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Inoka C. Perera Editor, IOB

Mail SLAAS Head Office Vidya Mawatha Colombo 07. Tel/Fax 011-2619618 Web www.iobsl.org

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The Institute of Biology is a leading professional body of biologists in Sri Lanka. Its current membership is over 400. The institute was formulated in a small way by a group of Sri Lankan biologists led by Prof. B. A. Abeywickrama (Emeritus Professor of Botany University of Colombo in 1981). It became an incorporated organization by Act of Parliament No 22 in 1984.

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

The institute has around 400 members, working in industry, research, education and healthcare. The institute also awards Fellowships and Charter of Biology for members. There are 7 categories of membership and members are encouraged to transfer to other grades in due course. Eligibility for each category depends upon a combination of professional experience and academic qualifications. Fellows are entitled to use the designatory letters F.I.Biol (Sri Lanka) while the members are eligible to use M.I.Biol (Sri Lanka), associate members, A.I.Biol (Sri Lanka) and licentiates L. I. Biol (Sri Lanka).

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.

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 even in the country which provide opportunities to students in the country to become champions in biology both locally and internationally. 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 continuing for the 31st time this year.

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PRESIDENTIAL ADDRESS Dr. K. H. Jayawardena

Trends in Biogenetics in Human Diseases

The term *Biogenetics* may sound like a lab that makes medical equipment or conducts research in genetics. But it is actually a production of living organism or tissues or organs from living organisms and not from nonliving matter. Studying living organisms and inheritance organisms comes the under umbrella of *Biogenetics*.

In order to understand nature, man was very inquisitive of all living organisms and that led to the development of the subject biology. Genetics is a part of biology. Biogenetics is the branch of biology concerned with altering the genomes of living organisms. Although it relates to the production of living organisms from other living organisms one can suppose that it is a recurrence of the evolutionary stages of species during the embryonic development and differentiation of member of that species.

People have been altering the genomes of plants and animals for many years using traditional breeding techniques. Artificial selection for specific, desired traits has resulted in a variety of different organisms, ranging from carrot to hairless cats. But this artificial selection, in which organisms that exhibits specific traits are chosen to breed subsequent generations, has been limited to naturally occurring variations. In recent decades, however, advances in the field of genetic engineering have allowed for precise control over the genetic changes introduced into an organism. Today, we can incorporate new genes from one species into a completely unrelated species through genetic engineering, optimizing cures for disease or facilitating the production of valuable pharmaceutical substances. Crop plants, farm animals, and soil bacteria are some of the more prominent examples of organisms that have been subject to genetic engineering under biogenetics.

Today, an enormous amount of genetic information is viable which is continuously fed by worldwide genome sequencing programs. Every day the human genome-sequencing program alone provides new information about human genes with potential therapeutic value. Therefore, the impact of Biogenetics on everyday life has increased enormously over the last two decades.

Specially in medical diagnosis of human diseases, pharmaceutical and pharmaceutical industries and lately even agricultural applications of Biogenetics have become standard. New trends in studies on different mechanisms for transporting DNA into the living cells, compact of DNA and compacted DNA get attached to the cell surface, barriers to efficient gene transfer, tissue sourcing and understanding of bio artificial organs.

With the progress of Biogenetics, new remedies for many human diseases are being discovered. Basically organs and cells of animal origin are manipulated genetically to cure some of the common genetic diseases like diabetes. Transplant of bio artificial livers for liver infections and hearts for cardiovascular disease are the new horizon of Biogenetics.

Living organs and cells are considered as a source of tissue for xenotransplantation. The islet of liver cell transplantation has become a widespread treatment for Type 1 diabetes. The solution must be found for increasing the availability of insulin-producing tissue and for overcoming the need for continuous immunosuppression. Insulin-producing cells being considered for clinical transplantation include porcine and bovine islets, fish-Brockman bodies, genetically engineered insulin-secreting cell lines and in vitro produced "human" beta-cells.

Both primary tissue and cultured cell lines have been employed in small animal xenotransplantation, including cells that have been genetically modified. Substantial efforts have also been made in the isolation of primary tissue, especially for pancreatic islets, though further improvements are necessary for practical, large-scale processing. The most urgent problem in transplantation is the shortage of donor organs and tissue.

Xenotransplantation could offer some advantages over the use of human organs. Xenotransplantation could be planned in advance; the organ would be transplanted while it is still fresh and undamaged. In addition, a planned transplantation allows the administration of therapeutic regime that call for the pretreatment of the recipient. Another advantage is the possibility that animal sources could be genetically engineered in order to lower the risk of rejection by expressing specific genes for the benefit of the patient.

Scientists are now concentrating on alternative tissue sources. Recently islets have been isolated from primates and xenografted into immunosuppressed, diabetic rodents, with short-term reversal of diabetes. However, there are ethical issues surrounding the use of primates for these studies. Other promising islet sources are porcine, bovine and rabbit islets, all of which function remarkably well in diabetic rodents. Long-term human, bovine and porcine islet xenograft survival have been documented in nude mice and rats, suggesting that, in the absence of an immune response, sufficient islet-specific growth factors are present in xenogeneic recipients.

Tissue engineering involves the *in vitro* or *in vivo* generation of organoids such as cartilage, skin or nerves. More enthusiastic seeks to recognize the quality of life of the diseased or injured patients and reduce the economic burden of treatment.

The biological organ or the bioartificial organs involve an *in vitro* prepared tissue-material interface fabricated into a durable device. A typical example is the bio artificial pancreas. The extra-corporeal bio artificial liver and the bio artificial kidney14 are examples of the transient replacement of organ functions, the former intended as a bridge to stabilize comatose patients until a whole organ can be procured.

Transplanting bioartificial organs need continuous immunosuppression. Encapsulation technology prior to the application of this bioartificial organ has experienced in in situ insulin production. The main motive of cell encapsulation technology is to overcome the existing problem of graft rejection in tissue engineering applications and thus reduce the need for long-term use of immunosuppressive drugs to reduce the side effects. Basically cells are immobilized within a polymeric semi-permeable membrane that permits the diffusion of molecules like oxygen, nutrients and other growth factors essential for cell metabolism. At the same time, the semipermeable nature of the membrane prevents immune cells and antibodies from destroying the encapsulated cells regarding them as foreign invaders. Recent studies have demonstrated that when these microencapsulated islets were implanted into diabetic rats, the cells remained viable and controlled glucose levels for several months.

Gene therapy is another domain where the efficient transfer of genes is essential. Many severe human diseases are caused by a genetic defect leading to the mal /over/ under-expression of the corresponding protein. Patients could be permanently cured if the missing genes could be transferred in a functional form into the concerned organs. Delivery of genes to specific tissues could become the most efficient medical treatment in the future, but for

obvious reasons, the establishment of a very safe and well-controlled method for gene delivery is an imported fact.

What are the barriers for Biogenetics?

DNA is the common carrier of the genetic information for all living entities of the planet that inspires variability in different organisms. All living organisms are exposed to large quantities of foreign DNA in the form of food or bacterial infections. Under these circumstances, nature had to provide powerful barriers against the spontaneous insertion of foreign DNA sequences into the genomic DNA of cells. Barriers are the plasma membrane of the cell, the envelope of the cell's nucleus, but also the possibility for DNA degradation in lysosomes and the cytoplasm. These protective mechanisms work rather well and even under optimized conditions. It is by no means easy to genetically modify a eukaryotic cell. However, the necessity to transfect cells for research purposes, the discovery of new and efficient reporter systems to verify the success of a transfection experiment (luciferase, green fluorescent protein) as well as the availability of powerful transfection reagents have spurred research in the area for many years. Several methods to transfer genes into cells have been developed during the last 30 years. However, considerable efforts to develop new techniques or to improve the efficiency of old ones are still being made.

Transfection reagents help to overcome the natural barriers to gene transfer by various strategies. The steps involved in the transfer of a "gene" from the outside into the genome of the cell comprise of the following steps; compact of the DNA, attachment to the cell surface, transport into the cytoplasm, import into the nucleus and insertion into the chromosomal DNA. Biogenetics has turned a new era on the planet.

FELICITATION *Professor C.V. Savitri Gunatilleke*

Presented by Prof. Sandun Senarath

I consider it is a great honour and privilege to be presenting this speech to felicitate Prof. C.V.S. Gunatilleke, an eminent scholar and a well-known scientist, who has contributed to inspire and mentor young and upcoming academics as well as scientists.

Malwattage Celestine Violet Savitri Gunatilleke was born on 30th July 1945. She had her primary education at Little Flower Convent, Bandarawela and secondary education at St. Bridget's Convent, Colombo. She entered the University of Ceylon, Colombo in 1965 and then moved to Peradeniya campus in 1967. Prof. Gunatilleke completed her undergraduate career in 1969 with exceptional merit, obtaining First Class Honours in the Special Degree in Botany, a rare feat at that time. In 1970, she started her academic carrier as an assistant lecturer. In 1971, she won a Commonwealth scholarship, and obtained her M.Sc. in General Ecology and Ph.D. in Tropical Forest Ecology and Conservation from the University of Aberdeen. Her Ph.D. thesis on 'The Ecology of the Endemic Tree Species of Sri Lanka in Relation to their Conservation' is widely considered a land-mark in quantitative ecological research in Sri Lanka.

Prof. Savitri Gunatilleke has shown a great interest in forest conservation. Since 1977, her main research focus was on the Sinharaja rain forest, where she aimed at understanding the conservation value of its tree flora, while it was still being logged by the State Timber Corporation. Her research findings, along with those of others, made a significant contribution to the designation of Sinharaja as a World Heritage Site. In addition, her research interests have been in a number of other forests in Sri Lanka such as Kanneliya, Hiniduma, Peak Wilderness and the Knuckles, which are of high biological value and some of them have since been designated as protected areas, either nationally or internationally.

Professor Savitri Gunatilleke's contribution to the advancement and dissemination of science in Sri Lanka is equally praiseworthy. She has shared her immense knowledge on ecology and environment for national development. She served as a member of the many national committees such as National Man and Biosphere committee, Biodiversity Action Plan, Sri Lanka Conservation and Sustainable Utilization of Medicinal Plants, Biological Science Advisory committee of the National Science Foundation. In 1999, she contributed her knowledge as a consultant for the Encyclopaedia Britannica's (India) section on Biodiversity of Sri Lanka. She was a consultant, of the section on 'Loss of Biodiversity', of Ministry of Environment in 2001 and also a member of the Agriculture and Forestry Advisory Committee at the National Science Foundation from 1999-2002.

Prof. Gunatilleke was a pioneer in the field of ecological teaching and research in Sri Lanka. Through field courses and training, she drew the attention of her students to the rich biological heritage of the island's forests. Prof. Gunatilleke, with the help of her colleagues established a mini-nursery cum arboretum and a students' working herbarium and museum which store specimens from different ecosystems of the country in the premises of the Department of Botany, University of Peradeniya. This is beneficial to undergraduates, post-graduates and others interested in plant ecology and plant biology.

Professor Savitri Gunatilleke is an erudite scholar and an academic of the highest calibre. She is the author of over forty research papers published in peer reviewed journals and five books in which she publish her research findings. She has more than thirty chapters in books published by both national and international publishers such as Academic Press, University of Chicago Press, Smithsonian Tropical Research Institute and so on. She has over thirty publications in internationally/nationally edited conference proceedings and over ninety communications on dissemination of ecological information to her credit - a true indication of her scholarly work. Her excellence in research was recognized by the Sri Lankan government awarding her the Presidential Research Awards in the years 2000, 2001, 2004, 2005 and 2006, and the Merit Award for Scientific Excellence in the field of Environment and Biodiversity in 2006 by the National Science Foundation of Sri Lanka.

Prof. Savitri Gunatilleke's high calibre of research is also evident from the research collaborations she had with eminent conservation scientists worldwide. She managed to secure the financial assistance for research through international competitive research grants. Darwin Initiative, UK; EU-Asia through Aberdeen University; John D. and Catherine T. MacArthur Foundation, USA; USAID; National Science Foundation, USA through Harvard University are among the prestigious research grants she obtained. She was also a recipient of a number of competitive research grants from local institutions such as the National Science Foundation and Sri Lanka Conservation and Sustainable Utilization of Medicinal Plants Project. Prof. Gunatilleke had been a supervisor/co-supervisor of number of postgraduate students from both local and foreign universities. She is the in-country advisor for students visiting Sri Lanka on exchange programs between the University of Peradeniya and Harvard University as well as Yale University in USA and Oxford and Aberdeen in the UK.

Professor Gunatilleke was awarded fellowships from a number of institutions for her excellence in research. She won the Charles Bullard Fellowship of the Harvard University, USA. She was an Associate of the Arnold Arboretum of Harvard University, USA in 1982-83 and again in 1992-93. She served as a Short-Term Research Fellow of the Smithsonian Tropical Research Institute, Republic of Panama. Prof. Gunatilleke is a Fellow of the National Academy of Science, Sri Lanka. She is a co-recipient of the prestigious Sultan Qaboos prize of UNESCO for environmental preservation which was given in recognition of the outstanding contribution to the management or preservation of the environment. She won the Silver Jubilee Award of the International Foundation for Science, Sweden in honour of her noteworthy achievements in research supported by the Foundation. In 1998, she won the 5th Woman of Achievement Award for Science, awarded by the Zonta Club-1 of Colombo, Sri Lanka. Professor Savitri Gunatilleke retired from university service in August 2010 as a Senior Professor and in appreciation of her long years of distinguished and dedicated service to the University System in Sri Lanka she was appointed a Professor Emeritus by the University of Peradeniya in 2011.

Ordinary teachers direct us along the right path, good teachers impart good education but great teachers groom their students to become leaders and inspire us to seek our own path. They encourage us to discover our talents. Madam you use yourself as a bridge over which you invited the students to cross, then having facilitated their crossing, joyfully encourage them to create bridges of their own. That's why we are here. I am very much grateful therefore for the opportunity to be here today to deliver the felicitation address for Prof. Gunatilleke, who was a guiding star for us to reach success in our careers. Dear Madam, may you have happiness throughout your life seeing all your students become fountainheads of success. With best wishes from the bottom of my heart I present Prof. CVS Gunatilleke for felicitation.



ABSTRACTS OF PAPERS

Effect of pretreatments on the quality of minimally processed green bell pepper (*Capsicum annuum* L.) strips in polyvinyl chloride packages

S. Ediriweera and K. Abeywickrama

Department of Botany, University of Kelaniya, Sri Lanka

The changing lifestyle and growing concern towards healthy living has increased the fresh fruit and vegetable consumption. Production of minimally processed fruits and vegetables that retain high sensory quality as well as nutritional value plays an important role in the food manufacturing and retail industries. Minimally processed bell pepper strips in polyvinyl chloride (PVC) packages stored at 5-7 °C up to seven days were evaluated for physicochemical, sensory and microbiological quality. Bell pepper strips were treated with 1% sodium chloride, 1% calcium chloride, 1% sodium + calcium chloride, 1% ascorbic acid, 1% citric acid, 0.1% chitosan or distilled water (control) before storage. The pretreatments did not significantly affect the physicochemical properties (pH, titratable acidity (TA), total soluble solids (TSS) and weight loss) when compared to the control. The values ranged from 5.3-6.3 for pH, 0.2-0.3% malic acid for TA, 3-50 Brix for TSS and 0.22-0.77% in weight loss during analysis period. There was a decrease in all the sensory attributes evaluated during the storage period where appearance, colour, odour, flavour, taste and overall acceptability data indicated that minimally processed bell pepper were satisfactory by day 7. The total plate count (TPC) ranged from $4.99 - 6.57 \log_{10}$ CFU/g by day 7. Yeast and mould count recorded very low values compared to TPC, which ranged from 0-3.38 log10 CFU/g by day. Salmonella was not detected in any of the treatments or control. As pretreatments had no drastic effect on physicochemical properties, sensory property values were satisfactory by day 7 and the microbial counts were within safe to consume limits. minimally processed bell pepper strips in PVC packages could be recommended to be sold at supermarket chains where cold storage (5-7 °C) facility is available.

Cluster analysis of eight caryophyllids using structural and pigment characters

G. L. T. Godagedara and S. P. Senanayake Department of Botany, University of Kelaniya, Sri Lanka,

Caryophyllidae is a subclass of three orders; Caryophyllales, Polygonales and Plumbaginales and includes familiar ornamentals (carnations, campions) and agricultural plants (beets, spinach).

The pollen morphology, specific P-type sieve-element plastids, embryological features and the distributional pattern of pigments are the important taxonomic characters used in the previous classifications of the subclass.

Selected morphological, stem and leaf anatomical characters of eight taxa; *Gomphrena globosa, Celosia argentea,Amaranthus spinosus,Amaranthus viridis,Talinum paniculatum,Mirabilis jalapa,Antigonon leptopus* and *Plumbago auriculata* representing three orders, were observed and photomicrographs were prepared. Pigment distribution in their leaves and floral parts were studied using paper chromatography in solvent systems; BAW (Butanol-Acetic-acid-Water), forestal (acetic acid: Conc. HCl: H₂O: 30: 3: 10) and 15% acetic acid. The variations were evaluated based on population samples obtained from their natural habitats. Multi access key was developed using DEscription Language TAxonomy (DELTA) package.

To study the phenetic relationships among the eight taxa, a set of 65 characters; 35 pigment characters and 30 structural characters, were analyzed using SYNTAX 2000 package. The cluster analysis indicated that the orders Polygonales and Plumbaginales have deviations with the order Caryophyllales with respect to their floral and leaf flavonoid distribution while the similarities of these orders were observed in structural characters. The main supportive evidence for deviation is the presence of anthocyanins in Polygonales and Plumbaginales and betalains in Caryophyllales. The present findings are in agreement with the view of Cronquist (1981) and Dahlgren (1983) which indicated the close relationship between order Caryophyllales and anthocyanin producing orders; Polygonales and Plumbaginales.

Investigation of Antibacterial Compounds in Vateria copallifera seeds

T. A. N. Siriwardena, E. D. De Silva and C. D. Wijayarathna

Department of Chemistry, Faculty of Science, University Colombo

Recent research has shown that medicinal plants are an important source of secondary metabolites with various biological activities including antimicrobial activity. Sri Lanka possesses a high degree of biodiversity and 23% of the flowering plants are endemic to the island. Thus the endemic medicinal plants of Sri Lanka become an attractive source for the discovery of novel compounds with antimicrobial activities. According to the results of previous research on the endemic medicinal plant Vateria copallifera, two antimicrobial compounds, copaliferol-A and -B have been isolated from its bark. In addition antimicrobial activity has been reported for the seed-extract of this plant. The reported antibacterial activity of the seeds was superior to that of the bark extract. In this research we focused on separation and characterization of antibacterial compounds present in V. copalliferaseeds. Seed samples were collected from the Kalutara area and the freeze dried materials were extracted sequentially using solvents with different polarities. These extracts were tested for antimicrobial activity against Methicillinresistant Staphylococcus aureus (MRSA) and Methicillin-sensitive Staphylococcus aureus (MSSA) using the agar disk diffusion method. The ethyl acetate- and methanol-crude extracts were active against both MRSA and MSSA, while petroleum ether and chloroform crude extracts were inactive.

The two active extracts, were subjected to extensive bioassay guided fractionation using both normal phase and reverse phase chromatography with a view to isolate the active compounds. ¹H NMR spectroscopic analysis of the active fractions from the ethyl acetate and methanol crude extracts showed that these components are different to the previously isolated compounds from bark of *V. copallifera*.

Effect of a local Trichoderma isolate on the onion basal rot pathogen in Sri Lanka

W. H. M. V. P. Edirisinghe and N. Deshapriya

Department of Botany, Faculty of Science, University of Kelaniya

As onion (*Allium cepa*) is an important component in the daily diet of Sri Lankans, there is a great consumer demand for onions throughout the year. However, its production in Sri Lanka is limited due to various reasons. One important reason is crop loss due to diseases. Basal rot disease, caused by *Fusarium oxysporum* f. sp. *cepae*, accounts for 10 - 50% of crop loss. To control the pathogen, the most widely used method is application of chemicals in spite of their adverse effects on the environment.

Biological control has been identified as an alternative for chemicals, as it does not cause damage to the environment and if the control agent is isolated locally, it causes minimal damage to the ecosystem. *Trichoderma* species are commercially used as biological control agents in controlling fungal pathogens amongst others.

In this study, basal rot pathogen of onion was isolated from diseased onion bulbs grown in farmer fields in Sigiriya and a *Trichoderma* species was isolated from the soil of the same fields. Dual culture of the pathogen with the *Trichoderma* isolate on Potato dextrose Agar (PDA) plates and slides indicated that the *Trichoderma* isolate was capable of controlling the growth of the onion basal rot pathogen isolated, *i.e. F. oxysporum, in vitro*.

The isolated *Trichoderma* species produced loops and clamps around the pathogen hyphae restricting the growth of the pathogenic fungus. This indicated the use of mycoparasitism as a mechanism of controlling the growth of pathogen hyphae. In addition, the *Trichoderma* isolate was able to utilize chitin and glucan as the sole C source when grown on modified Czapek – Dox Agar medium indicating the involvement of extracellular enzymes i.e. chitinase and glucanase in controlling the pathogenic fungus.

However, presence of secondary metabolites with a toxic activity towards the pathogen was not observed in the *Trichoderma* culture filtrates tested.

Therefore, formation of myco-parasitic structures such as loops, clamps and formation of coils around the pathogen is used by the isolated *Trichoderma* species for controlling the growth of the pathogen *F. oxysporum*. The *Trichoderma* isolate was able to grow in modified Czapek – Dox medium containing chitin or 1, $6 - \beta$ – glucan as a sole C source indicating synthesis and secretion of extracellular enzymes.

Feasibility of using palmyrah raw tuber flour as an alternative culture medium for fungal growth

S. Tharmila, E. C. Jeyaseelan and A. C. Thavaranjit Department of Botany, Faculty of Science, University of Jaffna

The nutrient composition of the medium and growth condition determine the growth of microorganisms under laboratory conditions. Potato dextrose agar (PDA) is used as a general purpose medium for fungal growth. However, high cost of media restricts the microbiological work, especially in developing countries. Therefore, several attempts have been made to find out alternative culture media from locally available cheap materials. The present study was conducted to test the ability of using locally available raw dried tuber flour of palmyrah as an alternative medium for fungal growth. Solidification ability of the medium was tested at different flour concentrations without adding agar and the time taken for solidification was compared with that of (3.9 g/100 ml) PDA. 16 g/100ml of palmyrah tuber medium showed complete solidification after 25 minutes which is similar to that of PDA. 8 mm diameter discs of Mucor sp., Penicillium sp., Fusarium sp. and Trichoderma sp. were transferred on to the centre of the test medium (16 g/100 ml concentration) and the control media (PDA). Their growth was measured at various time intervals by measuring radial growth of fungal mycelia. This revealed that the palmyrah tuber media was suitable for the growth of all the tested fungi and the growth of *Penicillium* sp. on palmyrah tuber medium was significantly higher (p < 0.05) when compared to PDA. Also the *Mucor* sp. showed better growth (p < 0.05) on palmyrah tuber medium than PDA after 24 hours of incubation. The test fungi, Trichoderma sp. and Fusarium sp. exhibited an approximately equal radial growth on palm and PDA media after 96 hours of incubation. In both media, the growth rate of most of the tested fungi increases with the extended incubation period. This study clearly demonstrated the possibility of using locally available palmyrah tuber flour as an alternative medium for fungal growth in order to carry out microbiological work. However, further studies are needed to evaluate the self-setting properties and the specific components of this medium that promote the growth and sporulation of fungi.

Screening Sri Lankan rice (*Oryza sativa* L.) varieties for tolerance/resistance of preplanting broad-spectrum herbicide, Glyphosate

W. J. Nimanthika and S. R. Weerakoon

Department of Botany, The Open University of Sri Lanka, Nawala, Nugegoda

Glyphosate is a widely used broad-spectrum, pre-planting herbicide in Sri Lankan rice fields. Although it has an efficient activity against rice-weeds, no comprehensive studies have been conducted to evaluate its effects on rice. Therefore a preliminary screening was carried out to evaluate the effects of Glyphosate on 22 Sri Lankan rice (Oryza sativa) varieties (BG, AT, BW LD series). Rice seed samples were surface sterilized and kept in moist chambers for germination. Two series of modified MS media with 0.5 g/l and 0.25 g/l Glyphosate (360g/l-Count-up®) concentrations were used as the growth medium for rice plants. A total of 60 Rice seedlings (4 cm height) were transferred to test tubes containing sterilized modifiedMS media with Glyphosate and the tolerance/resistance was observed for a period of one-week. Ten replicates in three trials (3*10) were carried out for each herbicide concentration and controls for each variety were used. The dead plants were considered as susceptible to the herbicide. The surviving plants with a substantial growth were considered as resistant and the plants which did not grow but remained green were considered as tolerant to the herbicide. The resistant/tolerant varieties were then transferred to soil medium and kept in an incubator for another one-week to observe the growth performance. The percentage tolerance/resistance was calculated. Results indicated that different rice varieties have shown diverse potential of tolerance/resistance to herbicide treatments. Varieties BG-300, BG-403, BG-379/2, BG-94-1, AT-308, AT-362 and BW-364(with >67%) were seen resistant while varieties BG-250, BG-406, BG-357, LD-408 and AT-405(>70%) were found tolerant to 0.25 g/l Glyphosate. Varieties BG-300, BG-403 and AT-308(>42%) were tolerant at 0.5g/l Glyphosate in MS media and LD-408 and BG-250(>59%) showed resistance to this concentration. The results of the study showed that there is a considerable effect from Glyphosate on rice-plant-growth. Further studies are recommended to evaluate the effects of Glyphosate on growth performance and yield of rice varieties in Sri Lanka, which could lead to develop herbicide resistant rice varieties in future.

Effect of Gibberellic acid (GA₃) on differentially salt tolerant rice cultivars in response to salt stress

J. M. D. R. Menike and P. Senadheera

Department of Botany, The Open University of Sri Lanka

Interactive effect of salinity and gibberellic acid (GA₃) on seedling growth and physiology of two rice cultivars with contrasting tolerance (i.e. Pokkali and Bg94-1) to salinity stress was studied. Fourteen days after sowing, rice seedlings were exposed to 50 mM NaCl (5 dS /m) for 15 days with exogenous application of giberrallic acid (10 ppm). Comparative studies revealed differences in mechanisms of salt tolerance and the differential effect of GA3. GA3 induced relatively higher growth and shoot elongation in tolerant Pokkali than the sensitive Bg94-1 in response to salt stress. Photosynthetic capacity of both cultivars was upheld by GA₃ as indicated by higher total chlorophyll concentration under salt stress. However, Chlorophyll a seems to be more responsive for the GA₃ than Chlorophyll b. Sensitive cultivar treated with GA₃ had lower relative water content than Pokkali in response to salt stress suggesting the higher rate of transpiration in Bg94-1. Comparative analysis of Na⁺ and K⁺ uptake and tissue level distribution in Pokkali and Bg94-1 showed differential effect of GA3 on different cultivars. GA3 altered in *planta* ion homeostasis mainly by decreasing the Na⁺ load in leaf tissue and changing the partition pattern. GA₃ also induced K⁺ accumulation which was significantly higher in tolerant Pokkali than the Bg94-1. The results suggest that GA₃ improves the growth and physiology of rice and ameliorates the adverse effects of salt stress in a cultivar dependant manner.

Antimicrobial properties of some selected lower plants

D. L. M. B. Jayarathne¹, P. S. Saputhanthri¹, R. P. Perera² and G. A. S. Premakumara³

¹ Department of Plant Sciences, ²Department of Chemistry, University of Colombo, ³ Herbal Technology Division, Industrial Technology Institute (ITI), Colombo 07.

Currently, biological compounds from lower plants, i.e. algae, bryophytes, ferns and fern allies, are being explored for their bioactive potential. Despite being an essential component of our natural ecosystems, lower plants have received only a little attention other than for taxonomical studies, in Sri Lanka. Our on going research aims to identify lower plants, particularly bryophyte species, found in the country that may have potential bioactive properties, and to identify their bioactive compounds. Here we report some preliminary findings on antimicrobial activities of some selected lower plants, namely three *Selaginella* species and a liverwort *Riccia glauca*, collected from different locations in the country between 2009 and 2011.

Methanolic extracts from whole plants were screened for positive antibacterial and/ or antifungal properties using bioassays. The disc diffusion method was used to test the extracts against two Gram positive bacteria, *Staphylococcus* sp. and *Streptococcus* sp., Gram negative *Escherichia coli* and *Klebsiella sp.* and fungi *Penicillium* sp., *Aspergillus* sp. , *Curvularia sp.* and *Mucor* sp. Gentamycin and Clotrimazole were used as standard antibiotics for bacterial and fungal bioassays respectively.

Of the crude methanolic extracts obtained from three *Selaginella* species, one showed significant inhibition ($p \ge 0.05$)on bacteria at 5 mg/disc concentration. None of the three extracts showed antibacterial or antifungal properties at 1 mg/disc concentration. In a previous preliminary survey, methanolic extracts of the liverworts (*Riccia glauca*), showed a considerable inhibition of at least two tested bacterial species at 1 mg/disc strength. Therefore it was attempted to fractionate *R. glauca* extract to isolate potential bioactive ingredients. The extract was fractionated using a silica gel column with gradient elution in an appropriate solvent system. Eluents were subjected to TLC analysis and according to the spot Rf values observed those were combined to form eleven fractions that were subsequently tested for antibacterial activity. The results showed that the polar portion of the *R. glauca* extract to have bioactivity against *E. coli*, but not against *Staphylococcus sp.*, as indicated prior to sub-fractionation of the crude. Loss of bioactive ingredients during the sub-fractionation process could be the reason for this discrepancy in observations.

Our observations further emphasize the potential of Sri Lankan bryophytes to have antimicrobial properties.

Effect of aqueous Allium cepa var aggregatum extract dip treatment on Willard mangoes

N. Krishnapillai and R. S. Wilson Wijeratnam Department of Botany, University of Jaffna

Willard mango (*Mangifera indica* L) is a popular mango variety found in most home gardens in Jaffna. Skin colour and taste of Jaffna Willard mangoes are exceptional. However, post-harvest losses of this variety are very high as fruits are very susceptible to the anthracnose pathogen, *Colletotrichum gloeosporioides*. Reducing postharvest losses and extending storage life would benefit home garden growers whose income is supplemented by the sale of such crops.

Alliumcepa var aggregatum (Shallots) extract is natural, non-residual and known to contain antimicrobial compounds and antioxidants. Aqueous extracts from bulbs of local Allium species belonging to the Allium aggregatum group were thus prepared and evaluated against Colletotrichum gloeosporioides by using agar plate assay. Extracts showed a 71% \pm 0.43 growth inhibition against Colletotrichum gloeosporioides. These in vitro studies indicated the possibility of using aqueous Allium extract effectively to control anthracnose pathogen in Willard mangoes.

Over 200 mature Willard mangoes were harvested carefully, washed and air dried. Willard mangoes were then dipped in 100%, 50% and 20% of aqueous *Allium* extract separately. 21 mangoes were used in each treatment with three replicates. Dipping treatment with 20% extract was observed to increase storage life and reduce the development of anthracnose symptoms. Poor ripening and bad taste after ripening were observed with the 100% and 50% *Allium* extract dip, although these treatments extended storage life by more than 10 days and reduced loss due to disease. Storage life of non-treated fruits was 7 ± 0.33 days. Taste panel results of fruits treated with 20% *Allium* extract were acceptable, and could be stored for 10 days at ambient temperature (30 °C-34 °C). *In vivo* studies with 20% *Allium* extract thus resulted in good quality fruits without affecting taste and marketability.

Floral biology of Hibiscus furcatus in relation to pollination

H. P. P. Premathilaka and R. M.C.S. Ratnayake

Department of Botany, University of Kelaniya, Kelaniya

Hibiscus furcatus (Malvaceae) is an important medicinal plant used in Ayurvedic medicine. Due to paucity of reproductive biological information, the present study was aimed to investigate the floral biology of *H. furcatus* in relation to pollination and to identify the breeding system, to facilitate future breeding and crop improvement programs. Floral level phenological changes were observed from initial flower bud stage to final wilting of the flowers. Timing and duration of anther dehiscence and stigmatic receptivity were studied. Floral biological changes in relation to symmetry of flowers were determined. Flowers were visualized under the UV light to investigate importance of colour as an attractant. Floral visitors were collected and they were identified. Pollen carbohydrate and lipid were analyzed. Pollen: ovule ratio and Out Crossing Index (OCI) were calculated.

Large (average diameter of 7.5 ± 0.08 cm) and funnel shaped *H. furcatus* flowers and demarcations of the petals which are arranged towards the staminal column were identified as an important pollinator attractants. Pollen grains were zoophilous and are rich in carbohydrates and lipids. They are characterized by large diameter (125 µm) and spiny tecta. The spines in pollen and highly concentrated epidermal hairs in five stigmatic lobes enhance the effectiveness of pollination. When the flower is fully opened at around 6.00 a.m., all the anthers have dehisced and from 6.00 a.m. to 3.00 p.m., pistillate phase prevailed. The flexistyly condition which prevents selfing was identified. But, as there was an overlapping between staminate phase and pistillate phase, it facilitates a chance for the accidental autogamy.

The percentage of left-handed flowers was higher than the right-handed flowers and floral symmetry did not influence its pollination. Species of bees, ants, beetles and flower fly were identified as the effective pollinators of *H. furcatus* flowers. Pollen: ovule ratio (328.28 ± 10.37) and OCI value (5) indicates that *H. furcatus* possess a partially self-compatible breeding system having very high out crossing demand for pollinators. While the present study strengthens the knowledge of breeding systems of Malvaceae family, the results would help to plan breeding strategies and conservation of *H. furcatus*.

Soil properties of Bellanwila – Attidiya Sanctuary: A preliminary investigation

S. Cooray¹, D. Wickramasinghe¹ and R. Piyadasa²

¹Department of Zoology, University of Colombo. ²Department of Geography, University of Colombo.

Wetlands are comprised of characteristic components of soil, water and biodiversity which interact with each other to give rise to a unique environment. This study investigates physical and chemical parameters of soil in Bellanwila-Attidiya Sanctuary, which is an urban wetland in the Colombo district. This study was carried out for a period of 3 months starting from February 2011 and site was visited one in two weeks. Soil samples were removed using a soil borer randomly in 10 different locations from two layers i.e. top- on the surface and bottom- at one m depth. Depth of water table was investigated using the water levels of existing dug wells. Soil samples were taken to the laboratory and physical and chemical properties were analyzed in duplicate.

The following results were obtained for different parameters (mean±SD);

Chemical properties of top layer- NO_3^- (0.15±0.08 ppm), PO_4^{3-} (2.6±0.64 ppm), SO_4^{2-} (142.00±17.45 ppm), Cl⁻ (1.25±0.40 ppm)and Fe³⁺ (1.22 ±0.01 ppm); *bottom layer-* NO_3^- (0.12±0.1480 ppm), PO_4^{3-} (1.69±0.69 ppm), SO_4^{2-} (1461.06±755.03 ppm), Cl⁻ (5.01±1.36 ppm)and Fe³⁺ (0.29 ±0.01 ppm).

Physical properties of top layer- moisture content (62.66±19.08 %), pH (5.59±0.49), salinity (0.35±0.08 ppt), electrical conductivity (824.30±289.65 μ S), temperature (30.42±1.69 °C), soil type (silt clay loam) and soil colour (brownish black); *bottom layer-* moisture content (60.35±6.92 %), pH (3.53±0.40), salinity (3.60±1.61 ppt), electrical conductivity (6985.33±2606.23 μ S), temperature (28.25±1.41 °C), soil type (clay) and soil colour (gray).

Parameters of top and bottom layers were significantly different at p < 0.05 level. Furthermore, there were significant correlations of soil properties with the height of ground water table.

Pollination and seed biology of Hibiscus furcatus

H. P. P. Premathilaka and R. M. C. S. Ratnayake Department of Botany, University of Kelaniya.

Hibiscus furcatus, a common low country plant, plays a considerable role in traditional medicine. This study was aimed to broaden our understanding of pollination biology and seed biology of *H. furcatus*. Pollen biological information, especially the optimum sucrose concentration (0, 5, 10, 15, 20, 25, 30%) and optimum time duration for *in-vitro* pollen germination, viability of pollen after anther dehiscence within the flower and viability of pollen under storage conditions (at 4 °C and 0 °C) were tested. Controlled pollination experiments (natural and artificial autogamy, open, geitonogamy and xenogamy) with a minimum of 50 replicates were carried out to determine its breeding system. Seed biological aspects such as percentage of insect-damaged seeds in a pod under natural conditions and viability of seeds under three storage conditions (desiccator, 4 °C and 0 °C) were determined. Three pre-sowing treatments (mechanical damaging of seed coat, heat shock and conc. H₂SO₄ treatment) were tested for *H. furcatus* seeds to determine the best seed dormancy breaking method.

The optimum sucrose concentration (20 % (w/v)) and duration (180 minutes) for the highest pollen germination (81.32 \pm 3.82%) was recorded from flowers opened at around 6.00 a.m. Therefore, for controlled pollination experiments of *H. fiurcatus*, pollen from nearly open flowers was used. Of the two temperatures tested for pollen storage, viable pollen were identified only from the 4 °C stored pollens after 24 hours (16.50 \pm 2.93%) and 48 hours (7.60 \pm 1.27). A relatively high percentage (>90%) of fruit set was recorded in the controlled pollination experiments than in natural (open) pollination (76%), indicating that the pollinator availability limits fruit set. The highest fruit set was reported from geitonogamy (96%) followed by autogamy (93%) suggesting that *H. furcatus* is highly self-compatible, but, xenogamy (91%) also occurs.

In this study 44% of pods were damaged by a black colored beetle species. The highest viability of *H. furcatus* seeds (5% \pm 0.6) was recorded under low moisture condition in a desiccator. Among the methods used to break dormancy of seeds, soaking in con. H₂SO₄ for45 minutes was the best (germination was 65.3%). The results of the present study would be helpful to plan breeding designs for *H. furcatus*. Furthermore, the study enhances the understanding of various breeding systems and important seed biological aspects of the family Malvaceae.

Effect of burying depth and surface fire on germination of selected dry zone forest plant seeds in Sri Lanka

R. M. C. S. Ratnayake and L. R. Jayasekera

Department of Botany, University of Kelaniya, Kelaniya

Seeds that survive in the soil after fires contribute to post-fire recruitment. Such seeds show various adaptations to retain their viability against fire. This study examines the effect of four burying depths on survival of seeds of ten selected dry zone forest species against fire. Ripe fruits of the species were collected from Pollonaruwa, Anuradhapura, Hingurakgoda and Moneragala. Among the eight seed beds prepared at Kaudulla, two beds were allocated for each burying depth (0, 1, 3 and 5 cm). In each depth, 100 viable seeds of selected species were buried in rows. One set of beds were subjected to the fire treatment while, the other set of beds were maintained as controls. Prior to fire treatment, all seed beds were maintained according to the standard nursery management practices. Data on germination percentage, performance of seedlings and growth of saplings were collected at two week intervals for four months.

All seeds of *Abrus precatorius, A. precatorius* (Black), *Cassia roxburghii, Bauhinia racemosa, Terminalia bellirica* and *T. chebula* were not germinated at 0 cm depth in the fire-treated beds. Seeds of *T. arjuna* showed germination at all depths in both fire treated and control beds. However *T. bellirica* and *T. chebula* germinated only at 5 cm depth in control beds. Seeds of *Adenanthera pavonina*were not germinated at all depths tested except for 5 cm depth in fire-treated seed beds. *Schleichera oleosa* showed germination in all depths except 0 cm in both fire treated and control beds. The highest germination percentage of *Bauhinia racemosa* was recorded at 5 cm depth in both control and fire-treated beds. Percentage germination of *C. roxburghii* seeds in fire-treated beds was higher than that of control beds at depths of 1, 3 and 5 cm. Even though the percentage viability of seeds of *Helicteres isora* and *Diospyros ebenum* were above 50%, their seeds did not germinate in both fire treated and control beds.

Of the10 species tested, the percentage germination of *Cassia roxburghii*, *Bauhinia racemosa*, *Terminalia belerica* and *Schleichera oleosa* seeds in fire treated beds were higher than that of the control beds (one-way ANOVA, P < 0.05). The burying depth of seeds has a significant effect on seed germination after fire. These four species with fire tolerant seeds can be used for forestry programs in fire prone areas.

Evaluation of *in vitro* antibacterial activity of some medicinal plant extracts on hair borne bacteria

S. Tharmila, E. C. Jeyaseelan and A. C. Thavaranjit

Department of Botany, Faculty of Science, University of Jaffna

Hair borne bacteria are found to be one of the causative agents for infectious diseases of hair follicles. Commercially available herbal shampoos are not completely natural. Since ancient times traditionally people use several plant materials and their extracts as hair washing substances. Plant based natural substances are not usually harmful and they are found to be effective. Therefore, the present study was carried out to evaluate the effectiveness of some medicinal plant extracts on different hair borne bacteria in vitro. Bacteria were isolated from the hair of randomly selected twenty five students in the faculty of science, University of Jaffna by cotton swab method and they were identified based on morphological, physiological and biochemical characteristics. 50 mg/ml aqueous extracts of leaves of Lawsonia inermis (Henna), seeds of Nigella sativa (Black cumin) and Vernonia anthelmintica, and bark of Azadirachta indica (Neem) and an extract of a mixture of above herbal powders (same concentration as above) were tested for the antibacterial activity against four characterized bacterial genera, Bacillus coagulans, Yersinia sp., Erwinia herbicola and Aerococcus sp. Agar well diffusion method was used and the effect was evaluated by measuring the zones of inhibition. Meera herbal shampoo (50 % v/v) was used as standard and the sterile distilled water was used as control. The average value of inhibition zone was calculated and statistical analysis was carried out by one way analysis of variance (ANOVA) followed by least significant difference test. Quantitative and comparative evaluation of antibacterial properties showed that the extracts of the leaves of L. inermis and the bark of A. indica possess antibacterial effects to significant extents and there was no significant (P<0.05) difference between the extracts of L. inermis and standard on E. herbicola. Aqueous extract of N. sativa and mixture of herbal powder were only able to inhibit the growth of Yersinia sp. and B. coagulans respectively. V. anthelmintica extract was unable to inhibit the growth of any of the tested bacterial genera. The standard was effective on all the tested bacteria. Present study reiterated the possibility of using leaf extract of L *inermis* and bark extract of A. *indica* as primary sources for the preparation of hair washing substances.

Some insights into the barcodes and phylogeny of the two endemic mouse-deer in Sri Lanka

J. A. H. U. Jayakody¹, M. R.Wijesinghe¹, C. D. Dangalle¹, H. D. K. G. A.Weerakoon¹ and S. Mendis²

> ¹Department of Zoology, University of Colombo ²National Zoological Gardens, Dehiwala

This study investigates the genetic composition of the two endemic mouse-deer in Sri Lanka, *M. meminna*, Erxleben, 1777 (White-spotted Chevrotain) and *M. kathygre*, Groves and Meijaard, 2005 (Yellow-striped Chevrotain).The relatively recent split between the two endemics was based solely on pelage features and bone structure of museum specimens. No studies have, so far, examined their genetic composition. In the present study we thus sought to confirm their identities through a genetic study conducted on the captive mouse-deer population at the National Zoological Gardens, Dehiwala. Blood samples were collected from the two species, *M. meminna* (n=3) and *M. kathygre* (n=5), and DNA was extracted and amplified using standard procedures, at Genetech, Sri Lanka. These DNA sequences were then used to derive phylogenetic relationships.

The present study has, for the first time, divulged substantial sections of the DNA barcodes of the two endemic mouse-deer species in Sri Lanka and shed light on their phylogenetic relationships. Published sequences of six ruminant species with the full mitochondrial genome of *Muntiacus reevesi* gave similar results confirming that the sequences generated essentially represents the barcoding regions for *M. kathygre* and *M. meminna*. Several variable sites were visible at the 1st, 2nd, 3rd, 22nd, 104th and 290th base positions along the two sequences. Phylogenetic trends revealed that *M. meminna* and *M. kathygre* belong to the same monophyletic clade. Molecular evidence also suggests that *M. kathygre*, specialized to inhabit the wet zone, was of a more recent origin than *M. meminna*, at present confined to the dry zone of the island. This was further supported by the sequence divergence values obtained for the two species. These findings thus, confirm the validity of the split between the two species which could be used to strengthen the protection of these two endemics in their natural habitats.

Rapid and low-cost DNA extraction procedure for PCR-based detection of pathogenic organisms in environmental waters

J. R. K. N Jayawardhane, N. Deshapriya and N. Welikala

Department of Botany, University of Kelaniya

Waterborne diseases are prevalent in developing countries including Sri Lanka causing four-fifth of all illnesses. Current culture-based survey and detection methods are expensive, laborintensive, time consuming and frequently result in erroneous or inconclusive results. Two rapid and low-cost molecular methods based on chaotrophic properties of guanidinium isothiocyanate (GITC) were modified and tested. In the first procedure, GITC was used in the lysis buffer and in the second procedure it was used in the protein precipitation step. DNA yields and purity were estimated by UV spectrophotometry and suitability of purified DNA for downstream applications was tested by PCR amplification with uidA primers specific for E. coli gene β-D glucoronidase and Bac32F and Bac708R primers specific for 16SrRNA gene of Bacteroides species. DNA yields estimated by the pellet size and agarose gel electrophoresis was higher in method 1 but UV spectrophotometric readings overestimated yields probably due to continued presence of contaminants including guanidinium and proteins although not detected in UV spectrum study. Presence of these contaminants however had no inhibitory effect on PCR amplification with both methods giving specific PCR products with both primer pairs. Results indicate method 1, previously described for detection of pathogenic microorganism in clinical samples is superior to method 2 producing higher yields and purify of DNA and higher PCR yields. Some modifications to both methods are needed when dealing with water containing high levels of algae.

A comparative bioinformatics study on CSN5 gene in Arabidopsis thaliana

K. H. H. Priyabhani and P. S. Saputhanthri

Department of Plant Sciences, University of Colombo, Colombo 03

The Constitutive Photomorphogenic 9 (COP9) Signalosome or CSN is a conserved protein complex consisting of eight subunits, in higher eukaryotes. The exact mechanisms of CSN actions are not fully understood. The main catalytic center of the CSN resides in its fifth subunit CSN5. The *csn5a* mutants in *A. thaliana* show a striking pleiotropic phenotype with reduced apical dominance and defects in light and hormone signal transduction in general. However, the *csn5a*mutant lines of *A. thaliana* differ from each other in the severity of the phenotype indicating the significant role(s) of CSN5A in regulating cellular functions. The study reported here was a bioinformatics approach aiming to analyze the sequences of the wild type (WT) *CSN5A* and two T-DNA insertion mutant lines of *A. thaliana*, namely *csn5a-1* and *csn5a-2*, at gene and protein levels and to predict and analyze the probable structural features that may be important functionally.

The methodology involved comparative DNA sequence analysis, protein sequence prediction, prediction of structural features of the WT and mutant proteins using those sequences and analyzing those in order to gain new insights into CSN functions. The WT *CSN5A* (At1g22920; 2338 bps) and the mutant gene sequences were obtained from TAIR and SALK data bases respectively. The *csn5a-1* sequence is with a 292 bp long foreign DNA insert (SALK_063436) and the *csn5a-2* is with a 40 bp insert(SALK_027705).All DNA sequences were analyzed with MEGA (version 4.0.2) and ORF Finder. Prediction of protein secondary structures, coiled-coils and remote homology modeling were carried out using PSI-PRED, COILS/PCOILS and Phyre (version 0.2) web servers respectively.

Comparative sequence analyses indicated introductions of premature stop codons in the mutant genes resulting truncated proteins. A large helix fold and coils region is absent in the csn5a-2 protein and several helical strands and coils in csn5a-1.Such local differences in the truncated proteins predicted are believed to result in the distinctive phenotypes observed in the two mutant lines, *csn5a-1* being the most drastically affected. In the absence of known structural data, homology modeling could not be performed to predict 3D features. Alternatively, remote homology modeling using the Phyre server indicated a missing protein fold of 55 amino acids in the two mutant lines, that may be playing a significant role in the functioning of CSN. This region shows highest fold similarity to an adaptor protein in β -catenin/Arm protein degradation via the ubiquitin-26S proteasome pathway. Our findings suggest a likely involvement of the CSN with plant 'Arm-repeat'- or β -catenin-like proteins that have been implicated in a range of signaling and developmental processes.

DNA fingerprinting of *Pyricularia grisea* in Sri Lanka, by repetitive-PCR method using a single primer based on the transposable element pot2

D. C. Wimalasiri, M. Y. Jothimala¹, W. S. S. Wijesundera², and R. P. N. Priyanthi²

¹Regional Agricultural Research Centre, Bombuwala, ²Department of Biochemistry and Molecular Biology, Faculty of Medicine, University of Colombo

Rice blast disease caused by Pyricularia grisea (Magnaporthe grisea) is one of the most destructive rice diseases worldwide. In this study DNA samples of P. grisea was fingerprinted by repetitive element based polymerase chain reaction (rep-PCR) using a single primer of the transposable element pot2. It is a type 2 transposable element which is 1861 base pairs in length and contains a terminal inverted repeat sequence, hence a single primer can be used for amplification of DNA sequence lying between the transposon. DNA was extracted from fungal isolates collected from ten different districts in Sri Lanka that were maintained at Bombuwala Research Center. Optimization of PCR conditions were carried out by varying reaction components and PCR cycle parameters. PCR product analysis carried out by ethidium bromide stained agarose gel electrophoresis yielded 5-11 distinct bands under UV illumination. Depending on the fingerprint results, polymorphism analysis of the rice blast fungus, in different agro ecological zones in Sri Lanka was carried out by cluster analysis. According to the results 6 clusters were observed. The main cluster was observed at the 46.6% similarity level which consists most of the individuals in the three sub clusters (A, B and C). These results indicate a low genetic diversity among P. grisea isolates which were studied at the selected ten districts in Sri Lanka.

Immune status, clinical aspects and risk factors of human leptospirosis in Gampaha district, Sri Lanka

S. U. Thrikawala¹, M. L. G. Piyatisse², G. Premawansa², I. C. Perera¹, R. P. V. J. Rajapakse³ and W. S. Premawansa¹

¹Department of Zoology, Faculty of Science, University of Colombo, Colombo 03 ²Colombo-North Teaching Hospital, Ragama.³Department of Veterinary Pathobiology, Faculty of Veterinary Medicine & Animal Science, University of Peradeniya, Peradeniya

Leptospirosis is a common zoonotic infection in tropical countries, caused by Leptospira interrogans and considered as an occupational hazard. Diagnosis of leptospirosis is difficult due to varying clinical manifestations. Patients suspected for leptospirosis, admitted to the Teaching hospital, Ragama and Base hospital, Gampaha were analyzed for Leptospira specific IgM and IgG antibodies by ELISA. Associated clinical status and risk factors were also analyzed. Out of 74 clinically suspected patients, 47% were positive for IgM and 39% for IgG. High disease prevalence was observed among males of age 20-60 years. 60% of patients were engaged in agricultural activities connected with seasonal paddy cultivation. IgM and IgG responses appeared within 0-10 days after the onset of symptoms and persisted up to 6 months. However, a significant decline of IgM levels with time (P < 0.05) was found while IgG levels decreased slightly, suggesting much longer persistence. Myalgia was significantly common among positive patients (100%, P<0.05). Icterus, conjunctival suffusion and muscle tenderness were important distinguishing physical findings (P < 0.05). Only about 1/3 of the patients tested were icteric. Platelet counts were increased with increasing IgM levels (P < 0.05) and potassium levels with elevating IgG levels (P<0.05). Thrombocytopenia, elevated levels of total bilirubin, direct bilirubin, serum creatinine and blood urea were observed in 37%, 21%, 36%, 35% and 26% of IgM positive patients (with current infection) respectively. Of these patients, blood urea levels gave significant association with disease (P < 0.05) and RBCs were present in urine in 46% of them. Educational level and knowledge and use of chemoprophylaxis showed a significant protection from disease (P<0.05). Risk of exposure due to occupation was significantly high in non-infected individuals from risk groups (P < 0.05), with 40% positivity for IgG with subclinical infections. This study suggests the requirement of using serodiagnosis and related clinical criteria to properly identify leptospirosis patients and of establishing proper preventive measures.

Phagocytosis as a biomarker of immunotoxicity in response to selected heavy metals in *Euphlyctis hexadactylus* (Ranidae): A pilot study

S. Priyadarshani, D. D. Wickramasinghe, D. N. de Silva and P. V. Udagama-Randeniya Department of Zoology, University of Colombo

Exposure to high concentrations of heavy metal ions, identified as toxic xenobiotics, that cause immunotoxic effects by means of immunosuppression may render amphibians more susceptible to novel diseases. It is plausible that amphibian models may serve as useful sentinels of environmental problems that humans face.

The present study, investigated effects of metal ion toxicity on the immune system of *Euphlyctis hexadactylus*(Indian Green Frog). The Bellanwila Attidiya (test) site was found to be polluted with high levels of heavy metal ions, such as copper (Cu), zinc (Zn), lead (Pb), cadmium (Cd), compared to the reference site in Bolgoda by Atomic Absorption Spectrophotometry (AAS) in a previous study. AAS revealed the accumulation of all four heavy metals in the liver and gastrocnemius muscle of *E. hexadactylus*(n=6 from each site) was significantly higher (p<0.05) in the test site compared to the Bolgoda reference site.

The nonfunctional immunological parameters such as total WBC count, spleen weight/body weight ratio and neutrophil/lymphocyte ratio were significantly lower (P < 0.05) in frogs of the polluted Bellanwila site compared to the Bolgoda site.

For the functional test, *in vitro* phagocytic assay (cellular process of engulfing solid particles) based on Nitro Blue Tetrazolium dye reduction, was used for the first time to measure the stimulation index (phagocytic capacity) of *E. hexadactylus* blood leukocytes, splenocytes and peritoneal macrophages. The phagocytic activity of *E. hexadactylus* in the Bellanwila Attidiya site was found to be significantly (p<0.05) lower compared to the Bolgoda site. Data obtained from Bolgoda, after *in vitro* exposure to selected heavy metals, Cu, Zn, Pb and Cd at concentrations of 10^{-3} , 10^{-6} and 10^{-8} M, for all selected cell types showed immunomodulation. Interestingly, it was commonly observed that very low metal concentrations stimulated phagocytosis of *E. hexadactylus* but as metal concentrations increased the trend was towards immunosuppression.

In conclusion, this preliminary *in vitro* study for the first time in Sri Lanka, clearly point towards immunomodulation of the frog species, *E. haxadactylus*, stimulated by heavy metals where ability to use phagocytosis as a successful biomarker in immunotoxicology was evident to detect aquatic heavy metal pollution.

Depression of mitotic indices and induction of chromosomal aberrations in common onion (*Allium cepa*) following exposure to selected industrial effluents

B. M. W. L. Jayathilaka and A. Pathiratne

Department of Zoology, Faculty of Science, University of Kelaniya

Industrial effluents discharge wide array of chemicals with large volumes to river systems and these may have potential threats to biota. The present study was carried out to evaluate the potential cytotoxic and genotoxic effects of two treated industrial effluents reaching Kelani river system at Biyagama and Pugoda. See thawaka area of Kelani river was used as the reference site. Cytotoxicity and genotoxicity were assessed using standard bioassay with root tip cells of common onion (Allium cepa). The water/effluent samples were collected from each site during three sampling visits (during February, June, August) in 2010 and physicochemical parameters of water/effluents were measured in situ. Bulbs of common onion were exposed in the laboratory to these water/effluent samples and to the aged tap water. Cytotoxicity and genotoxicity effects were investigated using the mitotic indices and nuclear aberrations of root tip cells of the common onion exposed to these samples respectively. Most of the pollutant indicative physicochemical parameters in the effluents were significantly higher compared to the water collected from Seethawaka site and tap water. The mitotic indices of A. cepa exposed to effluent samples were lower (P < 0.05) than those exposed to water from the reference site and tap water indicating the presence of cytotoxic pollutants in the effluents. Prevalence of chromosomal aberrations in A. cepa root tip cells exposed to effluent samples were 3-6 folds greater compared to those exposed to water collected from the reference site and tap water. Among chromosomal aberrations, occurrence of sticky chromosomes was the highest in the roots exposed to the effluents. No significant differences were noted between the aged tap water and water collected from the reference site in relation to the parameters measured in most cases. The present study revealed that tested effluent samples contain substances that are cytotoxic and genotoxic to flora and these substances have not been eliminated by the effluent treatments.

Purification of Phytoplasma associated with the Weligama Coconut Leaf Wilt Disease for production of diagnostic Polyclonal Antibodies

C. Kanatiwela¹, N. Shanmuganathan¹, D. Weerakoon¹, S. Premawansa¹, R. Wijesekara², and P. V. Udagama-Randeniya¹

¹ Department of Zoology, Faculty of Science, University of Colombo ² Coconut Research Institute, Lunuwila

Phytoplasma borne Weligama Coconut Leaf Wilt Disease (WCLWD), currently considered as the major threat to the crop has so far affected trees in the southern part of the country but will cause drastic consequences if spread to the coconut triangle. This research aims to raise diagnostic monoclonal antibodies to WCLW phytoplasma, where initially polyclonal serum raised in experimental animals to purified phytoplasma will be used to establish a specific ELISA for subsequent screening of hybridomas.

DNA extracted from ekel of spear leaves was used in a nested PCR employing phytoplasma specific universal primer pairs derived from conserved regions of the 16S ribosomal DNA. Infected palms could be differentiated from healthy ones by the presence of two bands of 880 bp and 1.2 kb on 1% agarose gels.

The WCLW phytoplasma was isolated and purified from spear leaves of the PCR positive samples using Percoll- discontinuous density gradient centrifugation (PDDGC) using standard methodology, with slight modifications. Briefly, leaves were homogenized in isolation medium, filtered, centrifuged and the pellet dissolved in the suspending medium (SM). Following low and high speed centrifugation, the final pellet was dissolved in SM and clarified by further centrifugation. PDDG (15%, 30%, 50% and 60%) was over-layed with 0.5 mL of partially purified phytoplasma preparation and centrifuged, producing a single turbid zone at the interphase of 15% and 30% step gradient, only in the infected leaf samples. This zone was separated and spun and the resultant pellet was dissolved in PBS.

The phytoplasma enriched faction produced a reproducible characteristic absorption spectrum with peaks at 200- 220, 260 and 280 nm, and two prominent bands (62.6, 81 kDa) interspersed with several minor bands (111, 123.2, 136.9 kDa) on SDS PAGE, which were lacking in healthy palms. The phytoplasma enriched faction thus characterized will be used in production of rabbit polyclonal antibodies to be used in the establishment of aWCLWD-phytoplasma diagnostic ELISA.

Effect of cinnamon oils on the root-knot nematode *Meloidogyne graminicola* in rice seedlings and young rice plants

L. D. Amarasinghe and W. K. A. G. A. Wijesinghe

Department of Zoology, University of Kelaniya, Sri Lanka

The present study was conducted to evaluate the effect of cinnamon leaf extraction and bark extraction in suppressing the root knot nematode, *Meloidogyne graminicola* in rice seedlings and young rice plants, at the Department of Zoology of University of Kelaniya during the period from September 2008 to May 2009.

This study was done in five separate experiments; Experiments I and II, to determine the LD_{50} of cinnamon leaf oil and bark oil to kill a 50% of second stage juveniles (J₂) of *Meloidogyne graminicola* in root galls respectively; Experiment III, to determine the efficacy of cinnamon leaf oil and bark oil in controlling J₂in rice seedling; Experiment IV and V, to determine the potential of using cinnamon leaf oil and bark oil respectively in controlling *M. graminicola* in young rice plants maintained in soil pots.

 LD_{50} values for cinnamon leaf oil and cinnamon bark oil for killing 50% of juveniles of *M*. *graminicola* in root galls after seven days of the treatment were 0.326 ppm and 0.454 ppm respectively. Formation of root galls by J₂ in the root system of rice seedlings was significantly reduced when treated with 0.9 ppm of cinnamon leaf oil and bark oil compared to control plants. However, there was no significant difference between leaf oil and bark oil. The root gall index has been significantly reduced in leaf oil treated and bark oil treated young rice plants compared to the untreated rice plants. However, there was no significant difference of gall indices between cinnamon leaf oil treated plants and bark oil treated plants. There was no significant difference of the mean plant height and number of dead plants in each treatment. There was a significant positive correlation between the number of galls developed and the plant growth parameters such as plant height and the mean number of roots and a significant negative correlation between the number of dead plants, and the mean percentage chlorosis. The mean root length did not show a significant correlation with the number of root galls.

The results revealed that, both cinnamon leaf oil and bark oil are equally effective in suppressing *M.graminicola* in rice plants.

In vitro nematicidal activity of weed plant extracts against the root-knot nematode, Meloidogyne incognita

G. D. T. M. Nanayakkara, P. B. Ratnaweera and A. A. K. Karunathilaka

Uva Wellassa University, Sri Lanka

Two weed plant species, *Acalypha indica* (Euphorbiaceae) and *Emilia sonchifolia* (Asteraceae) were assessed for their nematicidal properties against*Meloidogyne incognita*, root-knot nematode, in tomato (*Lycopersicon esculentum*). Plant leaves were extracted using ethanol, ethyl acetate and dichloromethane solvents to predict the best solvent and their chemical composition. Ten freshly hatched second stage juvenile larvae (J2) of *M. incognita* were dispensed into sterile petri dishes each containing 3 ml of one of each five different dilutions(100, 300, 500, 700, 1000 μ g/ml) of the crude plant extracts. Each treatment was replicated thrice and distilled water was used as the control. The nematicidal activity was assessed based on mean mortality percentage of the nematodes after 24 and 48 hours.

Dichloromethane extract of *A. indica* leaves of 1000 µg/ml concentration showed the highest nematicidal activity ($80.0 \pm 17.3 \%$) after 24 hours. 1000, 700 and 100 µg/ml concentrations of ethanol extract, all the concentrations of ethyl acetate extract and 700 µg/ml dichloromethane extract also showed a similar effect. The ethyl acetate extract of *A. indica* displayed the best LC₅₀ value of $283.9 \pm 0.12 \mu$ g/ml. Thus ethyl acetate proves to be the most suitable solvent for extracting bioactive compounds from *A. indica*.

Dichloromethane extract of *E. sonchifolia* leaves of 1000 µg/ml concentration was effective in causing 96.67 \pm 5.77 % *M. incognita* mortality after 24 hours. It showed a highly significant difference than 100, 300, 500, 700, 1000 µg/ml concentration levels of other solvent extracts (ANOVA, P<0.05). However dichloromethane extract with 700 µg/ml concentration also showed 86.67 \pm 11.5 % nematode mortality demonstrating a similar effect to the best treatment. Also dichloromethane extract showed the highest lethal effect to *M. incognita* with the LC₅₀ value of 372.39 \pm 0.07 µg/ml. These results demonstrate that the dichloromethane is the best solvent to extract the chemical compounds in the leaves of *E. sonchifolia*, and the bioactive compounds in *E. sonchifolia* are more prone to be non-polar. The results also demonstrated that in both plant extracts nematode mortality percentage increases after 48 hours of exposure.

In conclusion, this study clearly showed that the leaf extracts of weed plants, *A. indica* and *E. sonchifolia* possess good nematicidal activity against *M. incognita* in tomato.

Nematodes associated with banana (*Musa* spp) cultivations in selected sites in Gampaha district in Sri Lanka

W. B. P Vitharana and L. D. Amarasinghe

Department of Zoology, Faculty of Science, University of Kelaniya

Species of plant root nematodes associated with banana plant and their abundance in the selected locations within Gampaha district, Sri Lanka was studied in this research study. Two types of banana fields were mainly considered. One type of that was banana field at home backyards and the other type was banana fields at roadsides which are not maintained by any person. In addition to those, a banana plantation which is commercially maintained was also studied. Meanwhile five sampling fields within Veyangoda area were studied during the study period to study the temporal variation of soil nematodes. Farmers are unable to identify nematodes and their damage. Survey on plant nematodes is important to inform farmers for good yield.

The identified root parasitic nematodes were *Helicotylenchus multicinctus*, *Radopholus similis* and *Hoplalaimus* sp. No significant difference was identified in their abundance within the banana fields at home backyards and the banana fields at roadsides. The abundance of the free living species was higher in the banana fields at home back yards than that of banana fields at roadsides.

According to statistical analysis, abundance of *H. multicinctus* is significantly higher than *R similis* in the same habitat. Abundance of total parasitic nematodes and the abundance of free living species within the same habitat were significantly different. *Hoplalaimus* sp. is concerned as a minor pest on banana. And the recorded abundance of *Hoplalaimus* sp. and their damage was negligible.

Banana root nematodes were not found within the commercially maintained banana plantation. And no relationship was found between the abundance of banana root nematodes and the physico - chemical parameters of soil. Only the abundance of *R similis showed* a considerable temporal variation during the study period. Abundance of *R similis* was significantly decreased in dry weather conditions and the low moisture content in the associated soil.

Root-knot nematode infestations on Chilli (*Capsicum annuum*) at selected localities in Hambanthota district

W. T. S. D. Premachandra and D. P. C. Senarath

Department of Zoology, University of Ruhuna, Matara, Sri Lanka

Very recently, Chilli fields located in Hambanthota district suffered from root-knot nematode attacks which caused low pod production. Despite the great importance, to date, no research has been focused on this disease incidence. In this study, *Meloidogyne* infestations on four varieties of Chilli, namely, Devinur", "Ruhunu", "CA-8" and "KI-2, grown at four locations, Kattakaduwa", "Netolpitiya" and "Witarandeniya" (2 localities) were determined.

At all the localities, 100% of the Chilli plants examined were positive for nematode attacks Altogether, three *Meloidogyne* species, *Meloidogyne* javanica, *M. arenaria* M. incognita were detected and *M. incognita* was encountered as the key species irrespective of the variety. At three fields, i.e., Netolpitiya (varieties - Ruhunu and CA-8), Witarandeniya-1 and II (variety -KI-2) more than 96% of the rootlets per root system were infested by Meloidogyne nematodes. The mean galled area per root system was ranged 44-72% with the maximum of "Ruhunu Miris" at Netolpitiya. The highest mean number of galls (156±31.27/five rootlets) was detected on KI-2 at the field - II of Witarandeniya.Larval and mature female density of the nematodes per five rootlets were 218.5 (±105.55) and 249.1 (±131.84), respectively, which were higher on the "Ruhunu Miris" at Netolpitiya. However, the highest number of egg masses (120/5 rootlets) was encountered on KI-2 at the field - II of Witarandeniya. At Netolpitiya, on "Ruhunu Miris" and Kattakaduwa on "Devinur" M. incognita occurred as a single population while at Netolpitiya M. incognita co-occurred with M. javanica and M arenariaon the CA 8,. However, at Witarandeniya M. incognita was prevalent together with M. arenaria.Significant relationship (F =10.283; R^2 0.72; df 1, 5; P< 0.033) was only detected between the pod yield and the percentage galled area. Pod yield was found to be declined with the increasing galled area of the root system. It is evident that "Ruhunu miris" was the most susceptible variety for the nematode attacks.

Discrimination of two wild populations of tiger shrimp (*Penaeus monodon* Fabricius) in Sri Lanka using morphology and truss network system

D. H. N. Munasinghe and J. D. M. Senevirathna

Department of Zoology, University of Ruhuna, Sri Lanka

The black tiger shrimp, *Penaeus mondon* is one of the most commercially important crustacean species in Sri Lanka. Wild populations of *Penaeus mondon* are important because shrimp products are still mainly harvested from natural populations and wild brood stocks are being collecting for hatchery production. Thus, identification of structure of wild populations is important in fisheries management, culturing and conservation programs. This study was designed to determine the inter-specific variation of two wild populations of *P. mondon* in two geographically separated locations: Jaffna lagoon in Northern Province and Walawe River estuary in Southern province in Sri Lanka. Truss network system, which has been increasingly used for stock identification was applied to collect data.

Approximately 70 individuals were collected and measured from each population. Forty two truss distances between 18 landmarks were measured. Initially, forty two morphometric parameters were measured. Parameters that skewed from normality even after log transformed were omitted. Using student t test significant differences between sexes for all parameters within each population were determined and parameters that did not show significant differences between sexes for both populations were selected. Data that were collected for males and females were combined and finally twenty one morphometrc measurements were used for analysis. Using standardized data, Discriminant Function Analysis was performed to investigate distinction of morphological variations between populations. Results indicated a significant difference for mean vectors between populations (group centroids 1.287 and -1.268). Discriminant analysis correctly classified 87% original grouped cases. Derived Discriminant function using size-corrected data identified four morphometric parameters as significant contributors (Wilk's Lamda: P< 0.05). All four contributors were based on the abdominal region and among them, diagonal length of the 3rd abdominal segment acted as the strongest predictor. The derived graph indicated the separation of two populations with slight overlapping. The results indicated the availability of morphologically different types of P. monodon in two geographically separated locations.

Assessing the toxicity of nitrates on the haematogical parameters of the Massambique tilapia

T. T. K. Thenuwara, M. R. Wijesinghe, W. D. Ratnasooriya and D. N. de Silva

Department of Zoology, Faculty of Science, University of Colombo

Intensified use of fertilizers has resulted in nutrient enrichment in natural water ways located in proximity to agricultural areas. In this project we examine the toxicity of nitrates on the haematological paramaters of the adult Mossambique Tilapia (*Oreochromis mossambicus*) through empirical exposure trials. Toxicity was assessed using low, mid and high environmentally-relevant concentrations of nitrates recorded in streamlets associated with paddy fields in the Horana area.

The mean level of nitrates recorded in these streamlets (n=25) was $49.03 + 4.0 \text{ mgl}^{-1}$. Accordingly, 25, 50 and 75 mgl⁻¹was used for the exposure trials. Each treatment and control was tested on three adults of average body weight and total length of 129 +6.49 g and 19.0519.05 +0.25 cm respectively. They were housed individually in separate tanks and were repeatedly exposed to nitrates over 15 days. Fish were continuously fed. Fish were sacrificed and selected haematological paramteres (PCV, RBC count, haemoglobin concentration, clotting time, Differential count, WBC count, MCHC and MCV) were measured at the end of the exposure period. Changes were induced in many of the monitored haemotological parameters. For instance, the mean RBC (1.50-14.59 $\times 10^6$), mean WBC (1.44-1.85 $\times 10^6$), mean haemoglobin concentration (50.83-93.63%) and mean PCV (19.33-24.10) were higher in the exposed fish than in those not exposed. With regard to differential counts, the eosinophil count at 75 mgl⁻¹was much greater than that of the control fish. Although the lymphocyte counts at 50 mgl⁻¹ and 75 mgl⁻¹ were not different from that of the control, at the low concentration the count was reduced. The lymphocyte count was not dose dependent. The monocytes and neutrophil count decreased from 7.66 to 1.5 and 9.66 to 2.33 respectively, with nitrate exposure. MCHC values increased when exposed to nitrates while MCV values decreased. Seven of the primary blood parameters were either negatively or positively dose-dependent (Pearson's Co-relation). The clotting time appears to be unaffected by nitrate exposure.

These results demonstrate that exposure to field nitrate levels may affect the normal functioning of adult tilapia through sublethal toxicity induced in haematological parameters. Studies of this nature are important as it raises concerns about the extent of uncontrolled nutrient addition occurring in agricultural systems which may inflict harm on aquatic biota.

Comparison of avifaunal communities of the Dombagaskanda and Kirigala forest reserves

K. D. De Silva Jayasekara, H. D. K. G. A. Weerakoon and M. R. Wijesinghe

Department of Zoology, University of Colombo

The present study investigated the avifaunal communities in relation to habitat characteristics of two forests in Ingiriya, i.e. Dombagaskanda a natural dipterocarp forest and Kirigala a naturalized dipterocarp plantation forest. Comparisons were done with respect to composition, diversity and guild structure of the avifaunal communities. The study was conducted from February to April 2011. Five transects, each 200 m in length, were marked within the two forests with five Visual Circular Plots marked at 50 m intervals along each of these transects. Each transect was repeatedly surveyed (n = 9) both morning (0630 – 0930 h) and evening (1500 – 1800 h). Habitat assessments were conducted in quadrates of 5 x 5 m along each transect, within which eight habitat parameters were enumerated or estimated.

A total of 77 bird species belonging to 35 families were recorded from both forests. The Dombagaskanda forest had a greater species richness and abundance (75 species and 3339 observations) than the Kirigala forest (50 species and 2180 observations). A similar trend was seen at family level with five more families being recorded in the former forest, a trend also seen across endemics, breeding residents and migrants. Nevertheless, a large proportion of species (65 %) were recorded in both sites and it is significant that both forests were similar with respect to diversity. Dombagaskanda had greater floral diversity than Kirigala. Species richness and abundance of flora and the canopy cover were the major factors contributing to the differences in microhabitat features among the two forests. Based on utilization patterns of vegetation strata, the preferred height of birds was the 0 - 10 m zone and the least preferred height was 30 - 40 m in both forests. The guild structure of the bird communities in the two forest reserves was near similar with a greater proportion of insectivores. Ominvores or piscivores were the least abundant. The present study suggests that the Kirigala Forest Reserve although established as a monoculture with Dipterocarpus zeylanicus, has been successfully colonized by many other plant species, which in turn has attracted a reasonably rich community of birds. This suggests that such indigenous plantations could be used, at least in part, to compensate for the loss of natural forests.

The fishery in Maduganga estuary and Koggala lagoon areas (Sri Lanka) during the period of 2004 - 2007 with special consideration of the impacts of the Indian Ocean Tsunami event in December 2004

K. A. M. Sudarshani and N. J. De S. Amarasinghe

Department of Zoology, University of Ruhuna, Sri Lanka

Coastal ecosystems such as estuaries and lagoons are associated with human livelihoods because they provide services to the human society. The artisanal fishery and tourism are the major income generating human activities of coastal communities. Therefore any change of services provided by these ecosystems will affect the welfare of local people. Two coastal ecosystems, Maduganga estuary and Koggala lagoon are compared in present study. Both are located in Galle district of Sri Lanka. Maduganga is a complex coastal wetland system including an estuary and fifteen islets. Koggala lagoon also consists of a lake and fourteen small islands. Fishery is the major socio-economic activity within these ecosystems and these ecosystems have been impacted by the tsunami event in December, 2004. Purpose of this research was to study changes in the fishery in both areas that resulted from the tsunami impact over the period of 2004 - 2007. The present study was carried out from September, 2007 to February, 2008. Both primary and secondary data on fishery production, fish species composition, number of fishermen and fishing crafts were collected for the period of 2004-2007. Further, information about the damage caused by the Indian Ocean tsunami event on these areas was also gathered. Secondary data on fish production and fish species were collected from research papers published on the subject, published records on relevant statistics available in governmental and nongovernmental Institutions. A questionnaire survey was carried out to collect primary data on fish species, number of fishermen and number of fishing crafts from selected fishermen household. It was found that the fishery production in Koggala lagoon has decreased from 2004 to 2007 whereas the fishery production has increased in Magduganga estuary at the same period. Mean fishery catches in 2006 and 2007 were significantly different in Magduganaga estuary. The main fish species contributed to the fishery in both sites were Hilsa kelee, Caranx sexfasciatus, Leiognathus fasciatus etc. Both of these study sites and some Grama Niladhari Divisions surrounding these water bodies have been affected by the tsunami which may have affected on this socio- economic activity. It is concluded that negative change in fishery production from 2004 to 2007 badly affected on the wellbeing of local community in the area of Koggala lagoon.

Diversity of insects trapped in *Nepenthes distillatoria* pitchers in Sinharaja World Heritage Site with respect to height from the ground, morphology and maturity

E. M. R. Samanmalee and S. W. Kotagama

Department of Zoology, University of Colombo

The diversity of insects trapped in pitchers of *N. distillatoria* with respect to height from the ground, morphological differences and maturity was studied at the Sinharaja Forest from April 2009 to August 2009. Three sampling sites were selected and 30, 24 and 30 samples was collected from Level 1 (0 m-0.5 m), Level 2 (1.5 m-2 m) and Level 3 (2.5 m-3 m) respectively. Length and width of the pitcher and pH of the pitcher fluid were recorded. Height to the pitcher from the ground was measured for each pitcher. Trapped insects were collected separately. Ten pitchers of each category of mature and immature were tagged and sampled after two weeks.

Total of 11310 Arthropods in 359 species; 11263 Arthropods were trapped in the pitchers of *N. distillatoria*. These included 11263 insects belonging to 322 species, 43 spiders belonging to in 33 species, 2 Lepidopteran larvae and 2 species of millipedes. Class Insecta was the largest group trapped in pitchers. A total of 120 complete specimens of insect species were identified; 82 of them belonging to the Order Hymenoptera, 22 to the Order Coleoptera, 6 to the Order Hemiptera, 1 in the Order Neuroptera and 9 in the Order the Orthoptera. The largest group of trapped insects was Family Formicidae in Order Hymenoptera. 82 species belonged to Family Formicidae with 9772 individuals. The results demonstrated correlations between height from the ground with the pH of the pitcher fluid, length and width of the pitcher. Mature pitchers showed higher number of species at all height levels. Generally, number of insects was higher in mature pitchers at all height levels. There was no correlation between the diversity of trapped insects in different levels and sites was done using EstimateS 8.2.0. (Robert K. Colwell). Site 2 and Level 3 showed the highest diversity of trapped insects. One *N. distillatoria* plant was found with mutated pitchers at Site 2.

Effect of Glyphosate and Chlorpyrifos on the histology of the testis in *Megascolex spectabilis*

J. H. T. Rajapakse and S. R. Krishnarajah

Department of Zoology, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka

Soil organisms are sensitive to different kind of agrochemicals which are generally contaminating the soil. Various agrochemicals can create toxic effects even though the earthworms may not be immediately affected and cause changes in the fecundity.

The widely used Agrochemicals, Chlorpyrifos and Glyphosate were applied to the tropical earthworm species *Megascolex spectabilis* to investigate the histological alterations in the testis.

Treatments with two agrochemicals in three different concentrations as high (Chlrpyrifos- 20 mll⁻¹, Glyphosate-100 mll⁻¹) recommended (Chlorpyrifos-15 mll⁻¹, Glyphosate- 72 mll⁻¹) and low (Chlorpyrifos-10 mll⁻¹, Glyphosate-50 mll⁻¹) and the controls (without agrochemicals) in four replicates and two adult earthworms were inoculated to each sample. After 12 days, earthworms were dissected and the sections of testis were stained using standard techniques for the observations.

Observation revealed that exposure to Chlorpyrifos and Glyphosate caused alterations in the histology of testis of *M. spectabilis*, in varying degrees in all treated samples except the control and also it was shown that all concentrations caused histological damage. Testis showed notable aberrations in the tissues as destroyed locules, sperm deformities, abnormalities, cell aggregation, cyst formation and reduced sperm formation and absence of sperms due to both agrochemicals in all concentrations.

The experiment provides evidence that both agrochemicals induce sublethal damage such as histological alterations in testis, which might ultimately be detrimental to the survival of the entire population of earthworm *M. spectabilis*.

Zoonotic importance of domestic rat *Rattus rattus* and pet animals in some selected sites of Western province in Sri Lanka

E. M. D. L. Premathilake and L. D. Amarasinghe

Department of Zoology, Faculty of Science, University of Kelaniya

Present study was carried out from January 2010 to July 2010. Zoonotic importance of domestic rat, *Rattus rattus* was studied by a parasitic survey of *R. rattus*. Zoonotic importance of pet animals was carried out by analyzing faecal samples of domestic cats, dogs and faecal samples of humans associated with them.

Parasitic survey was carried out in selected 13 sampling locations under 5 sites in Gampaha and Colombo districts. The sites were Gampaha, Kadawatha, Wattala, Dalugama and Sedawatta Bloemendhal. Out of 43 rats examined, no ectoparasites and blood parasites were recorded. Eleven rats caught from Sedawatta, Bloemendhal site were infected with intestinal helminth parasites *Hymenolepis* sp. (Phylum Platyhelminthes, class Cestoda) and *Strongyloide* sp. (Phylum Nematoda) where percentage infestation rate was higher in *Strongyloide* sp. than *Hymenolepis* sp. Gampaha, Kadawatha, Wattala, Dalugamasites were negative for any kind of parasite.

Faecal analysis of domestic cats and dogs revealed toxocarid type eggs and trichurid type eggs. Seventeen human faecal samples gathered from individuals of 1.5-16 years in Sedawatta, Bloemendhal site were positive for ascarid type eggs. Average human faecal egg count of males is higher than that of female in each age group. As the average faecal egg count of male and female of all ages are less than 10 000, it was rated as a mild infection. But the faecal egg count increased with the increasing age of the individuals.

The study revealed the presence of zoonotically important parasites of R. *rattus* were high in the areas where the environment is highly polluted and there is a higher risk for humans to acquire the zoonotic diseases.

Effect of Carica papaya leaves on rat platelet count and RBC permeability

A. Gammulle¹, W. D. Ratnasooriya², S. Nagananthini² and P. V. Udagama-Randeniya²

¹Institute of Biochemistry, Molecular Biology &Biotechnology, University of Colombo. ²Department of Zoology, University of Colombo.

A previous pilot study conducted by us, established that the *Carica papaya* leaf concentrate (CLC) using mature leaves was found to be orally active, relatively non-toxic and effectively increased rat platelets, justifying the claims of Ayurvedic physicians of Sri Lanka.

As a follow up study, the platelet increasing potential of mature papaya leaves Vs immature leaves was investigated. Thrombocytopenia was established in Wistar rats (N=6/group) with the oral administration of Hydroxyurea ($1/10^{\text{th}}$ of 15 mg/kg dose). Two groups of thrombocytopenic rats (N=6/ group) were orally treated with the high dose (0.72ml/100g) of CLC using either mature or immature leaves of the same plant, and non-thrombocytopenic rats (N=6) were given distilled water, for 3 consecutive days. The HD of CLC prepared by both mature and immature leaves of *C. papaya* showed a high potential in increasing platelets by 73.8% and 71.3%, respectively, in thrombocytopenia induced rats with no significant difference (P ≥ 0.05) between the percentage increase of platelets by the 2 types of leaves of the same plant.

In addition, membrane stabilizing effect of mature CLC on rat RBCs exposed to heat was investigated by standard methodology. The whole leaf extract exhibited a maximum membrane stability of 10.11% at a concentration of 8 mg/ml as compared to the control. The plant therefore may be regarded as a natural source of membrane stabilizer that warrants future in depth analysis.

In conclusion, this study for the first time demonstrated that freshly prepared concentrate from both mature and immature leaves of *Carica papaya*, effectively and comparably increases rat platelets when administered orally. Thus, it is reiterated that the CLC has the potential to be developed as a plant based therapeutic agent for thrombocytopenia. Further, rat RBC membrane stabilizing property of CLCn is reported for the first time.

Increased serum NO_x levels in severe leptospirosis patients in Sri Lanka

T. L. Kalugalage¹, T. D. P.Vithanage², P. Somaratne³, H. J.De Silva⁴, S. Rajapakse² and S. M. Handunnetti¹

¹Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo²Department of Clinical Medicine, Faculty of Medicine, University of Colombo ³Department of Microbiology, Medical Research Institute, Colombo 08 ⁴Department of Medicine, Faculty of Medicine, University of Kelaniya

Leptospirosis is an endemic disease in Sri Lanka caused by the bacterium, Leptospira. The underlying pathogenic mechanisms associated with severe manifestations have been attributed mainly to endothelial dysfunction and tissue damage mediated by pro-inflammatory cytokines and inflammatory mediators such as nitric oxide (NO'). NO has a short half-life and it converts to nitrite (NO_2^{-}) and nitrate (NO_3^{-}) , referred to as NO_x . The objective of this study was to compare serum NO_x levels in severe and mild patients and to determine whether serum NO_x levels could be used as a prognostic marker of disease severity. Patients recruited from National Hospital Sri Lanka and Base Hospital Homagama were categorized according to their *m*icroscopic agglutination test (MAT) titre and disease severity; severe leptospirosis (≥ 800 ; n=24), mild leptospirosis (≥800; n=13) and MAT equivocal (100-400; n=30). Non-leptospirosis fever patients (<100; n=18) and healthy controls (<100; n=23) were used for comparison. Severe patients had significantly higher NOx levels $(32.1\pm12.2\mu M)$ compared to mild patients (21.6±6.4µM), MAT equivocal patients (15.2±8.5µM), non-leptospirosis fever (13.5±11.5µM) and healthy controls (5.8±2.5µM) (P<0.01). In severe and mid leptospirosis patients, both serum nitrite levels and MAT titres were not significantly different. Considering all patient groups, the NO_x levels showed a significant correlation with the MAT titres (r=0.57; P<0.001). Mean age between these different patient groups were comparable. Duration between onset of symptoms and sampling of severe and mild leptospirosis patients and non-leptospirosis fever patients were comparable (P>0.05), but significantly higher compared to MAT equivocal patients (P=0.036). In confirmed leptospirosis patients, serum NOx levels were significantly correlated with serum creatinine (r=0.470; P=0.003), blood urea (r=0.369; P=0.025) and total bilirubin (r=0.383; P=0.019). These results indicate that NO may play an important role in pathogenesis and may be a prognostic indicator of severe leptospirosis.

Study of Anti-malarial Activity of Artemisia vulgaris Leaf Extract, using the Plasmodium berghei murine model

B. A. G. S. Bamunuarachchi¹, W. D. Ratnasooriya¹, G. A. S. Premakumara², and P. V. Udagama-Randeniya¹

¹Department of Zoology, University of Colombo, Colombo 03, Sri Lanka. ²Herbal Technology Division, Industrial Technology Institute, Colombo 07, Sri Lanka.

Artemisinin isolated from the Chinese plant, *Artemisia annua*, is the single potent antimalarial against chloroquine resistant strains of *Plasmodium falciparum*. The only *Artemisia* species in Sri Lanka is *A. vulgaris*, a weed abundant in the upcountry. This study examined antimalarial properties of A. *vulgaris* ethanolic leaf extract (AVELE) tested against the *P. berghei* murine model with similar pathogenesis to falciparum malaria.

AVELEat 1000 and 500 mg/kg doses significantly ($P \le 0.01$) inhibited parasitaemia on average by 87.3% and 79.3%, respectively, in the 4-day suppressive assay but lacked anti-parasitic activity in the curative assay. Both 500 and 1000 mg/kg doses significantly reduced the profound thrombocytopenia ($P \le 0.01$) and altered the end- stage disease ($P \le 0.05$) associated with *P*. *berghei* pathogenesis, while 1000 mg/kg dose demonstrated significant ($P \le 0.05$) anti-pyretic activity in the yeast-induced mice pyrexia model. AVELE demonstrated significant antinociceptive activity in the hot plate test ($P \le 0.05$) and also with acetic acid induced writhing reaction in mice ($P \le 0.01$). Anti-disease activity was further corroborated by increased survival of infected mice treated with both 500 and 1000 mg/kg doses. The lowest dose of AVELE (250 mg/kg) did not show any significant effect.

Chronic administration of 1000 mg/kg of AVLE was well tolerated by mice, showing no overt signs of toxicity and stress. Hepatotoxicity (evaluated in terms of serum GOT and GPT levels), renotoxicity (in terms of serum urea and creatinine) and haematotoxicity (in terms of RBC, WBC and DC) were also ruled out.

Phytochemical and TLC analyses revealed thatAVELE contained alkaloids, coumarines and a group that contains higher alcohols, phenols, steroids and essential oils.

In conclusion, this study for the first time demonstrated that *A. vulgaris* crude leaf extract possesses both potent and safe anti-malarial action, in terms of anti-parasite and anti-disease (anti-pyretic action, peripheral antinociception and reversal of thrombocytopenia) activity, when administered orally and tested in a *P. berghei* murine malaria model.

Effect of oral administration of hot water infusion of black tea (*Camellia sinensis* L) on serum toxic heavy metal concentrations in rats

K. R. W. Abeywickrama¹, A. M. T. Amarakoon² and W. D. Ratnasooriya³

¹Analytical Laboratory, Sri Lanka Tea Board, Colombo ²Department of Chemistry, University of Kelaniya ³ Department of Zoology, University of Colombo

Like many other plants, toxic heavy metals [arsenic (As), lead (Pb) and mercury (Hg)] which cause toxic implications in human, could be found in manufactured black tea (*Camellia sinensis* L). In the present study, such metals in black tea samples obtained from major agroclimatic elevations (low-, mid- and high-grown) in Sri Lanka and the percentage transferred into their infusions were determined using the Atomic Absorption Spectrophotometer coupled with hydride vapor generation kit. Blood serum content of these metals in rats (n=9/group) orally administered with different doses (equivalent to $1\frac{1}{2}$, 3 and 12 cups respectively: one cup is 170 ± 10 ml) of tea infusions was measured at three days prior to the treatment, 30 days intervals for 90 consecutive days. Acute effects were assessed by orally loading the rats with metal solutions ($100mgL^{-1}$) followed 15 minutes later by treatment with tea infusions. Experimental rats were observed daily for any overt signs of toxicity and for the presence of erythrocyte toxicity, renotoxicity and hepatotoxicity.

Results revealed that, significantly (P<0.05) high arsenic was found in low grown ($0.17\pm0.02 \ \mu gg^{-1}$) than mid-($0.10\pm0.02 \ \mu gg^{-1}$) and high-grown ($0.09\pm0.01 \ \mu gg^{-1}$) tea. Whereas, lead contents in mid-($0.41\pm0.03 \ \mu gg^{-1}$) and high-($0.38\pm0.04 \ \mu gg^{-1}$) grown tea were significantly lower than the low grown ($0.49\pm0.05 \ \mu gg^{-1}$) tea. Black tea Hg content was in the range: $0.01-0.03 \ \mu gg^{-1}$ independent of the agroclimatic elevation. The percentages released to infusions for arsenic were: 0.85%, 0.75% and 0.72% in low-, mid- and high-grown tea respectively and Pb in the range: 0.32-0.37%, but Hg was not detected in any infusion. Recoveries in the infusions were low when black tea was spiked with metal solutions (1ml of 1000 mgL⁻¹per 2g): for As, 59\%, 39% and 37\%; for Pb, 39\%, 47\% and 43\% and for Hg, 17\%, 27\% and 23\% in low-, mid- and high-grown respectively. In the in-vivo experiments significantly inhibited As and Hg absorption dose-independently (46-54%) by the tea infusion. In the chronic treatments; As, Pb and Hg contents in blood serum of rats were not altered at any measured point. Detected levels of metals in blood were below the limit declared by the FAO/WHO. Observations revealed that, no signs of toxicity in any of the black tea treated rats during the study period.

Parasites of mammals housed in the National Zoological Gardens, Sri Lanka

N. L. Dangampola¹, L. A. J. P. K. Jayasekara², I. C. Perera¹ and P. V. Udagama-Randeniya¹

¹ Department of Zoology, Faculty of Science, University of Colombo. ² National Zoological Gardens, Sri Lanka.

As parasitic infections can aggravate and pose serious threats to captive animals, establishing parasite profiles of zoo animals is vital. A systematic survey was undertaken to examine intestinal, ecto and blood parasites of mammals housed in the National Zoological Gardens, Sri Lanka from December 2010 to April 2011. Fecal samples (N=141) randomly collected from 74 mammalian species of 8 different Orders; Marsupialia (2 spp), Rodentia (3), Lagomorpha (3), Artiodactyla (20), Perissodactyla (8), Proboscidea (2), Carnivora (18) and Primata (18), and ecto-parasites and blood samples collected under the supervision of a veterinarian, were examined according to standard methodology.

Of the fecal samples screened, 28 (18%) harboured parasitic infections while a majority (82%) were uninfected. A total of 20 species of mammals, mostly carnivores, were infected with 4 different types of nematode ova *i.e.* strongyloide, trichuroide, strongyle and ascaroide types, and protozoan cysts and trophozoites encountered with an occurrence of 57.2%, 14.3%, 14.3%, 7.1%, 7.1% and 3.5%, respectively. Six species of carnivores harbored either strongyloide or ascaroide type ova, with a higher prevalence of the former, while a multiple infection with both types were detected in a seventh species. Occurrence of strongyloide, strongyle and trichuroide type ova in 5 Artiodactyla species were 40%, 40% and 20%, respectively. Two types of ova, strongyloide and trichuroide, and a flagellated trophozoite were detected in 2 species of primates. Ecto-parasites collected were restricted to 4 species of Artiodactyles, and all were ticks of a single genus, *Haemaphysalis*. Blood parasites were not detected in any of the samples examined.

The data acquired from this first parasitological survey of mammals housed in the National Zoological Gardens, Sri Lanka, will be useful in conserving mammals under captivity in disease free conditions, and for conducting future studies on parasites of captive and wild mammals in Sri Lanka.

The 31stAnnual Sessions of the Institute of Biology Sri Lanka Schedule for Technical Sessions

(At Faculty of Humanities and Social Sciences, Open University of Sri Lanka, Nugegoda on 30th September, 2011)

Time (p.m.)	Session I (Seminar Room 2-A)	Session II (Seminar Room 2-B)	Session III (Seminar Room 1)
1.00-1.15	 01 - Effect of pretreatments on the quality of minimally processed green bell pepper (<i>Capsicum annum</i> L.) strips in polyvinyl chloride packages S. Ediriweera and K. Abayawickrama 	15 - Some insights into the barcodes and phylogeny of the two endemic mouse-deer in Sri Lanka.J.A.H.U. Jayakody, M.R. Wijesinghe, C.D. Dangalle, H.D.K.G.A. Weerakoon and S. Mendis	
1.15-1.30	02 - Cluster analysis of eight caryophyllids using structural and pigment characters.G.L.T. Godagedera and S.P. Senanayake	16 - Rapid and low-cost DNA extraction procedure for PCR-based detection of pathogenic organisms in environmental waters.J.R.K.N. Jayawardhane, N. Deshapriya and N. Welikala	 27 - Discrimination of two wild populations of tiger shrimp (<i>Penaeus monodon</i> Fabricius) in Sri Lanka using morphology and truss network system. D.H.N. Munasinghe and J.D.M. Senevirathna
1.30-1.45	 03 - Investigation of antibacterial compounds of <i>Vateria copallifera</i> seeds. T.A.N. Siriwardena, E.D. De Silva and C.D. Wijayarathna 	17 - A comparative bioinformatics study on <i>CSN5</i> gene in <i>Arabidopsis thaliana</i>.K.H.H. Priyabhani and P.S. Saputhanthri	 28 - Assessing the toxicity of nitrates on the haematological parameters of the mossambique tilapia. T.T.K. Thenuwara, M.R. Wijesinghe, W.D. Ratnasooriya and D.N. de Silva
1.45-2.00	04 – Effect of local <i>Trichoderma</i> isolate on the onion basal rot pathogen in Sri Lanka W.H.M.V.P. Edirisinghe and N. Deshapriya	 18 - DNA fingerprinting of <i>Pyricularia grisea</i>, in Sri Lanka, by repetitive-PCR method using a single primer based on the transposable element pot2. D.C. Wimalasiri, M.Y. Jothimala, W.S.S. Wijesundera and R.P.N. Priyanthi 	29 - Comparison of avifaunal communities of the Dombagaskanda and Kirigala forest reserves.K.D. De Silva Jayasekara, H.D.K.G.A. Weerakoon, and M. R. Wijesinghe
2.00-2.15	05 - Feasibility of using palmyrah raw tuber flour as an alternative culture media for fungal growth.S. Tharmila, E.C. Jeyaseelan and A.C. Thavaranjit	 19 - Immune status, clinical aspects and risk factors of human leptospirosis in Gampaha district, Sri Lanka. S. U. Thrikawala, M.L.G. Piyatisse, G. Premawansa, I. C. Perera, R.P.V.J. Rajapakse and W.S. Premawansa 	 30 - Fishery in Maduganga estuary and Koggala lagoon areas (Sri Lanka) during the period of 2004-2007 with special consideration of the impacts of the Indian Ocean Tsunami event in December 2004. K.A.M. Sudarshani and N.J. De S.Amarasinghe
2.15-2.30	 06 - Screening Sri Lankan rice (<i>Oryza sativa</i> L.) varieties for tolerance/resistance of pre-planting broadspectrum herbicide, Glyphosate. W.J. Nimanthika and S.R. Weerakoon 	 20 - Phagocytosis as a biomarker of immunotoxicity in response to selected heavy metals in <i>Euphlyctis hexadactylus</i> (Ranidae): A pilot study. S. Priyadrshani, D.D. Wickramasinghe, D.N. de Silva and 	31 - Diversity of insects trapped in <i>Nepenthes distillatoria</i> pitchers in Sinharaja World Heritage site with respect to height from the ground, morphology and maturity.E.M.R. Samanmalee and S.W. Kotagama
	W.J. Nimanthika and S.R. Weerakoon	S. Priyadrshani, D.D. Wickramasinghe, D.N. de Silva and P.V. Udugama-Randeniya	E.M.R. Samanmalee and S.W. Kotagama

2.30-2.45	07 - Effect of Gibberellic acid (GA3) on differentially salt tolerant rice cultivars in response to salt stress J.M.D.R. Menike and P. Senadheera	 21 - Depression of mitotic indices and induction of chromosomal aberrations in common onion (<i>Allium cepa</i>) following exposure to selected industrial effluents. B.M.W.L. Jayathilaka and A. Pathiratne 	32 - Effect of glyphosate and chlorpyrifos on the histology of the testis in <i>Megascolex spectabilis</i>.J.H.T. Rajapakse and S.R. Krishnarajah
2.45-3.00	08 - Antimicrobial properties of some selected lower plants D.L.M.B. Jayarathne, P.S. Saputhanthri, R.P. Perera and G.A.S. Premakumara	 22 - Purification of Phytoplasma associated with Weligama Coconut Leaf Wilt Disease for production of diagnostic polyclonal antibodies. C. Kanatiwela, N. Shanmuganathan, D. Weerakoon, W.S. Premawansa, R. Wijesekara, P.V. Udugama-Randeniya 	33 - Zoonotic importance of domestic rat, <i>Rattus rattus</i> and pet animals in some selected sites of Western Province in Sri Lanka.E.M.D.L. Premathilake and L.D. Amarasinghe
3.15-3.30	09 - Effect of aqueous <i>Allium cepa</i> var aggregatum extract dip treatment on Willard mangoes.N. Krishnapillai and R.S. W. Wijeratnam	23 - Effect of cinnamon oils on the root knot nematode <i>Meloidogyne graminicola</i> in rice seedlings and young rice plants.W.K.A.G.A. Wijesinghe and L.D.Amarasinghe	34 - Effect of <i>Carica papaya</i> leaf concentrate on rat platelet count and RBC permeability.A. Gammulle, W.D. Ratnasooriya, S. Nagananthini and P.V. Udugama-Randeniya
3.30-3.45	10 - floral biology of <i>Hibiscus furcatus</i> in relation to pollination.H.P.P. Prematilleke and R.M.C.S. Ratnayake	24 - <i>In vitro</i> nematicidal activity of weed plant extracts against the root-knot nematode, <i>Meloidogyne incognita</i>.G.D.T.M. Nanayakkara, P.B. Ratnaweera, and A.A.K. Karunathilaka	 35 - Increased serum NOx levels in severe leptospirosis patients in Sri Lanka. T.L. Kalugalage, T.D.P.Vithanage, P. Somaratne, H.J. De Silva, S. Rajapakse and S.M. Handunnetti
3.45-4.00	11 - Soil properties of Bellanwila-Attidiya Sanctuary: A Preliminary Investigation.S. Cooray, D. Wickramasinghe and R. Piyadasa	25 - Nematodes associated with banana (<i>Musa</i> spp) cultivations in selected sites in Gampaha district in Sri Lanka.W.B.P. Vitharana and L.D. Amarasinghe	
4.00-4.15	12 - Pollination and seed biology of <i>Hibiscus furcatus</i> . H.P.P. Prematilleke and R.M.C.S. Ratnayake	26 - Root-knot nematode infestations on Chilli (<i>Capsicum annum</i>) at selected localities in Hambantota district.W.T.S.D. Premachandra and D.P.C. Senarath	 36 - Study of anti-malarial activity of <i>Artemisia vulgaris</i> leaf extract, using the <i>Plasmodium berghei</i> murine model. B.A.G.S. Bamunuarachchi, W.D. Ratnasooriya, G.A.S. Premakumara and P.V. Udugama-Randeniya
4.15-4.30	13 - Effect of burying depth and surface fire on germination of selected dry zone forest plant seeds in Sri Lanka.R.M.C.S. Ratnayake and L.R. Jayasekera		 37 - Effect of oral administration of hot water infusion of black tea (<i>Camellia sinensis</i> L) on serum toxic heavy metal concentrations in rats. K.R.W. Abeywickrama, A.M.T. Amarakoon and W.D. Ratnasooriya
4.30-4.45	14 - Evaluation of <i>in vitro</i> antibacterial activity of some medicinal plant extracts on hair borne bacteria.S. Tharmila, E.C. Jeyaseelan, and A.C. Thavaranjit		 38 - Parasites of mammals housed in the National Zoological Gardens, Sri Lanka. N.L. Dangampola, L.A.J.P.K. Jayasekara, I.C. Perera and P.V. Udugama-Randeniya

Notes