var. 'Rosalin' – pink flowers and var. 'Kilimanjaro' - white flowers). Effect of varying concentrations of each substance and combinations on delaying the wilting of flower heads, drooping of flower stalk, petal pigment degradation, pH of vase solution, and preventing blockages in xylem vessels were analyzed. The best combination of preservatives to prolong the vase life of both varieties significantly was found to be 6% sugar, 10 ppm Bleach, 350 ppm Citric acid and 0.1% $CaCl_2$. This combination in vase solution extend the vase life of the variety 'Rosalin' (pink) flowers upto 17 days and the same combination minus $CaCl_2$ increased the vase life of the variety 'Kilimanjaro' (white) flowers up to 13 days compared to 8 days of the control (distilled water), while keeping the best decorative quality.

Dichogamy: Undisclosed sexual systems of genus *Bridelia* in Sri Lanka

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Family Phyllanthaceae express diverse of dichogamy sexual systems including duodichogamy, heterodichogamy and temporal dioecy. Twenty three individuals of *Bridelia retusa* in three sampling sites (Kelaniya university premises, Kottawa forest and Naththandiya) and six individuals of *B. moonii* in Kottawa forest were studied weekly for their reproductive phenology during flowering season (seven months).*B. retusa* showed four flowering patterns as; alternate male (7-19 days) to female (7-15 days) in 34.78% of individuals, or female (7-17 days) to male flowering pattern (14-17 days) indicating heterodichogamy; among them 26.09% produced male flowers and then female flowers, but without a third flower phase and 8.70% first produced female flowers, followed by male flowers while 30.43% individuals produced male flowers (12–14 days), then female flowers (7–14 days), followed by another male flower phase (12–23 days) which expressed duodichogamy. Two individuals produced female to male to female flowering pattern and only one individual produced female to male to female to male to female to male flowering pattern. Therefore temporal dioecy was expressed in 13.04% of individuals and also pure males were recorded as 13.04%. These sexual alternations ensure the mating within individuals and prevent geitanogamyit ensuring xenogamy. Flower buds did not bloom (stagnated) during rainy season as a mechanism to avoid wastage of energy for reproductive allocation. The 6 individuals of *B. moonii* showed three flowering patterns: duodichogamy (33.33%), heterodichogamy (33.33%) and pure males (16.67%). Both *Bridelia* species express duodichogamy, heterodichogamy and additionally *B. retusa* show temporal dioecy. This study provides new information which enriches the limited literature on dichogamy in *Bridelia* species. Also the documentation of dichogamy in *Bridelia* species may help to solve problems related to reproductive assurance of *Bridelia* species. It also identified the significance of maintenance of sufficient densities of individuals of *B. mooniii* in a population as it produces pure male flowers.

Drought resistance and salinity tolerance of selected Sri Lankan rice (*Oryza sativa* L.) landraces

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Twenty four traditional rice cultivars were evaluated for drought and salinity tolerance at seedling stage. Following an International Rice Research Institute (IRRI) standard protocol, salinity levels 6dS/m and 10dS/m were induced to Yoshida nutrient media for eight days by adding adequate amounts of NaCl when the seedlings were two weeks old. The modified Standard Evaluation System (SES) was used to assess the visual symptoms of salt toxicity. Drought condition was induced to four week old seedlings grown in pots filled with soil by cutting off water for two weeks. Experiments were conducted according to completely randomized block design with 3 replicates and 5 plants per replicate. Two weeks later, plants were evaluated by measuring plant height, root length and dry matter of the recovered plants. Characterization of rice cultivars was also conducted and data of vegetative characters, yield and yield attributed characters were obtained. Both drought tolerance and recovery after drought period were indicated in the cultivars 'Kaluheenati' and 'Rathuheenati' with respect to 'Dular'. Cultivars 'Godaheenati', 'Sudurusamba' and 'Suduheenati' were susceptible to drought. 'Godaheenati' showed the highest salt tolerance for both salinity levels with respect to the salt tolerant cultivar 'Pokkali'. 'Sudurusamba' was moderately tolerant and highly susceptible to 6dS/m and 10dS/m respectively. From the agronomical characterization of these cultivars, 'Mawee' was the tallest plant while the shortest was 'Kaluheenati'. 'Rathuheenati' showed the highest number of reproductive tillers but 'Godaheenati' showed the highest panicle characters such as panicle length, number of spickelets and number of fertile spicklets. Application of molecular biological analyses of drought and salt tolerance are recommended for further confirmation of the results.

Evaluation of phenetic diversity of selected orchid cultivars with ornamental value

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Orchidaceae is one of the largest and most diverse families of flowering plants and includes major export ornamental crops of many tropical countries. The demand for cut flowers has drastically increased over the years. Cultivar development is a key for the success of ornamental flower industry and therefore, it is vital to identify the phenotypic diversity of the cultivars with high demand. The major problem faced by the Sri Lankan orchid growers is the lack of new orchid cultivars with high ornamental values with authorship. Therefore, the introduction of cultivars with desirable characters to meet the demand is needed. The objective of this study was to evaluate the diversity of qualitative and quantitative traits of selected orchid cultivars with ornamental value. Morphological characters (108) of vegetative and floral parts from 35 selected orchid cultivars belonging to the genera *Dendrobium* (*31*), *Phalaenopsis (3)* and *Cattleya* (1) were studied. Both qualitative and quantitative characters were studied and Cluster Analysis (CA) and Principal Component Analysis (PCA) were performed to infer phenetic relatedness among the cultivars using MINITAB 17 software package. Interestingly, cultivar of *Cattleya* has shared some characters such as root nature and leaf shape with *Dendrobium* cultivars. Floral diversification was clearly observed within *Dendrobium* cultivars. Sepal and petal surface colors, root thickness, plant nature, presence of pseudobulbs, length and width of floral parts, leaf length and width are the characters that influenced primarily on morphological clustering of the closely related orchid taxa. Findings of the study would pave the way to thrive in establishing cultivars with promising characters.

Assessment of genetic diversity among *ex-situ* conserved finger millet (*Eleusine coracana* L.) accessions of Nuwara Eliya district in Sri Lanka

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Finger millet (*Eleusine coracana* L.), commonly known as "kurakkan" in Sri Lanka is a highly nutritious crop which is currently gaining popularity as a diabetic relief food. Even in recent records it is stated as a neglected crop globally and locally due to lack of consideration in research and crop improvement programs. Plant Genetic Resource Center, Gannoruwa has a collection of 249 finger millet germplasm accessions representing 13 districts of Sri Lanka where 20 of the accessions are from Nuwara Eliya District. This study was conducted to assess the genetic diversity of those 20 accessions using 20 SSR (Simple Sequence Repeats) markers. DNA was extracted from 7-10 days old leaves and screened for all 20 SSR markers. Alleles were scored and the data was analyzed using Power Marker version 3.25. Shared alleles were calculated and cluster analysis was performed with UPGMA method and the Treeview software (TreeView 1.6 version for WXP). Six of the markers (UGEP 3.1, UGEP 1, UGEP 18, UGEP 31, UGEP 78 and UGEP 90) were found to be monomorphic and the rest of the 14 markers (UGEP 3.2, UGEP 5, UGEP 10, UGEP 12, UGEP 15, UGEP 21.1, UGEP 21.2, UGEP 24, UGEP 68, UGEP 77, UGEP 81, UGEP 102, UGEP 106 and UGEP 110) were polymorphic. Across the 20 accessions, the number of alleles amplified by 14 markers ranged from 2 to 6 alleles per locus. Polymorphic information content ranged from 0.0476 to 0.6573. Dendrogram constructed on the basis of SSR polymorphism contained one main cluster leaving accession 960: "Kurakkan" as an out group. In the main cluster accession 1556: "Kurakkan" was separated from the remaining 18 accessions out of which three of the accessions 1460 "Sudu Kurakkan", 1457 "Kalu Kurakkan" and 9083 "Kaha Kurakkan" were genetically similar although they are having different accession names. Accessions 491 and 8851 were found to be genetically distant irrespective to their same accession name "Mora kurahan". These findings can be used in fine tuning the conservation programs by avoiding duplications and identifying the core species for conservation. Individuals with highest genetic distances can be used as potential parents in breeding programs.

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Agrobacterium tumefaciens mediated *in planta* transformation of Bg 94-1 rice (*Oryza sativa* L. ssp. *indica*)

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Rice is the staple food source for nearly half the world's population. In the past rice was considered as the most recalcitrant of crops in *Agrobacterium* mediated genetic manipulation but now advances in molecular biological techniques have bridged this difficulty. In this project *Oryza sativa* L. ssp. *indica* Bg 94-1 variety was used due to its transformable capabilities. *Agrobacterium tumefaciens* mediated gene transfer methods for rice have been widely used in many laboratories over the world. Transformed plants are regenerated via tissue culture which requires sterile conditions and is time consuming. The novel *in planta* transformation protocols are advantageous because they do not involve *in vitro* culture of plant cells or tissues and therefore the tissue culture-induced somaclonal variations are avoided. Considering the above, the simple and efficient *in planta* transformation method was used to transform rice variety Bg 94-1. *Agrobacterium tumefaciens* carrying the pCAM-glb-TFGL construct (containing cloned trehalose synthetic otsA and otsB genes from *E.coli)* was cultured in LB medium. Bg 94-1 viable *Oryza sativa* L. ssp. *indica* rice seeds were surface sterilized, and induced for germination. Embryo of seeds were pierced to a depth of about 1mm with a needle (No 27) and dipped in the *A. tumefaciens* inoculum carrying the pCAM-glb-TFGL, for 30 minutes. The transformed seeds were allowed to germinate and established in soil. Transformed rice plants were individually screened by Polymerase Chain Reaction (PCR) using CaMV 35S promoter specific primers. The percentage of seedling germination after transformation of BG 94-1 was 90. The transformation efficiency was estimated to be 30 % by PCR. The results demonstrated that transformation of recombinant construct into BG 94-1 rice variety by *in planta* transformation was successful and this method is an efficient transformation method for rice.

Microsatellite markers reveal high genetic diversity among the principal dengue vector, *Aedes aegypti* in Sri Lanka

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Genetic diversity is a parameter which effectively reflects the adaptive potential of any organism. For mosquito vectors, high level of genetic variability may be important in developing resistance to control methods. The severity of the current dengue epidemics is suggestive of a high adaptive potential within the vector populations, which could be partly attributed to the high level of genetic diversity within them. Accordingly, this study was aimed at investigating the genetic diversity of the principal dengue vector, *Aedes aegypti* in nine selected dengue endemic areas in Sri Lanka based on six established microsatellite markers. Fourth stage larval samples of *Aedes aegypti* (n=238) were collected from nine different sites (Dematagoda (n=24), Kirulapone (n=42), Grandpass (n=24), Thummulla (n=28), Horana (26), Keselwaththa (20), Galle (n=30), Negombo (n=30) and Dalugama (n=14) and analysed with BbA10, BbB07, BbH08, CT2, AC7, and GyP8 microsatellite markers. Based on the results obtained following parameters were calculated; average number of allele per locus, proportion of loci polymorphic (PLP), effective number of alleles, allele richness, average expected heterozygosity (He) and the inbreeding coefficient (F_{IS}). According to the results obtained all nine mosquito populations studied were polymorphic for all tested microsatellite markers (PLP=100%). Values observed for average number of alleles per locus (4.333-5.333), allelic richness averaged over loci (3.88-4.37) and H_e (0.453 to 0.654) were all suggestive of high genetic diversity and were comparable to the values that had been reported previously from the neighbouring countries in the region i.e. Vietnam and Thailand. However H_e was substantially higher than what was reported from American subcontinent. The high genetic diversity exhibited by the mosquito populations studied is in agreement with the low inbreeding coefficients exhibited by them (0.086) which are indicative of a high level of genetic mixing within populations. This may have been brought about by the active avoidance of mating between close relatives. Observed high genetic diversity in all studied *Aedes aegypti* populations in Sri Lanka suggest an extensive evolutionary potential within the vector species which might be having significant implication in their control.

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Long distance passive migrations may explain the low genetic differentiation in principal dengue vector (*Aedes aegypti)* in Sri Lanka

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Aedes aegypti is a mosquito vector which transmits several important arboviral diseases. Presently it acts as the principal vector for dengue worldwide. Up to date, dengue prevention strategies in Sri Lanka are based on the vector control which has yielded only a limited success. Therefore, identifying the factors that limit the effectiveness of current dengue prevention programs would be of utmost importance. Partly, the success of any vector control program would lie in vector genetics which determines its response to control measures. Hence, this study aims to investigate the level of genetic differentiation in selected *Ae. aegypti* populations in Sri Lanka using microsatellite markers. DNA of 248 *Ae. aegypti* larvae collected from nine areas in Sri Lanka (Dematagoda (N=24), Kirulapone (N=42), Grandpass (N=24), Thummulla (N=28), Horana (N=26), Keselwaththa (N=21), Galle (N=30), Negombo (N=36) and Dalugama (N=17)), was genotyped with six microsatellite markers; CT2, AC7, BbB07, BbH08, BbA10 and GyP08. Each Collection site covered an area with a 500 m diameter. Allelic results were analyzed with Genepop 4.2, Fstat 2.9.3 and Arlequin 3.5. The overall F_{ST} value for the nine populations was 0.026 (95% CI: 0.016 - 0.034). In pairwise population comparisons, 8 pairs out of 36, showed significant ($P<0.05$) but low F_{ST} values (<0.04). The two populations which were collected from the most far away sites- Negombo and Galle (136 km apart) were not significantly differentiated. Gene flow (*Nm*) estimates indicated 20 migrants per generation between these two sites. Overall, high levels of gene flow (*Nm*>3) were observed between all populations. There was no significant correlation (Mantel r=0.063, P>0.05) between the genetic and geographic distances of these mosquito populations. The low levels of genetic differentiation among populations irrespective of the geographical distance, seem to be compatible with the high levels of mosquito migrations observed. Since the maximum active dispersal ability of *Ae. aegypti* is limited to ~500 meters, these long distance migrations may indicate passive mosquito dispersals probably aided by human activities, which might have negative implications on current dengue control programmes.

Association between Human Papillomavirus infections and lung cancers in Sri Lanka

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Lung cancers, with multi-factorial etiology, are the most common cause of cancer related deaths worldwide. Establishing definite and emerging risk factors may offer new insights into the pathogenesis of lung cancers in Sri Lanka. Studies elsewhere have established association between Human Papillomavirus (HPV) and lung cancers; The current study was undertaken to investigate the relationship of HPV with primary carcinomas of the lung cancer patients in Sri Lanka. The case-control retrospective study was based on 52 each of lung cancer, and age and gender matched non-cancer controls. PCR was performed on viral DNA extracted from formalin fixed paraffin embedded lung tumor tissue targeting the L1 region of the HPV genome. A 150bp fragment was amplified and sequenced and sequences were analyzed with NCBI BLASTn service. Twenty three lung cancer patients (44.2%) screened positive for HPV, while all controls tested negative. Odds ratio value suggests HPV positivity of lung tissue may result in a 84 fold risk of developing lung cancer ($P<0.05$;OR=83.664; 95% CI= 4.9-1427.72) without considering other confounding factors (passive smoking, environmental carcinogens [asbestos, radon] and diet). Smoking alone posed a 3 fold risk of developing lung cancer (OR=2.956; 95% CI= 1.249-6.997), with no significant association established between smoking and HPV detected in lung cancer cases ($P>0.05$). Members of the Alpha-papillomavirus 9 group, HPV 16 (N= 20), HPV 31 (N= 1) and HPV 33 (N= 2) were associated with lung cancers; HPV 16 was more common in urban regions of the island while HPV 31 and 33 were detected in relatively rural areas. These findings are the first to suggest that HPV infections of the lung poses a strong risk factor for carcinogenesis of the lung in Sri Lanka; HPV type 16 infections may be responsible for a significant proportion of lung cancers, with minor contribution from HPV types 33 and 31.

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Screening of methicillin resistant gene for identification of potential methicillin resistant *Staphylococcus aureus* from clinical wastes

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Methicillin resistant *Staphylococcus aureus* (MRSA) has become a serious public health concern as it has evolved from traditional nosocomial to community associated infections. MRSA exerts resistance against all β-lactam antibiotics. Central determinant of the antibiotic resistance of MRSA is the *mecA* gene. The study focused on screening *mecA* gene in order to identify the potential MRSA in hospital effluents from different regions in Sri Lanka. Wastewater collected from three different hospital environments were inoculated on manitol salt agar (MSA) to isolate *Stapylococcus* spp. Antibiotic resistance was tested at the levels of 50, 100, 200 and 300 µg/mL ampicillin. Extracted DNA was amplified with *mecA* gene specific primers and sequenced. Sequence results were analysed using BLAST (NCBI) and EMBOSS Needle tool (EMBL-EBI). Randomly selected two bacterial isolates of Polgahawela hospital effluent were able to grow at 200 µg/ml ampicillin. DNA extracted from these bacterial isolates amplified with *mecA* gene specific primers indicated the presence of *mecA* gene. Sequence analysis of amplified *mecA* gene product of these two bacteria showed sequence similarity with the penicillin-binding protein (*mecA*) gene of *Staphylococcus aureus* strain 28C with 95% identity and methicillin-resistance gene region of *Staphylococcus sciuri* with 96% identity respectively. Pairwise alignment results proved 89.6% sequence similarity between the two sequences. In conclusion, potential MRSA was detected along with *Staphylococcus sciuri* only in the clinical effluent collected from Polgahawela base hospital. Further studies on antibiotic resistance level for different β-lactam antibiotics and *mecA* gene expression level will confirm the resistance capacity of isolated bacteria.

A preliminary assessment of Sexual Transmitted Infections (STIs) in Sri Lanka: District-wise overview

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This study examines the district wise Sexual Transmitted Infections (STIs) in Sri Lanka to evaluate the trends and relationships of STIs and to provide recommendations for further investigations. The data was acquired from the National STD/AIDS control programme and Most at Risk Populations (MARPs) report in 2015 in Sri Lanka. District wise STIs cases and census data were utilized to calculate disease incidences for 100,000 people in terms of sex. The seven STIs namely, Syphillis, Gonorrhoea, non-Gonococcal, Genital Herpes, Genital Warts, HIV/AIDS and Trichomoniasis were mapped along districts to identify the risk areas. Canonical Correspondence Analysis (CCA) was carried out to identify how STIs correlate with male/female sex workers within districts using PC-ORD$_4$ software. The results showed that the diagnosis of early Syphillis incidences were low (≤1) in most districts except Colombo (3), Galle (2) and Kilinochchi (2). In contrast, late Syphillis incidences were notably high in Colombo (19) followed by Gampaha (5), Galle (5) and Kandy (5) districts. The late Syphillis cases for both male and female were significantly higher ($P<0.05$) than early Syphillis. The Gonorrhoea incidences were high in Polonnaruwa (9) and Colombo (7) districts. Non-Gonococcal incidences were significantly higher ($P<0.05$) than Gonorrhoea with high incidence in Colombo (30), Kurunegala (21) and Gampaha (18). The relationship of STIs among districts was examined by CCA. Three distinguishable clusters of districts were identified. The first group included seven districts and four STIs *viz*., HIV/AIDS, early Syphillis, Genital Warts and Trichomoniasis. The second group included five districts *viz*., Matale, Ratnapura, Trincomalee, Moneragala, and Puttalam that associated with Genital Herpes. The third group comprised of Kalutara and Hambantota districts correlated with late Syphillis and Gonorrhoea. Furthermore, CCA ordination depicted that Colombo and Gampaha districts were highly correlated with male sex workers and direct/indirect drug users respectively. The results showed that the tourists attracted zones are vibrant for STIs in general. It is useful to monitor the alcohol and drug addictions for the patients and conducting STI prevention programs in vulnerable areas.

ABSTRACTS OF PAPERS

Parallel session 3

Microscopical profiling and evaluation of sensory characters of Sri Lankan origin bees honey for the detection of adulteration

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Microscopic profile is unique in natural bees honey and hence adulteration can be detected easily. Market samples of honey are often, substandard and admixed with extraneous matter. Adulterated bees honey cannot be identified only referring to SLS 464: 1979 (Specifications for bees honey) because laboratory manipulation is possible in order to comply with SLS 464:1979. There are no studies on the comparative identification of wild and domesticated hives made bee honey available in terms of their sensory characters and microscopic identity. Therefore, the present study focused on the microscopic profiling and evaluation of sensory characters of Sri Lankan origin bees honey for detection of adulteration. Three samples each from wild, domesticated and market samples were collected from nine provinces and were composited separately for each province. Composite samples were analyzed separately for sensory characters such as colour, odour, taste and consistency as per World Health Organization (WHO) guidelines. Microscopically identifiable components were observed under the Sigma Labomed Compound microscope. Results showed that the colour is lighter in domesticated samples and taste differs according to the floral source of honey. Odour slightly intensifies in wild honey whereas samples adulterated with artificial inverted sugar or heated above 60 ^{0}C had a caramelized sugar odour. Domesticated honey had less number of pollen diversity and density than wild honey. Wild and domesticated honey contained a few bee hairs (setae), chunks of wax from the hive and a few crystals. Market samples contained plant parts such as fibres, vessels, trichomes, fragments of petals, starch grains, sugar crystals (sucrose) and coloring matter as adulterants. Above results shows the wild and domesticated bees honey can be differentiated from market samples based on microscopic characteristics and therefore, microscopic characteristics could be considered as a reliable parameter in identification of adulteration in bees honey.

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Differences in web architecture of the Giant Wood spider (*Nephilapilpes*) in forested and non-forested areas in the Wet zone of Sri Lanka

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The present study investigated the web architectural properties of the Giant Wood Spider (*Nephilapilpes*), the largest orb weaver that inhabits the forest and non-forest areas in the Wet zone in Sri Lanka. The primary role of spider webs is to capture prey. Hence, based on the premise that forests differ from non-forests in prey availability, as shown in many studies before in tropical areas, we hypothesized that web architectural properties of *Nephilapilpes* would differ in forest and non-forest habitats. Two forest reserves, Sinharaja and Batadombalena, and non-forest habitats, namely home gardens, rubber and tea plantations located within approximately 2 km from the forest border were selected for the study. A total of 50 webs; 25 webs from each of the forest and non-forest habitats, with resident adult female spiders were located and selected standard web morphometric measurements were made using accepted protocols.The study revealed some differences in architectural properties of *Nephilapilpes* webs in forested and non-forested areas. The mean web diameter was greater (68.3 cm ± 18.8 cm) in forests than in non-forest habitats (67.10 cm ± 19.5 cm) indicating slightly larger webs in the forest. The mesh height in non-forest webs were somewhat lower (forest – 0.41 cm ± 0.12 cm; non-forest 0.38 cm ± 0.19 cm), resulting in a greater number of threads within a given area. The mean tensile strength was higher in silk threads of the forest webs (46 ± 36 MPa) than those in non-forest habitats (40 ± 35 MPa). In contrast the silk of threads in non-forest webs were thicker (43.4 ± 31.1 x 10^{-6} m) than that in forest webs (36.4 ± 26.8 x 10^{-6} m). These differences were, however, not significant. The significantly different hub asymmetry values (0.57 ± 0.095 in forested areas and 0.66 ± 0.09 in non-forested areas) show that spiders in non-forest habitats strategically position themselves to approach prey faster reducing the likelihood of prey escape. Each of these alterations in web structure would very likely allow spiders in non-forest habitats to increase prey capture efficiency, to overcome limitations of prey availability. Most importantly, these differences in web architectural features between forest and non-forest habitats show the potential for plasticity in web design in *Nephilapilpes*.

A Preliminary survey of the occurrence of tiger beetle species (Coleoptera, Cicindelidae) in the Jaffna Peninsula of Sri Lanka

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Cicindelidae are represented by a group of highly predacious ground beetles with over 2,500 species described worldwide. Sri Lanka is regarded as a hot spot for tiger beetle diversity. According to available literature fifty six species of tiger beetles have been recorded from Sri Lanka of which thirty five are endemic to the country. Despite the high diversity and endemicity, very few studies have been conducted and present distribution status for majority of species is poorly known. This preliminary survey was conducted to determine the presence of tiger beetles in the Jaffna peninsula. According to previous literature only three species of tiger beetles have been recorded from Jaffna District namely *Jansenia cirrihidia, Hypaetha biramosa, and Calochroa sexpuncta*ta. Rapid sampling was conducted in the month of March, 2015 for three days from 8.00 hr. to 16.00 hr. in the Jaffna District using visual encounter surveys. At each sampling location surveying resulted in foot paths, abandoned lands with vegetation, stream edges, scrubs, lagoons, beaches, coast ways, marshes, mangroves, grasslands and paddy fields. Important environmental variables of the habitats were recorded. Specimens collected using a sweep net were preserved in 70% alcohol and subsequently identified using available standard keys. Rapid sampling resulted in collecting five species namely *Calomera angulata, Calochora sexpunctata, Hypaetha biramosa, Lophyra catena* and *Myriochile distinguenda* inhabiting sandy beaches, lagoons, marshy grasslands and paddy fields*. Jansenia cirrihidia* was not encountered. The most abundant species recorded was *Hypaetha biramosa* with population counts over 100 and least recorded species was *Lophyra catena* with only 4 individuals at an edge of a paddy field. Tiger beetle species *Lophyridia angulata, Lophyra catena* and *Myriochile distinguenda* were recorded for the first time from Jaffna peninsula and this survey has added new information on the distribution and occurrence of tiger beetle species in Sri Lanka.

Host tree species, nest appearance and colony demography of medically important *Tetraponera rufonigra*Jerdon (Hymenoptera, Formicidae), in selected urban localities of Sri Lanka

K S S D Fernando[1] and R K S Dias

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Serious medical conditions caused by *Tetraponera rufonigra* Jerdon stings have been recently reported from urban locations in Sri Lanka. Nests of *T.rufonigra* were surveyed by checking the worker trails visually and locating and severing the nests on the host trees at the Grounds of Royal Colombo Golf Club, Colombo 08, Tyre Cooperation Road, Kelaniya and Vihara Mahadevi Park, Colombo 07 from February to August, 2015. Host trees of the species were listed and the physical appearance of each type of nest and colony demography of each nest was described. Nine host tree species, *Acacia catechu*Willd, *Casuarina equisetifolia* L., *Albizia lebbeck*(L.) Benth, *Cassiafistula*L., *Adenanthera pavonina*L., *Filicium decipiens*(Wight&Arn.) Thwaites, *Pericopsis mooniana* Thwaites, *Plumeria* sp. and *Tectona grandis* L.f. were recorded for the first time as host trees of *T. rufonigra*. Well-decayed branches carrying many longitudinal tunnels and large holes throughout the hardwood and peripheral softwood, moderately decayed branches bearing few longitudinal tunnels and smaller holes in hardwood and many holes in peripheral softwood and, less-decayed branches with very few holes in the peripheral region, were observed. Tunnels made by other insects seemed to be occupied by the species but very small holes seen throughout the *Plumeria* wood log were probably made by the workers of the species. Workers, winged females, de-alate queens, males, eggs, larvae and pupae were observed in 25%-83%, 0.18%-0.72%, 0%-0.13%, 0% - 1.5%, 0% - 42%, 14.6%-70.5% and 0.94%-9.2%, respectively. Dead or cut branches of the above tree species should be fully-removed or covered to prevent colonization by the ant species.

Acknowledgment: Financial support from the Kelaniya University Research Grant RP03/02/07/01/2015 is highly acknowledged.

Worker ant community observed in two rainy months and related information in a selected region of "Indikada Mukalana" Forest Reserve, a habitat of *Aneuretus simoni* Emery

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Worker ant community (Hymenoptera, Formicidae) of a selected region in "Indikada Mukalana" Forest Reserve, a habitat of island endemic, *Aneuretus simoni* Emery, was investigated using quadrat method for the nests and pitfall traps for the workers in two rainy months, December, 2015 and February, 2016. Twenty, 1 m^2 quadrats were laid at each of the two, 10 x 10 m^2 plots in each locality at 159 m and 291 m elevations. Hundred pitfall traps were set along eight transects at 4 m distance at each elevation and collected after six hours. Collected ants were preserved in 70% ethanol and identified to the possible taxonomic levels using a low power stereo-microscope. Mean nest density, percentage frequency of nest occurrence and percentage frequency of worker occurrence out of 100 pitfall traps, for each ant species were calculated. Mean values of air temperature (24 ± 0.05 °C), soil temperature (21 ± 0.04 °C), depth of leaf litter (4 ± 1.1 cm), soil humidity (48.3 ± 2.4 %), soil organic matter (23.2 ± 3.3 %) at the region were also measured using standard methods. Nests of 29 species of 19 genera in 5 subfamilies including that of *A. simoni* only at 291 m elevation were recorded. The highest values for mean percentage frequency of nest occurrence, 32 %, mean nest density, 0.32 m^{-2}, and frequency of worker occurrence, 20.7 %, were observed for *Odontomachus simillimus* Smith F. whereas mean percentage frequency of nest occurrence, mean nest density and frequency of worker occurrence of *A. simoni* were 8 %, 0.08 m^{-2} and 5.6 %, respectively. Thirty seven species in 25 genera of 6 subfamilies, Aneuretinae, Dolichoderinae, Formicinae, Myrmicinae, Ponerinae and Pseudomyrmecinae recorded on the two occasions can be considered an inventory for the region.

Acknowledgment: Financial assistance provided by NSF/ RG/ 2015/ EB/ 03 is highly acknowledged.

Diversity and abundance of phytoplankton in Diyawanna Lake, an urban wetland in the Western Province of Sri Lanka

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The abundance and diversity of phytoplankton in Diyawanna lake in the administrative capital of Sri Lanka, Sri Jayawardenepura Kotte was studied during the inter-monsoonal and southwest monsoonal periods of 2015. Phytoplankton were sampled using a 50µ plankton net in March, May, July, September and November 2015 in five sampling sites, two in the un-rehabilitated region and three in the rehabilitated region, with the objective of comparing their diversity and abundance in these two regions of the lake. Total of 31 species of green algae, 15 species of cyanobacteria, 11 species of diatoms and 4 species of flagellates were identified during the study. Abundance of these phytoplankton, which are >50µ in size ranged from 1490/L to 2547/L at different sampling sites. Species richness ranged from 34 to 44 while Shannon Weiner diversity index ranged from 2.60 to 2.80. Pielou'sevenness index was 0.71 - 0.77. The most abundant species was the green algae *Oedogonium* sp. (811/ L). The most abundant cyanobacteria and diatom species were *Microcystis aeruginosa* (121/L) and *Melosira granulata* (134/L) respectively. Mean abundance of cyanobacteria and diatoms was significantly higher in the rehabilitated region than in the un-rehabilitated region ($p<0.05$). Mean abundance of toxin producing cyanobacteria species *Microcystis aeruginosa* was also higher in the rehabilitated region than in the un-rehabilitated region ($p<0.05$). This may be due to nutrient enrichment of the rehabilitated area through urban runoff and domestic household wastes. Due to high abundance of *Microcystis aeruginosa*, consumption of fish living in this area of the wetland may cause health issues. In addition to removing aquatic macrophytes such as *Hydrilla verticillata* and *Eichhornia crassipes* at fortnightly intervals in the rehabilitated region by mechanical means, action may also be taken to reduce nutrient enrichment of this region of the wetland.

Spatial variation of macrobenthic community in relation to water and sediment quality parameters in the Ja-Ela canal, Sri Lanka

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The present study was conducted to assess the spatial variation of macrobenthic community in relation to water and sediment quality in the selected sites of the Ja-Ela canal, which is a freshwater stream located in Gampaha district. Five study sites to cover the entire length of the stream, which are adjacent to different land uses were sampled for water and sediment quality parameters and macrobenthic invertebrates from April to October 2015.The variations of water and sediment quality parameters were assessed using Principal Component Analysis (PCA). Shannon-Weiner diversity index (H`), Hilsenhoff Family Biotic index (FBI), Taxa richness (TRI), and Ephemeroptera, Plecoptera and Trichoptera (EPT) index of macrobenthic invertebrates were calculated for each site. MINITAB 14 and PRIMER 5 statistical software packages were used in the statistical analysis. Results revealed significant spatial variations of the macrobenthic community and the physico-chemical parameters in sediment (Organic carbon content, particle size distribution) and the over lying water (pH, dissolved oxygen, conductivity, visibility, total dissolved solids, BOD, COD, total nitrogen, dissolved phosphorous total phosphorous concentrations) of the study sites. Altogether 16 families of macrobenthic invertebrates belonging to Phylum Annelida, Phylum Mollusca and Arthropoda were recorded. The values of the biotic indices ranged as follows: H`: 1.88-2.38, FBI: 6.17 – 6.97; TRI: 8.4 – 13.6, EPT: 0.2-6.2. Significantly higher biotic index values were recorded from the reference site. The EPT index showed significantly strong correlation (R^2>0.6, $P \leq 0.05$) with the physico-chemical parameters in sediment and the over lying water of the study sites while the other biotic indices showed moderately strong correlations. Therefore, it was evident that the spatial distribution of macrobenthic invertebrate community in Ja Ela canal is governed by a combination of some key physico-chemical parameters of the sediments and overlying water.

Characterization of a bacterial isolate from Madunagala thermal spring in the Hambanthota district, Sri Lanka

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In Sri Lanka ten thermal springs are found along a narrow belt running from Hambanthota to Trincomalee with temperatures ranging from 35°C to 61°C. Madunagala thermal spring is the only thermal spring found in the Southern Province of Sri Lanka. It is located in the Hambanthota district, at Latitudes 6.25^0 North and Longitudes 80.98^0 East. The spring is also renowned as Mahapelessa or Sooriyawewa thermal spring. A study was conducted with the objective of isolating and characterizing themophilic/ thermostable microorganisms from several thermal springs of Sri Lanka. One of the isolates from Madunagala had deep orange coloured, shiny, dome shaped colonies with entire margins and smooth appearance. This bacterium was a Gram positive short rod having an optimum growth temperature of 45^0C at pH 7 and NaCl concentration 2.0% (w/v). Growth temperature, pH and NaCl concentration maxima were 65^0C, 10 and 3.5% w/v respectively. It was identified as *Exiguobacterium marinum* by 16S RNA sequencing that was carried out using 27F;5' AGAGTTTGATCCTGGCTCAG3' and 1492R; 5'TACGGYTACCTTGTTACGACTT3' universal primers. The type strain of this bacterium was previously isolated, identified and described by Kim *et. Al* (2005) from the Yellow Sea, Korea. Due to the presence of a marine bacterium, *Exiguobacterium marinum* which is able to withstand high salt concentrations (3.5% w/v), it could be speculated that a possible connection may have existed in the geological past between Madunagala thermal spring and the marine environment, which is around 35 km away from the spring.

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Comparison of indoor and outdoor windrow composting methods of MSW in relation to final product quality

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Karadiyana, one of the biggest municipal solid waste (MSW) dumping sites in the Western Provinceof Sri Lanka practices windrow composting by constructing piles outdoor for one month and shifting them under a shed for the rest of the process. However, construction of a shed has become a considerable constrain to the management. If the whole process could be done outdoor without any adverse impacts to the quality of compost, this high cost would be saved in future site planning. The present study was planned to evaluate the resultant compost qualities between indoor (prevailing method) and totally outdoor maintained windrows. Pre-sorted and pre-weighed biodegradable waste, were heaped up on the prepared floor up to a height of 1 m at the middle with the dimensions of 1.5 m width and 3 m length. Three replicates from each treatment were maintained for three months. Sufficient moisture and oxygen were provided for the degradation process by adopting squeeze test and turning, respectively. The pile settlement, pH, volatile solid content, nitrogen content, carbon to nitrogen ratio and electrical conductivity were monitored once a week while temperature was measured thrice a week. In addition, moisture content, particle size, sand content, Phosphorous, Magnesium and Calcium contents were determined at the end of the composting process. The data were subjected to two sample t test in MINITAB version 14.0. Results revealed that the parameters tested for the resultant compost between both methods were not significantly different and compatible with Sri Lanka Standard 1246: 2003. Results further revealed that the highest mass reduction (63.2 % ± 1.3) and the lowest compost production (31.7 % ± 1.7) were achieved from indoor method. Although a high initial cost has been observed for constructing of a shed, the indoor windrows showed better results in managing MSW.

A preliminary study to determine the Water Footprint during the production process ($WF_{process}$) of Desiccated Coconut in Sri Lanka

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The present study attempts to quantify the total Water Footprint (WF) during the production stage of desiccated coconut in three mills located in the North Western province of Sri Lanka operating at different levels (large, medium and small scale) of production. The total $WF_{(processing)}$ of each mill was determined by calculating blue WF (fresh water consumption), green WF (rain water consumption), and grey WF (fresh water requirement to assimilate the pollution load to acceptable levels). To calculate the WF, data on volumes of fresh water extraction, consumption & waste water generation, production capacities and water quality from different stages of the production cycle was collected. The lowest total WF (0.093L/nut) was shown by the large scale mill while the small scale mill had the highest total WF value (1.61L/nut) irrespective of the production capacity and water consumption. Detailed analysis showed that the highest contribution to the total WF of each mill was from the grey WF. The small scale mill has the highest grey WF due to the release of waste water to the environment without any treatment. The medium scale mill has the highest blue WF due to the consumption of large quantities of fresh water for the process. Since rain water was not used, the green WF of the process is 0. To lower the grey WF, waste water treatment to a level below CEA water quality standards, pre-treatment of sap, separation of oil before treatment, continuous monitoring of water quality are recommended. To lower the blue WF, adoption of cleaner production technologies and increasing employee awareness on water consumption are recommended. To forecast the total WF of the entire DC sector in Sri Lanka, a comprehensive long term study to investigate the water consumption and pollution of each production unit in different DC mills is recommended.

An assessment of Cd and Pb accumulation in the Golden apple snail (*Pomacea diffusa*)

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Due to rapid industrialization and poor waste management, the inland water bodies of Sri Lanka are polluted with heavy metals. Studies elsewhere have examined the potential of using indicator organisms to assess the status of heavy metal pollution in aquatic systems. The overall aim of this study was therefore to ascertain the bioaccumulation patterns of Cd and Pb in the soft tissues of the Golden apple snail (*Pomacea diffusa*), under standard empirical conditions, to assess its usability as a heavy metal indicator. Snails were exposed to two environmentally relevant levels of heavy metals, i.e. levels recorded in inland water bodies of Sri Lanka and permissible levels for release of the metals as stipulated by the Central Environmental Authority. Trials were conducted with both individual metals and combinations of the two metals over a standard 28 days for effects of chronic exposure with the test medium being renewed every two days. Accumulation of Cd and Pb significantly and positively increased with time (28 days) (Cd ($F=1.31$, $P<0.05$); Pb ($F=1.22$ $P<0.05$). In single exposures, tissues accumulated 22.61±1.02 and 40.70±2.06 μg g^{-1} of Cd respectively at field and permissible levels, while corresponding values for Pb were 99.45±0.91 μg g^{-1} and 56.06±1.46 μg g^{-1}. A Bio-Accumulation Factor (BAF) greater than 1 for both metals reflects higher uptake than elimination. Combined exposures indicate an antagonistic effect on Cd in the presence of Pb. In contrast Pb accumulation increased in the presence of Cd. The high accumulation within a relatively short time at environmentally relevant levels of the heavy metals highlights the necessity for better treatment of effluents prior to their discharge into inland water bodies. The study has also shown that while individual exposures may indicate that the Golden apple snail is a suitable bio-monitoring organism, combined exposures show that accumulation of an individual metal may be influenced by the presence of another metal, suggesting that the accumulation levels of some metals in biota may not quantitatively reflect the bioavailability of that element within the aquatic system.

Survival of guppies (*Poecilia reticulata*) following exposure to three concentrations of lead under different temperatures

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Lead (Pb) a toxic heavy metal at present found in the environment in considerable amounts is primarily a result of automobile emissions and the use of leaded compounds in the paint industry. The current study evaluated the toxic effects of lead on the survival and the feeding behavior of the guppy (*Poecilia reticulata*). Guppies, both males and females, acclimatized for seven days under empirical conditions were exposed once to one of three concentrations of $Pb(NO_3)_2$ (0.002, 0.02 and 0.08 mgL^{-1}). Aged tap water was used as the control. Treatment and control trials were conducted in triplicate. Each exposure was also maintained under three temperatures (30, 32 and 34 ^oC) for a standard 96 hrs. At the end of the trial the guppies were monitored for a further 28 days with water renewal at 4 day intervals. Mortality was recorded daily while feeding behavior was recorded at uniform intervals throughout the trial period. At the end of the experiment (exposure for 96 hrs and thereafter for 28 days) the percentage cumulative mortality in guppies in all tested concentrations of $Pb(NO_3)_2$ was significantly higher when compared to the control ($F_{3,8} = 4.64$ $P<0.05$). What is of greater significance is that the mortality patterns depicted a hormetic response where the highest recorded mortality was at the mid concentration. Interestingly, the hormetic response was observed consistently across the three test temperatures, for a given metal concentration. However no significant differences were observed in the feeding behavior ($F_{3.8} = 0.17$, $P>0.05$) across different lead levels or temperatures. In conclusion the present study has demonstrated that exposure to lead induces enhanced mortality in guppies. In comparison to the effect of the metal, the study does not provide sufficient evidence that rises in temperature, at least within the tested levels (30 – 34 ^oC), seriously alters trends in mortality of the test species.

Hexavalent chromium induced histopathological effects in *Labeo dussumieri* (Malabar Labeo), a food fish species in Sri Lanka

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Chromium (Cr) is a heavy metal that exists commonly in trivalent and hexavalent forms. The latter is highly toxic at low doses and exists in more water soluble forms. Water bodies receive high levels of Cr from untreated industry effluents and Cr containing fertilizer, posing a major threat to aquatic fauna. Although many previous studies have investigated aspects of Cr toxicity on aquatic species, few have focused on histopathological effects. Therefore, the present study examines alterations in histology induced by exposure to environmentally relevant levels of Cr on *Labeo dussumieri*; a food fish. Fish were exposed to six concentrations of hexavalent Cr (Cr^{6+}) (0 – 2 mg/ L) for 28 days, with water renewal done every other day, to study changes in the histology of gills, liver and muscle tissues. Gills of the exposed fish showed mild to severe alterations in structure; namely lamellar hyperplasia, oedema and aneurysm causing fusion of secondary lamellae and epithelial lifting and clubbing. In the liver, Cr^{6+} induced changes in hepatocyte architecture, vacuolation, leukocyte infiltration, blood congestion and necrosis and increased melanomacrophage centers, while in the muscle the metal induced signs of oedema, vacuolation, atrophy, splitting of muscle fibres, increased separation of myotomes and nuclear proliferation. Fish exposed to 0.2 mg/ L Cr^{6+} and higher showed significantly increased water-blood barrier thickness in a positive and dose dependent manner while the hepatocyte width decreased significantly depicting hepatocyte atrophy. This study thus highlights the potential of $Cr^{6+}$to induce sub-lethal impacts such as tissue damage in vital organs of fish, leading to their poor health. Such a condition may impact commercial fish species such as *L. dussumieri* leading to losses in the inland fishery industry.

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Schedule of the Scientific Sessions

36th Annual Sessions of the Institute of Biology, Sri Lanka
30th September, 2016 at 'Sausiripaya' Auditorium (CIDA)

Parallel Session 01

Time	Abstract Number	Title
1.30 pm	1-01	Determination of UV absorption properties of selected Serpentine flora, using in-vitro SPF assay U W R Sampath and P S Saputhanthri
1.45 pm	1-02	Evaluation of antimicrobial properties of selected Serpentine plant species collected from Ussangoda and Indikolapelessa U W R Sampath and P S Saputhanthri
2.00 pm	1-03	Investigation of in vitro bioactivities, targeted isolation of bioactive compounds from Sri Lankan sea grapes, Caulepa racemosa Kalpa W Samarakoon, I P Shanura Fernando, U K D S S Gunasekara, Pathmasiri Ransinghe, G A S Premakumara and You Jin-Jeon
2.15 pm	1-04	Anti-lipase and anti-cholesterol esterase activities and binding of bile acids by leaf extracts of Aporosa lindleyana Baill. (Kebella) S Kathirgamanathar, W P K M Abeysekera, D M K P Weerasinghe, P Ranasinghe and A M C U Binduhewa
2.30 pm	1-05	Antioxidant properties at different stages of maturity of widely cultivated tomato (Lycopersicon esculentum) varieties in Sri Lanka H H Ifla, W K S M Abeysekera, R C Pitipanaarachchi, M D G S Perera, S G Walliwala, I G N.Hewajuilge and C D Wijayarathna
2.45 pm	1-06	Isolation and characterization of plant growth-promoting endophytic diazotrophic bacteria from traditional and new improved rice varieties grown under organic conditions K A D V Kumarapeli and N Welikala
3.00 pm	1-07	The effect of pH on the biocontrol activities of Trichoderma spp. under in vitro conditions G D D Abeyratne and N Deshappriya
3.15 pm	1-08	Antibacterial activity and chemical analysis of fruit oil of Trachyspermum ammi Linn. Sprague G A S Premakumara, S Kathirgamanathar, T Thayalini , V S Bandara, D A M Arawwawala and V Thevanesam
T	E	A
3.30 pm	1-09	Survival of Lactic Acid Bacteria isolated from Sri Lankan finger millet variety D M W D Divisekera, J K R R Samarasekera, S D T Maduwanthi, C Hettiarachchi, J Gooneratne and S Gopalakrishnan
3.45 pm	1-10	Enumeration and characterisation of lactic acid bacteria from bovine milk collected from wet and intermediate zones of Sri Lanka D U Rajawardana, I G N Hewajulige, C M Nanayakkara and T M D A Jayawardana
4.00 pm	1-11	Optimization of a low cost medium to enhance the growth of Geobacillus stearothermophilus for production of thermostable alpha amylase S Jayaram, H H K Achala, M S Thiwanka and W W P Rodrigo
4.15 pm	1-12	Isolation and partial characterization of plant growth promoting endophytic diazotrophic bacteria from selected rice cultivars M R F Nasla and N Welikala
4.30 pm	1-13	Isolation of Salmonella species in Rousettus leschenaulti fruit bats in Sri Lanka H I T Perera, W B Yapa and H K K Perera

Parallel Session 02

Time	Abstract Number	Title
1.30 pm	2-01	Morphological variation of *Nepenthes distillatoria* L. in Sri Lanka E P C M Ekanayake, H S Kathriarachchi[1] and A M A Attanayake
1.45 pm	2-02	A floral food formulation to improve vase life and postharvest quality of Gerbera jamesonii varieties 'Rosalin' (pink) and 'Kilimanjaro' (white) cut flowers N C D Perera and P S Saputhanthri
2.00 pm	2-03	Dichogamy: Undisclosed sexual systems of genus Bridelia in Sri Lanka M A Dias and R M C S Ratnayake
2.15 pm	2-04	Drought resistance and salinity tolerance of selected Sri Lankan rice (Oryza sativa L.) landraces S P Munasinghe, S Somarathne and S R Weerakoon
2.30 pm	2-05	Evaluation of phenetic diversity of selected orchid cultivars with ornamental value F Farook R N Attanayake and S P Senanayake
2.45 pm	2-06	Assessment of genetic diversity among ex-situ conserved finger millet (Eleusine coracana L.) accessions of Nuwara Eliya district in Sri Lanka P W Wakista, P N Dasanayaka, R J Illeperuma and S A C N Perera
3.00 pm	2-07	Agrobacterium tumefaciens mediated in planta transformation of Bg 94-1 rice (Oryza sativa L. ssp. indica) B Rathefer, K G W W Bandara, H H K Achala and W T G S L Withana
3.15 pm	2-08	Microsatellite markers reveal high genetic diversity among the principal dengue vector, Aedes aegypti in Sri Lanka P D Gangani, M D Nirmani, K L N Perera and G H Galhena
T E A		
4.00 pm	2-09	Long distance passive migrations may explain the low genetic differentiation in principal dengue vector (Aedes aegypti) in Sri Lanka M D Nirmani, P D Gangani, K L N Perera and G H Galhena
4.15 pm	2-10	Association between Human Papillomavirus infections and lung cancers in Sri Lanka Sankha L Hewawasam, Roshana Constantine, Kanthi A Perera and Preethi V Udagama
4.30 pm	2-11	Screening of methicillin resistant gene for identification of potential methicillin resistant Staphylococcus aureus from clinical wastes M P D L Luphzy, K Vivehananthan and M P Dassanayaka
4.45 pm	2-12	A preliminary assessment of Sexual Transmitted Infections (STIs) in Sri Lanka: District-wise overview B D Madurapperuma, A A N Nishad, J S Borges, D I K Solangaarachchi and R Kangath

Parallel Session 03

Time	Abstract Number	Title
1.30 pm	3-01	Microscopical profiling and evaluation of sensory characters of Sri Lankan origin bees honey for the detection of adulteration T D C M K Wijayasiriwardena and W A D D Wasalamuni
1.45 pm	3-02	Differences in web architecture of the Giant Wood spider (Nephilapilpes) in forested and non-forested areas in the Wet zone of Sri Lanka Tharaka Wijerathna, Inoka C Perera and Mayuri R Wijesinghe
2.00 pm	3-03	A Preliminary survey of the occurrence of tiger beetle species (Coleoptera, Cicindelidae) in the Jaffna Peninsula of Sri Lanka A Thotagamuwa, T Wijerathna C D Dangalle, N Pallewatta and E Lokupitiya
2.15 pm	3-04	Host tree species, nest appearance and colony demography of medically important Tetraponera rufonigraJerdon (Hymenoptera, Formicidae), in selected urban localities of Sri Lanka K S S D Fernando and R K S Dias
2.30 pm	3-05	Worker ant community observed in two rainy months and related information in a selected region of "Indikada Mukalana" Forest Reserve, a habitat of Aneuretus simoni Emery R K S Dias and W S Udayakantha
2.45 pm	3-06	Diversity and abundance of phytoplankton in Diyawanna Lake, an urban wetland in the Western Province of Sri Lanka R M Asanka Dilini and M J S Wijeyaratne
3.00 pm	3-07	Spatial variation of macrobenthic community in relation to water and sediment quality parameters in the Ja-Ela canal, Sri Lanka K M B P P Kalaotuwawe and W M D N Wijeyaratne
3.15 pm	3-08	Characterization of a Bacterial Isolate from Madunagala Thermal Spring in the Hambanthota District, Sri Lanka G G W Nandanee, P N Dasanayaka and S C Wijeyaratne
T	E	A
4.00 pm	3-09	Comparison of indoor and outdoor windrow composting methods of MSW in relation to final product quality. H M B N Karunapala and M D M DW M M K Yatawara
4.15 pm	3-10	A preliminary study to determine the Water Footprint during the production process (WF process) of Desiccated Coconut in Sri Lanka. M G D K Bandara, D N de Silva and V R S Peiris
4.30 pm	3-11	An assessment of Cd and Pb accumulation in the Golden apple snail (Pomacea diffusa) K M Rathnayake, M R Wijesinghe and R D Wijesekera
4.45 pm	3-12	Survival of guppies (Poecilia reticulata) following exposure to three concentrations of lead under different temperatures Tharaka Wijerathna, Shashiprabha Jayasinghe, Kavindya Koswinna, Thejanee Perera, Kanchana Sajeewani and Mayuri R Wijesinghe
5.00 pm	3-13	Hexavalent chromium induced histopathological effects in Labeo dussumieri (Malabar Labeo), a food fish species in Sri Lanka V A K Fernando, I C Perera, C D Dangalle, S Premawansa and M R Wijesinghe