



# PGIS News Internet Edition

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*Quarterly Update of the work and progress of the Postgraduate Institute of Science (PGIS), University of Peradeniya, SRI LANKA*

## PGIS News

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**This is the inaugural issue of PGIS News published by the Postgraduate Institute of Science. The first issue reports the events of PGIS since its establishment in 1996. In the forthcoming issues, we intend to publish articles and short notes of academic nature. We shall be pleased to receive your comments, suggestions and contributions with a view to improving its quality. Correspondence and requests for copies of PGIS News should be addressed to Dr. N C Bandara - Editor:**

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**↑ First National Workshop on Computer Based Interactive Physics**

## Teaching

The first national workshop on computer based interactive physics teaching, organized by the Board of Study in Science Education of the PGIS and sponsored by the National Science Foundation, Sri Lanka was held from 13th to 15th February 2001 at the Department of Physics, University of Peradeniya.

Science teaching through computer based and non-computer based interactive methods is fast becoming popular in many countries as a novel and efficient technique to educate students, especially at secondary and university first year levels. These methods will focus on promoting active involvement of students in the learning process through activity-based strategies. In computer based interactive learning, students will explore scientific concepts through hands-on experiments with the use of microcomputers. The students will get the opportunity to interact with nature more effectively and to understand clearly the scientific principles underlying various observations. With minimal guidance from the instructor, the students can learn by themselves much more effectively than in the case of a conventional laboratory session or a class room lesson. Interactive teaching/learning will not only generate interest and scientific curiosity in students but also develop creativity and independent thinking in the student minds. In most developed countries and also in some developing countries, interactive methods are now widely used for science teaching.

However, in Sri Lanka, these teaching methods have not been adapted up to now, mainly due to the non-availability of teachers trained in this area.

This national workshop, organized by the PGIS was aimed at training a selected group of young university lecturers in the use of computer based and non-computer based interactive methods for teaching Physics. This is the first time that a workshop of this nature was held in Sri Lanka. Computer based workstations recently purchased through the TETD Project of the Ministry of Education were used for this purpose. 16 Lecturers in Physics, selected from different universities of Sri Lanka and 02 A-Level Science teachers following the M.Sc. (Science Education) programme participated in this workshop. Prof. Alex Mazzolini, Secretary of the Asian Physics Education Network (AsPEN) from Swinburne University, Australia, who has wide experience in conducting similar workshops in other Asian countries, Ms. Obiminda Cambaliza from the Phillipines and senior Physics academic staff from Peradeniya and Colombo universities contributed as resource persons.

Judging from the feedback received from the participants, the workshop has given them a novel experience in interactive science teaching methods. According to the foreign resource persons, this workshop was one of the most successful workshops conducted in Asian countries on this theme. The Board of Study in Science Education is planning to organize a series of workshops of this nature covering the subject areas of Physics, Chemistry, Biology and Mathematics, mainly for the benefit of university lecturers and G.C.E. Advanced Level science teachers. Once the teachers are trained, through a series of workshops, they should be able to gradually introduce interactive teaching methods in their respective universities and schools.

Organization of this workshop would not have been possible without the interest and the cooperation of several individuals and organizations. We would like to extend our sincere thanks to Prof. R. P. Gunawardane, Secretary, Ministry of Higher Education and Information Technology for expanding the activities of the TETD Project of the Ministry of Education to include programmes in Science Education conducted by the PGIS. We are also thankful to the Director and Board of Management of the PGIS for promoting this activity. A special word of thanks goes to the National Science Foundation for sponsoring the workshop.



**Workshop participants and Resource Persons**

**Prof. M.A.K. Lakshman Dissanayake**  
**Chairman, Board of Study in Science Education**  
**& Co-ordinator of the Workshop**

## **Mathematics Education for the 21st Century**

Mathematics is said to be the language in which secrets of nature are written. Latter part of the twentieth century saw applications of mathematics not only in natural sciences but also in social sciences. The progress in other disciplines now depends more and more on mathematics. Yet, there is a lack of understanding among the general public regarding the role of mathematics in this technological age. It is difficult to say whether and when an area of mathematics becomes useful for real-life applications. An excellent example of this is Number Theory. This is an area which was studied for its own beauty for centuries. Number Theory is famous for providing a wealth of problems that are easy to state but, at the same time, are difficult to solve. One such, yet unsolved, problem is the Goldbach conjecture. This is the simple statement that every even integer greater than 2 can be written as the sum of two prime numbers. (For example  $4=2+2$ ,  $6=3+3$ ,  $8=3+5$  and  $10=3+7$ . Can this always be done?) This ranks at the very top of the list of unsolved problems in mathematics together with the twin prime conjecture and the Riemann hypothesis. The twin prime conjecture is the statement that there are infinitely many 'twin primes'. (Two prime numbers are said to be twin primes if they differ by 2. For example 3 and 5, 5 and 7, 11 and 13, 41 and 43 are twin primes. Are there infinitely many such pairs?) Riemann hypothesis requires more mathematical concepts to state than the two problems mentioned above. What use there is, one might ask, in studying these types of purely mathematical problems? Can the society at large benefit from these activities? With the advent of high-speed computers, Number Theory has found applications that we now cannot live without. The security of information transmitted electronically is based on the study of prime numbers. Cryptography is another area which uses Number Theory. Factorization of large integers and primality testing have gained so much attention due to these applications.

The work-force of the 21st century will require more and more skills that are mathematical in nature. Are we prepared to face the challenges of this century that demand a good knowledge in mathematics and science? The report issued by the 'Glenn Commission' appointed to assess this in U.S.A. emphasizes good teaching as the most important factor in preparing students to take up these challenges. (The report titled 'Before it's Too Late: A Report to the Nation from the National Commission on Mathematics and Science Teaching for the 21st century' is available at <http://www.ed.gov./inits/Math/glenn/report.doc>.) The general recommendations given there are of value even to countries like ours. In Sri Lanka, there is a growing concern about the lack of mathematical skills of students at all school levels. This is apparent when we look at the performance of O/L and A/L students. Can we improve this without bringing the standards down? Yes, and good teaching is the key. Recently, there was an O/L mathematics teacher with over 10 years of teaching experience claiming that he has constructed 10 degree angle by using a straight-edge and a compass. First line itself of the 'proof' contained an error which could have been detected with only a knowledge in A/L mathematics. There were other errors which indicated that this teacher does not have even a basic understanding of what constitutes a mathematical proof. To make matters worse, there were five other more knowledgeable persons endorsing this 'proof'.

A good mathematics teacher must, first of all, possess knowledge well beyond the level at which she/he is teaching. Teachers must be able to communicate to students the diversity of mathematics and its connections to other fields. They should be able to get the students interested in the subject. They must be competent to give a historical development of concepts and provide enough motivation to attract the students to the subject. Mathematics should not be taught as a mere collection of techniques and formulae. Most of all, they must be able to impart the excitement associated with doing mathematics.

In order to improve the quality of mathematics teaching in schools, it is therefore necessary to have programmes for teachers aimed at their professional development. Teachers must be given opportunities to enrich their knowledge in mathematics and teaching skills. They must be trained to use technology in the class rooms. They must be given a forum to discuss mathematics. The proposed Mathematics Education component of the M.Sc. Programme in Science Education at the PGIS is structured, at least partially, to do this. We need more of these types of programmes to improve the quality of preparation of the present mathematics teachers and to train their future counterparts.

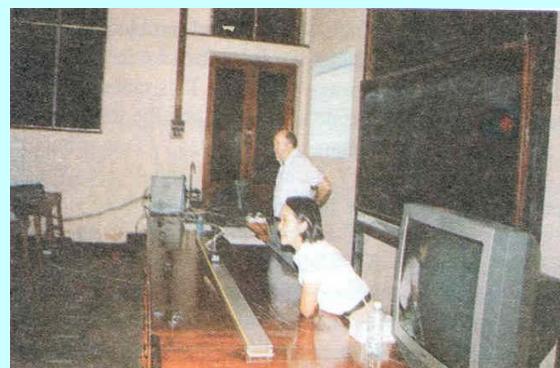
**Dr. A. A. S. Perera**  
**Chairman**  
**PGIS Board of Study in Mathematics**

## ↑ **Active Learning with emphasis on Physics - An Asian Experience**

The Asian Physics Education Network (AsPEN) was formed in 1981, and currently has about 15 actively participating member countries from Asia and the Pacific Rim region. AsPEN has four primary objectives:

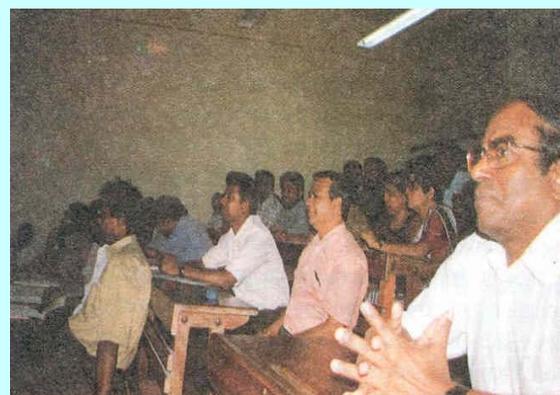
- to promote the overall development of university physics education in the Asian region.
- to establish a program of cooperation amongst members in physics education and related areas.
- to establish effective channels of communication.
- to disseminate information on physics education and related ideas.

In January 1999, American National Science Foundation (NSF) funded "Chautauqua" workshop entitled "Promoting Active Learning in Introductory Physics Courses" which was held in Melbourne, Australia, at Swinburne University of Technology. Professors David Sokoloff (Uni of Oregon), Priscilla Laws (Dickinson College) & Ron Thornton (Tuffs Uni), who are all internationally recognised experts in physics education research, facilitated this workshop.



The Melbourne workshop outlined the results of widespread educational research which clearly showed that the majority of students had difficulty in learning essential physics concepts when taught in traditional (passive learning) courses, and that active learning methods were much more effective in improving conceptual understanding amongst physics students. The workshop demonstrated many "hands on", computer-based, active learning strategies in mechanics, heat and thermodynamics, electricity and magnetism, and waves and optics.

AsPEN was strongly represented at the Melbourne "Active Learning" (AL) workshop, and funded 11 AsPEN participants from 6 Asian countries. As a result of this workshop, AsPEN has resolved to run a number of National AL workshops (both computer-based and non-computer-based) in member countries using (where-ever possible) local expertise and resource people from within AsPEN



**Prof. Alex Mazzolini and Ms. Obiminda Cambaliza demonstrating ?Active Learning? to the workshop participants**

To date National AL workshops have been run in Laos, Vietnam and Sri Lanka. The most recent National AL workshop was held at the University of Peradeniya, Sri Lanka in February 2001. The workshop was extremely successful, and utilised the skills and experience of two AsPEN resource people (Dr Alex Mazzolini, from Swinburne University of Technology, Australia and Ms. Obiminda Cambaliza from Ateneo de Manila University, Philippines), as

well as many local resource people from Peradeniya and Colombo Universities.

The workshop was organised and prepared entirely by the local organising committee, chaired by Prof Lakshman Dissanayake with only minimal assistance from the external resource people. The workshop itself was well organised and the local academic and technical staff set up, tested and then perfected all AL laboratories used in the workshop. All computers, interfaces, sensors and other equipment worked faultlessly, which is a credit to the careful planning and implementation of the local organisers. The 18 local participants (from throughout Sri Lanka) were enthusiastic and open, and showed a genuine appreciation of AL principles and practice. AsPEN is hopeful that several of these local participants have the potential to become AsPEN resource people in the very near future. The AsPEN resource people were very pleased with the successful outcomes of the AL workshop in Sri Lanka, and believe it should be the model for future AsPEN National AL workshops in other developing countries.

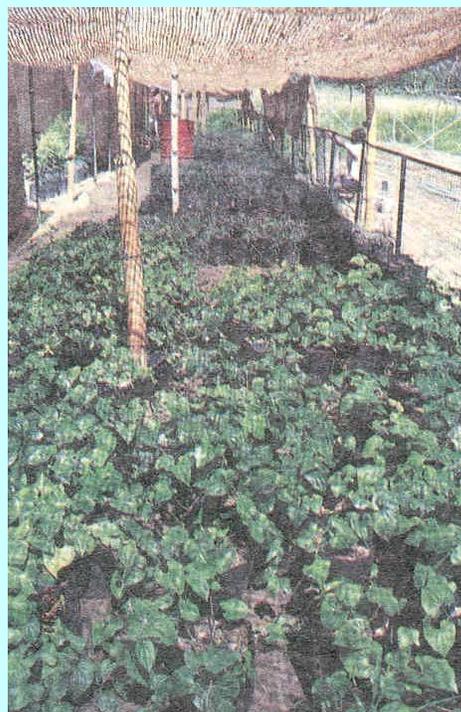
*Prof. Alex Mazzolini*

*Secretary of the Asian Physics Education Network (AsPEN), Swinburne University, Australia*

## ↑ Research Project on Medicinal Plants

Sri Lanka is blessed with over 1400 medicinal plants species comprising nearly 24 % of the Island's flowering plants. They include at least 189 (7.4 %) endemic species and are distributed in different climatic zones of the country. These plants have been identified as having a wide array of medicinal properties for one or more of over 300 different ailments and diseases. Associated with them are also rich tradition and a wealth of indigenous knowledge on their use either alone or in mixture, against a wide range of diseases and ailments.

Recent surveys have revealed that Sri Lanka needs over 1500 mt of herbal raw materials annually and 60 % of these materials (63 items of 61 species) have been imported during the year 1997. The bulk of the remaining 40% was collected from natural habitats while only a small proportion was gathered from cultivated plots. This over-exploitation from natural habitats causes habitat degradation and substantial reduction of wild populations.



(From top left - anti-clockwise) (i) **Shade houses and the plant nursery constructed at Meewatura farm for the growth of medicinal plants** (ii) **Sandalwood** (*Santulum album*) (iii) **Thippili** (*Piper longum*) and **Iramusu**

(*Hemidesmus indicus*)

The Ministry of Indigenous Medicine secured a grant of US \$ 3.4 million from the Global Environment Facility Trust Fund for conservation and sustainable use of medicinal plants of Sri Lanka. While funding the in situ restoration of medicinal plants in five selected areas, this project extended its support to leading research institutions to expand ex situ conservation of around 30 widely used medicinal plants in Sri Lanka. Under the latter program, a group of scientists through the PGIS were awarded a consultancy for research on propagation and agronomy of ten widely used medicinal plants namely, Suduhandun (*Santalum album*), Weniwel (*Coscinium fenestratum*), Iramusu (*Hemidesmus indicus*), Thippili (*Piper longum*), Ingurupiyali (*Kaempferia galanga*), Kalanduru (*Cyperus rotundus*), Kiribadu (*Ipomea mauritiana*), Sassanda (*Aristolochia indica*), Ela Pitawakka (*Phyllanthus debilis*) and Hatavariya (*Asparagus falcatus*).

The objectives of the study are three fold:

- Development of rapid and simple propagation techniques, to overcome the short supply of planting material, which is one of the most serious constraints to the widespread cultivation of medicinal plants in Sri Lanka.
- Recommendation of suitable agronomic and farming practices.
- Evaluation of chemical profiles/active compounds of plants grown under different growth conditions.

The information gathered in this project will be used as a means for increasing the quantity and variety of medicinal plants cultivated on farms and plantations. By increasing ex situ conservation, the project hopes to ease the pressure on wild stocks of medicinal species.

Work of the first stage of the project is currently in progress. Two M. Phil. Students, two M. Sc. Students and a Research Officer are working in this program. The trials are carried out in the Meewatura Farm, University of Peradeniya, in four plant houses under different light regimes and different growth media. For Suduhandun, Weniwel, Iramusu and Thippili, the scientists attached to the research project have completed the questionnaire based survey of local propagation practices, characterized different provenances in Sri Lanka, examined the seed viability levels and optimum seed storage conditions, suitable seed germination methods (for *Santalum* and *Coscinium*) and vegetative propagation techniques (for *Coscinium*, *Hemidesmus* and *Piper*). In addition, investigations on the effect of light quantity and different potting media on plant growth, including pot-hosts for the obligate woody root hemiparasite *Santalum album* have also been completed. The overall aim of this study is to impart the research findings to ayurvedic physicians and potential medicinal plant growers so that they could cultivate the correct species under optimum conditions to obtain good quality planting material for the preparation of herbal medicines in Sri Lanka.

The World Bank Funded Sri Lanka Conservation and Sustainable Use of Medicinal Plants Project EA 1 P of the Ministry of Forestry and Environment is providing the financial support for this project undertaken by the Board of Study in Plant Sciences, PGIS and the Department of Botany, University of Peradeniya.

**Collaborating Scientists:** Prof. Nimal Gunatilleke, Prof. Savithri Gunatilleke, Dr. Kushan Tennakoon, Prof. M. D. Dassanayake and Dr. W. P. Wanigasundara. **Research Students:** Damayanthi Bodiyaadu & P.L.K. M. Senani (M.Sc. candidates), Mano Basnayake & Lalith Etampawala (M.Phil. candidates) and Rizana M. Mahroof (Research Officer).

*Dr. Kushan Tennakoon*

## ↑ Student Evaluation under the Course Unit System: Need for a Shift in Perspectives

Prior to the introduction of course units, the evaluation of students of the undergraduate and postgraduate programmes had relied on the raw marks of different subjects. However, even after the introduction of course units many teachers find it difficult to get away from the idea of corresponding raw marks to grades. It is not easy to convince most teachers who have been themselves evaluated using raw marks in the secondary as well as tertiary education stages,

that grading course units based on categories using fixed marks is not feasible in the course unit system.

Within a subject a student receiving a higher mark is obviously a better student than any other student receiving a lower mark. However, how much better (or worse) a student is compared to another cannot be judged by raw marks, since raw marks constitute an ordinal scale. It is like stating that a student receiving 80 marks is twice better than a student receiving 40 marks. All one can state is that the student receiving 80 marks is better (or much better) than the other. When considering different subjects comparisons of raw marks become meaningless. A student receiving 50 marks in one subject cannot be equated to another student receiving 50 marks in a different subject.

Evaluating students in the course unit system involves categorizing students into different grades (A, B, C, etc). However the categorization cannot be based on raw marks. The distribution of raw marks varies from subject to subject and even within a subject from examiner to examiner and from year to year. There is no absolute standard of judgement, such as implied by raw marks. A student can only be judged by his relative performance compared to other students, in a given subject.

A change in perspectives is needed. Assigning grades must necessarily take into consideration the distribution of marks. In large classes (with the number of students greater than 12 - 15), the  $z$  score can be used to assign grades. Another alternative for any class size is using dot plots, and assigning grades based on the distribution. An examiner can use any technique for assigning grades as long as he takes into consideration the distribution of marks. A student's performance is then judged solely on his relative performance compared to that of other students. The bottom line is that raw marks have to be considered as rank data.

**Prof. R.O. Thattil**

*Chairman/ Board of Study in Statistics and Computer Science*

## **Insecticides and Mosquito-borne Disease**

*(Summarized version of an article that appeared in Nature, Vol 407,26 Oct 2000)*

Filariasis, caused by the nematode parasite *Wuchereria bancrofti* is endemic in Sri Lanka. Mosquito *Culex quinquefasciatus* is the common vector of filariasis. Control of this mosquito is mainly by organophosphorus insecticides. Resistance mechanism of *Culex* mosquitoes to organophosphorous insecticides is the elevation (increased quantities) of mosquito carboxylesterases and occurs in more than 80% of resistant *Culex* worldwide. Biochemical characterization of these carboxylesterases, purified from *C. quinquefasciatus* from Colombo, Sri Lanka, revealed that they bind and inactivate organophosphorous insecticides very fast. Antiserum was raised against these esterases and respective genes were isolated. It was found that gene amplification was responsible for the increased production and the resistant insects have up to 80 copies of the gene. Electron-microscopic studies with the esterase antiserum, revealed that these enzymes in resistant mosquitoes are expressed at very high levels in the mosquito gut and sub-cuticular layer. As the parasites must pass through some of these tissues to complete their development, parasite survival and hence the vectorial capacity of insecticide resistant mosquitoes was tested for the first time.

Blood fed female *C. quinquefasciatus* were collected from seven filariasis endemic areas of Sri Lanka. Mosquitoes were individually analyzed for parasite loads by quantitative PCR and insecticide resistance by biochemical assay with para-nitrophenyl acetate (pNPA). Almost 80% of the mosquitoes were infected with *W. bancrofti*. However, there was a strong negative correlation between esterase activity levels and parasite RNA levels in all seven localities. Membrane feeding of the insecticide resistant and susceptible mosquito colonies with *W. bancrofti* infected blood, produced infective parasite larvae after twelve days in 76% of the susceptible and none of the resistant females. This suggests that elevated mosquito esterases of insecticide resistant mosquitoes affect the development of *W. bancrofti* larvae. Filarial worm infection of mosquitoes cause significant damage to the mosquito host. The predominance of the elevated esterase-based resistance mechanism in field populations of *C. quinquefasciatus* may therefore be influenced by the dual roles of insecticide detoxication and reduction of microfilarial burdens. Results indicate that the mosquitoes resistant to organophosphates are incapable of transmitting filariasis.

**Authors:**

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# Anti-Filariasis Campaign, Colombo, Sri Lanka

*Prepared by Prof. S H P P Karunaratne*

## **Degrees Awarded (October 2000 - March 2001)**

### **Name of Awardee**

### **Title of the Thesis**

#### ***Ph.D. - Chemical Sciences***

- |                             |   |
|-----------------------------|---|
| 01. Ms. A M A Priyadarshani | Structure-activity studies of aryl alkenes and synthesis and use of chiral inductors in Iridoid synthesis.    |
| 02. Ms. R M T P Bombuwala   | Biochemical Interactions in Shot-Hole Borer Infestation of Tea and Studies of Three Microbial Polysaccharides |
| 03. Mr. B D K Bombuwala     | Isolation and Bio Activity Studies of Lichen Substances from Sri Lankan Lichens                               |

#### ***M.Phil. - Chemical Sciences***

- |                          |  |
|--------------------------|--|
| 01. Ms. G P K Marasinghe | Chemistry and antiviral/anti-HIV activity studies of family Clusiaceae |
|--------------------------|--|

#### ***M.Sc. Analytical Chemistry***

- |                             |   |
|-----------------------------|---|
| 01. Ms. W D V Karunaratne   | Analysis of pesticide residues in chilli ( <i>Capsicum annuum</i> )   |
| 02. Ms. H W C C Karunaratne | A comparative survey of bio accumulation of some metallic ions such as Cu(II), Cr(VI)O <sub>4</sub> <sup>2-</sup> by the aquatic fern - <i>Azolla pinnata</i> |
| 03. Ms. P S K Rajapakse     | Impurities adulterants and diluents of illicit heroin in Sri Lanka  |

#### ***Applied Statistics***

- |                              |   |
|------------------------------|---|
| 01. Ms. S S K B M Dorabawila | Classification of state schools in Sri Lanka: a multivariate approach |
|------------------------------|---|

***Environmental Science***

- Ms. H M S
01. Herath Menike                      Assessment of the ground water quality
02. Mr. A M A Lebbe                Some studies on the variation of physico-chemical parameters in a sequence batch reactor installed to treat fruit canning effluent

***Industrial Chemistry***

01. Mr. K Pathmanathan            Manufacture of precipitated calcium carbonate from dolamitic quick lime
02. Mr. D J A de S Rajakaruna    Utilization of rice husk to remove metal ions in solution

**↑ Abstracts of Ph.D./M.Phil. Theses****Ph.D. (Chemistry)**

**A M A Priyadarshani**, Department of Chemistry, University of Peradeniya, Sri Lanka

**Structure-Activity studies of Aryl Alkenes and synthesis and use of Chiral Inductors in Iridoid synthesis**

This thesis consists of two parts.

A previous study of *Zingiber purpureum* had shown the presence of an aryl alkene, (E)1-(3,4-dimethoxyphenyl)-butadiene, which was active against *Aedes aegypti* with LC50 of 6.5 ppm and against the bruchid, *Callosobruchus maculatus* with LC50 of 2mg. The compound also showed oviposition deterrent and ovicidal effects against the bruchid. The aryl alkene was, however, unstable when exposed to light and air. Structurally related compounds, were therefore synthesized (Wittig reaction) in order to study the structure-activity relationship to obtain aryl alkenes with the same or enhanced activity. Aromatic aldehydes substituted with hydroxy and methoxy groups at different positions on the aromatic ring were reacted with ylides of different length (1 to 4 carbons).

Para methoxy substituted aryl alkenes were generally found to have strong insecticidal activity against *Callosobruchus maculatus* in the residual film bioassay. In the seed treatment bioassay, these compounds showed oviposition deterrent and ovicidal effects against the bruchid.

Gastrolactole, which is a key intermediate in the synthesis of sex pheromones, Nepetalactoles and some Iridoidal compounds was synthesised via an intramolecular [4+2]-cycloaddition of an enamine derivative of 8-oxocitral, wherein the enamine moiety acts as the chiral inductor. 2-Methyl-, tert-Butyl-, Phenyl-indoline were used as chiral inductors in the cycloaddition step and three different cycloaddition products were obtained in different diastereomeric ratios. 2-Phenylindoline was the best chiral inductor for the cycloaddition step.

Racemic 2-phenylindoline was resolved into its enantiomers, by first converting them to urea derivatives using (R)-(+)- $\alpha$ -methylbenzylisocyanate. The diastereomers of the urea derivative were then separated by medium pressure column chromatography and finally they were released as separate samples of (R)- and (S)-2-phenylindoline after reaction with diborane in refluxing THF. The enantiomeric purity of the two enantiomers was checked by chiral gas chromatography.

**Supervisor:** Prof. V Kumar (University of Peradeniya and PGIS)

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Ph.D. (Chemistry)

**R. M. Thushari P. Bombuwala**, Department of Chemistry, University of Peradeniya, Sri Lanka

### **Biochemical Interactions in Shot-Hole Borer Infestation of Tea and Studies of Three Microbial Polysaccharides**

The thesis is in two parts. The first part describes some studies carried out to understand the biochemical interactions between the tea plant (*Camellia sinensis*), shot-hole borer (SHB) beetle, *Xyleborus fornicatus* and its symbiotic ambrosia fungus *Monacrosporium ambrosium*.

Microbial flora of SHB galleries was studied. A *Fusarium* species, *Pestalotiopsis theae* and an *Aspegillus* species were found along with the symbiotic fungus *M. ambrosium* in plugged SHB galleries. None of the fungi inhibited the growth of *M. ambrosium*.

The total phenolic content of stems from tea clones TRI 2023 and TRI 2025 (resistant and susceptible respectively to SHB) was found to be higher in TRI 2025 and highest in tea stems which were infested with SHB. Phenylalanine ammonialyase (PAL) and polyphenol oxidase (PPO) enzyme activities were also found to be higher in the infested stems of both clones, while the highest activity was observed in the susceptible clone TRI 2025.

The cup plate assay was used to determine polygalacturonase (PG) and pectinase activity of culture filtrates from *M. ambrosium*. PG activity was observed to be weaker than those of standard PG from *Aspergillus niger*. Chitinase enzyme activity was detected in tea clones of TRI 2023 and TRI 2025, TRI 3015, TRI 3019, TRI 4053 and TRI 4078. The highest enzyme activity was detected in the healthy stem samples of the SHB resistant tea clones of the three series. The fungus was also found to produce xylanases that could free xylose from the xylan in tea stems.

Mycelial development, sporulation and spore germination of *M. ambrosium* (which had been observed to be different in the two clones TRI 2023 and TRI 2025 during a previous study) were found to be affected by the glucose and inositol composition and/or the ratio of these sugars in tea stems, and also by the concentration of dextrose in the medium.

Part two of the thesis describes some structural studies of three microbial polysaccharides. The lipooligosaccharide of *Salmonella dalhem* was found to contain neuraminic acid and therefore it belongs to the O-48 sero type. The structure of the tetrasaccharide repeating unit of the *Hafnia alvei* polysaccharide was established, while compositional and methylation analysis of the mycelial polysaccharide isolated from the fungus *M. ambrosium*, indicated it to be a glucogalactomannan.

**Supervisor:** Prof. N S Kumar (University of Peradeniya and PGIS)

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Ph.D. (Chemistry)

**B. D. K. Bombuwala**, Department of Chemistry, University of Peradeniya, Sri Lanka

### **Isolation and Bio Activity Studies of Lichen Substances from Sri Lankan Lichens**

This thesis describes the isolation of bioactive compounds from four lichen species collected in Sri Lanka: *Usnea* sp., *Heterodermia diademata*, *Roccella montagnei* and *Leproloma sipmanianum*.

From the CH<sub>2</sub>Cl<sub>2</sub> extract of an *Usnea* sp. collected from Ambewela in the Central province, three compounds namely, ambewelamide A, ambewelamide B and usnic acid were separated. Ambewelamides A and B are new members of a family of highly modified diketopiperazines and constitute the first examples of this family of compounds isolated from a lichen. The MeOH extract of the same lichen furnished two new depsidone lactones and b-sitosterol. Ambewelamide A was active against the 2nd instar larvae *Aedes aegypti* (LC<sub>50</sub>=1.70 ppm) and was also highly active

against five fungi: *Cladosporium cladosporioides*, *Colletotrichum musae*, *Colletotrichum gloeosporioides*, *Curvularia trifolii* and *Monacrosporium ambrosium*. Ambewelamide A was found possess potent in vitro cytotoxicity (murine leukemia P388: IC50 8.6 ng/ml) and significant in vivo antineoplastic activity (P388: %T/C 140 @ 160 mg/Kg).

Seven compounds were isolated from the *Roccela montagnei* lichen collected from Bamunakotuwa in the Kurunegala district, North Western Province: from the CH<sub>2</sub>Cl<sub>2</sub> extract, aspisin was separated; the MeOH extract yielded erythrin, methylorsellinate, erithritol, rocellic acid, b-sitosterol and b-carotene.

The third lichen studied was *Heterodermia diademata* collected from a rock beside a small stream in Labukelle, in the Nuwara Eliya district. The hexane extract of the above lichen provided three compounds: 5-chloro-3-formyl-4-hydroxy-2-methoxy-6-methylbenzoic acid, methyl b-orcinol carboxylate, and zeorin. From the CH<sub>2</sub>Cl<sub>2</sub> extract, atranorin and chloroatranorin were separated. The MeOH extract yielded b-sitosterol in addition to atranorin. To the best of our knowledge, 5-chloro-3-formyl-4-hydroxy-2-methoxy-6-methylbenzoic acid has not being reported before.

*Leproloma sipmanianum* specimens were collected in the upland area of Nuwara Eliya on proterozoic rocks of gneiss and quartz schist which are exposed at road edges in the rather extensive areas around Beragala. *Leproloma sipmanianum* has previously been reported from South Africa, Colombia and Brazil. This is the first report of the lichen from the Asian region. The butterfly *Talicadia nyseus nyseus* (Guer) (Red Pierrot) was found to be closely associated with *Leproloma sipmanianum*. The CH<sub>2</sub>Cl<sub>2</sub> extract of *Leproloma sipmanianum* contained five compounds namely, (+) usnic acid, atranorin, b-sitosterol, zeorin, and a long chain fatty acid ester. The latter compound is new to lichens. Upon comparison, the extract of the adult *Talicadia nyseus nyseus* (both the collected adult butterflies and the ones which emerged from pupae) contained all of the above compounds. The presence of lichen substances in the adult *Talicadia nyseus nyseus* indicates that their larvae feed on *Leproloma sipmanianum*. To the best of our knowledge, there are no previous reports of the butterfly family (Lycaenidae) feeding on lichens.

**Supervisor:** Prof. V. Karunaratne (University of Peradeniya and PGIS)

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M.Phil. (Chemistry)

**G P K Marasinghe**, Department of Chemistry, University of Peradeniya, Sri Lanka

### **Chemistry and antiviral/anti-HIV activity studies of family Clusiaceae**

This thesis describes the chemistry and antiviral/HIV activity studies of *Calophyllum cordato-oblongum* and *Calophyllum moonii*.

The twigs of *C. cordato-oblongum* have been shown to contain the 12-O-methylcordatolide A, 12-O-methylcordatolide B, 12-O-methylcordatolide C, three reported pyranocoumarins; (cordatolides A and B, oblongulide), friedelin, canophyllol and sitosterol. Methylation of cordatolide B and attempted methylation of cordatolide A under acidic conditions gave the 12-O-methylcordatolide B and 11,12-anhydrocordatolide. These findings together with the results of the methylation of soulattrolide and inophyllum A have led to the proposed mechanism for the methylation of the 12 hydroxy group of *Calophyllum* pyranocoumarins. The methyl ethers of cordatolide A, B and C as well as 11,12-anhydrocordatolide are new compounds.

The root bark of the *C. cordato-oblongum* afforded friedelin, sitosterol and an acid mixture. The acid mixture was esterified under acidic condition and methyl esters of cordato-oblongic acid and isocordato-oblongic acid were isolated. This is the first report of the occurrence of isocordato-oblongic acid in nature.

The buds of the *C. moonii* gave friedelin, sitosterol, inophyllum A and soulattrolide. They were previously reported from the leave of the same species. The presence of pyranocoumarins (inophyllum A and soulattrolide) in the buds of *Calophyllum moonii* indicates the protective role of pyranocoumarins in tender plant tissues.

All the above compounds were isolated by various separation techniques such as PTLC, MPLC, gravity column

chromatography, flash chromatography and crystallization. Their structures were elucidated by spectral (IR, UV, NMR, HPLC) analysis, physical (mp, [α]<sub>D</sub>) methods and chemical conversions.

Methanolic extracts of the various plant parts of *C. cordato-oblongum* were subjected to the Aspartic Proteinase Bioassay and the stem bark extract showed the promising activity. Therefore, the stem bark extract was further purified by Anion Exchange Chromatography and some of the fractions showed inhibition but the percentage inhibition of the major peak fractions was low.

As cordatolide A and cordatolide B have shown significant activity on HIV-1 RT assay, oblongulide and 12-O-methylcordatolide B were subjected to the RT assay and they have shown insignificant activity. However, the inactivity of oblongulide and 12-O-methylcordatolide B indicated the important role of the three chiral centers and in particular the 12-OH of the pyranocoumarin in the activity.

**Supervisors:** Dr. H R W Dharmaratne (Institute of Fundamental Studies)  
Dr. S B P Athauda (University of Peradeniya and PGIS)

## Workshops

### Workshops (WS), Short Courses (SC) and Training Programmes (TP) conducted from November 2000 to February 2001

| Event                                                                              | Coordinator/s                 | Period           | No. of Participants |
|------------------------------------------------------------------------------------|-------------------------------|------------------|---------------------|
| (TP) Ceramic Technology                                                            | Dr. A. D. L. C. Perera        | Nov. 3-5, 2000   | 16                  |
| National Seminar on Intellectual Property Rights and Commercialisation of Research | NSF & PGIS                    | Nov. 24, 2000    | 75                  |
| (WS) Student Evaluation under the Course Unit System                               | Dr. N. C. Bandara             | Jan. 20, 2001    | 69                  |
| (WS) Acid Rain Monitoring and Air Quality Monitoring and Management                | Prof. O. A. Ileperuma         | Feb. 12-15, 2001 | 49                  |
| First National Workshop on Computer based Interactive Physics Teaching             | Prof. M. A. K. L. Dissanayake | Feb. 13-15, 2001 | 18                  |

## *Coordinators? Reports*

### *Training Programme on Ceramic Technology*

*The Training Programme on Ceramic Technology organized by the Board of Study in Chemical Science was held from Nov. 3-5, 2000 at the Postgraduate Institute of Science, University of Peradeniya. Sixteen participants attended the programme. All but two of the participants are employed in the ceramic industry. There were five resource persons from the ceramic industry, one from the Industrial Technology Institute and three from the University of Peradeniya. The programme was very successful and highly appreciated by the participants. The following points were raised during discussions with participants.*

- There is a great need for this type of University-Industry Interaction. Many of the participants expressed the idea that graduates employed in industry will find even ?Refresher Courses? related to various industries very useful. The courses could begin at a lower level (eg. Introductory undergraduate course material) and build up to postgraduate level. Graduates employed in Industry, (unlike undergraduates in the university) are highly motivated to learn and have much to gain from these courses.
- Resource Persons from Industry welcomed the opportunity to interact with University programmes and academic staff.

**Coordinator: Dr. A. D. L. C. Perera** *Workshop on Acid Rain Monitoring and Air*



**Dr. A D L C Perera** addressing the participants of the training programme. (Seated from L) Prof. N S Kumar (Chairperson, Board of Study in Chemical Sciences) and Prof. K Dahanayake (Director, PGIS)

### **Quality Monitoring and Management**

The main objective of this workshop was to educate the participants from the environmental sector and university academics who are beginning to teach Environmental Science in their undergraduate and graduate level courses with issues related to atmospheric acidification and air quality management. The objectives were pursued through consideration of the following issues.

- a. sources of atmospheric acidification and their relationship to air quality information environmental implications of acid rain
- b. experimental techniques of acid rain monitoring
- c. formation of a national network for acid rain monitoring
- d. training of RAINS-ASIA computer model for predicting acid depositions and its relationship to energy policies
- e. studying trends in air pollution in Sri Lanka through available data on air quality monitoring.

### **Other issues related to air quality that were discussed included**

- a. air quality monitoring techniques used in Sri Lanka and elsewhere
- b. physical and chemical aspects of fine particles
- c. indoor air pollution and health
- d. monitoring air quality in workplaces for occupational exposure
- e. health impacts of air pollution
- f. air pollution modelling
- g. risk assessment
- h. sampling practices for volatile organics in air
- i. monitoring of lead in household dust



**Prof. O A Ileperuma** (centre) making a presentation at the workshop

The workshop was announced nationally through a newspaper advertisement and in addition, a brochure was sent to

universities and research institutes. Fifty one applications were received and 49 participants attended the workshop. Amongst the participants were 16 senior lecturers from eight universities.

Lectures were conducted on the following topics: Acid rain, RAINS-ASIA Model, Air pollution, Air quality Monitoring for Regulatory Purposes, Fundamentals of Air Quality Modelling, Indoor air quality and health, Particulates and Volatile Organics, Low cost Monitoring techniques, Monitoring lead in the atmosphere, Monitoring workplaces for through Passive gas sampling techniques, Basic principles of Risk assessment, Radioactivity in air, Pollution Standards Index, Air pollution and respiratory function, Indoor air pollution, passive smoking and smogs.

Practical sessions on the following topics were conducted.

- Rain water analysis using ion chromatograph
- Passive gas sampling of air pollutants
- Air quality model demonstrations (ADMS-URBAN,HIWAY,PAL,RAODWAY)
- RAINS-ASIA MODEL to calculate acidic depositions arising from transboundary pollution.

The practical sessions were quite popular amongst the participants where the use of models such as RAINS-ASIA which predicts acidic depositions in future owing to increased coal use can be calculated. For example, this model enables the calculation of acidic depositions in Sri Lanka by the year 2010 and the percentage of sensitive ecosystems at risk. Air pollution models such as PAL can calculate the increase of air pollutant levels experiences at a residential neighbourhood which is 10 km away from a proposed power plant. These are important for carrying out EIA processes for future power plants. The participants were also given a demonstration of a simple inexpensive passive sampling device for monitoring air pollutants such as sulphur dioxide, nitrogen oxides and ozone. This device has been used for determining the levels of the above air pollutants in Kandy. The subject matter covered during the workshop was incorporated into a Book of Proceedings.

An evaluation of the workshop was carried out by providing a questionnaire to the participants where 39 participants responded. A majority of the participants agreed that the workshop provided them with new knowledge useful for the work they already carry out.

***Coordinator: Prof. O. A. Ileperuma***

### ***Workshop on Student Evaluation under the Course Unit System***

The above workshop was conducted at the Faculty of Science, University of Peradeniya on Saturday 20th January 2001. This workshop was planned with a view to discussing and clarifying problems encountered in evaluating the performance of students under the course unit system. About 70 members of the PGIS teaching panels and some selected faculty members participated in the workshop. The resource persons included senior academics from Faculties of Agriculture, Engineering & Science, University of Peradeniya and Faculty of Science, University of Kelaniya. Professors O A Ileperuma and R O Thattil made presentations. Professors K Dahanayake, M A K L Dissanayake, O A Ileperuma, R O Thattil, M J S Wijeratne and Drs. A A S Perera and N Somaratne served on the discussion panel.

***Coordinator: Dr. N. C. Bandara***

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## **↑ JUNIOR RESEARCH ASSISTANTSHIP PROGRAMME (2001/2002)**

Every year the PGIS launches a Junior Research Assistantship (JRA) scheme aimed at providing an opportunity for brilliant Sri Lankan students who have excelled at the G.C.E. (A/L) Science Examination. This is an excellent opportunity for young students to share the excitement and experience of scientific research by working with eminent scientists, prior to embarking on university education. The Junior Research Assistants (JRAs) are expected to carry out

research work under the guidance of some selected senior scientists of the Sri Lankan university system. The Junior Research Assistantship is a full-time temporary position with a monthly allowance of Rs. 3000/-. After calling for applications by press advertisement, the final selection of JRAs was made based on their examination results and performance at an interview. The fifth batch of Junior Research Assistants whose names and affiliations appear below were selected to join the PGIS on March 15, 2001:

C. R. J. Amalraj (Highland's Maha Vidyalam, Hatton)  
P. A. A. Chandrasiri (St. Aloysius' College, Galle)  
D. M. S. U. K. Dassanayake (Science College, Matale)  
C. Thamara Hapuarachchi (Sirimavo Bandaranayake Balika Vidyalaya, Colombo)  
I. M. M. B. Illangasinghe (Dharmaraja College, Kandy)  
D. Melani Jayasuriya (Maliyadeva Girls' College, Kurunegala)  
G. L. N. W. Liyanage (St. Peter's College, Colombo)  
W. Chathura Sankalpa Mendis (Nalanda College, Colombo)  
N. M. R. Kumari Nayakarathna (Maliyadeva Girls' College, Kurunegala)  
Dilami Upeksha Pathiraja (Maliyadeva Girls' College, Kurunegala)  
Yasitha Ranasinghe (Rahula College, Matara)  
N. Mahesh D. Ranawaka (Rahula College, Matara)  
R. M. P. Amalangi Rathnayake (Maliyadeva Girls' College, Kurunegala)  
C. Neelakanthi Ratnatunga (Girls' High School, Kandy)  
R. D. L. Srikantha Rideewita (Trinity College, Kandy)  
N. Rangajeewa Rubasinghe (Rahula College, Matara)  
P. M. K. Rivi de Silva (Royal College, Colombo)  
Balakrishnan Thanushan (St. John's College, Jaffna)  
Chaminda A. Wijesinghe (Kingswood College, Kandy)  
Hiran Deshantha Yapa (Narammala Mayurapada National School, Ku

## OFFICE TRAINEE PROGRAMME (2001/2002)

Every year the PGIS launches an office trainee programme aimed at providing an opportunity for brilliant students in the Kandy district who have excelled at the G.C.E. (A/L) Commerce Examination. This is an excellent opportunity for young students to share the excitement and experience of working in an office environment, prior to embarking on university education. The office trainees are expected to work in the PGIS office and this appointment is a full-time temporary position with a monthly allowance of Rs. 3000/-. The twenty commerce students of Kandy district ranked top at the G.C.E. (A/L) Commerce Examination held in 2000 were called for an interview and three trainees were selected based on their examination results and performance at the interview. The three office trainees whose names and affiliations appear below were selected and they joined the PGIS in February 2001:

Gayani C. G. Punchihewa (Girls' High School, Kandy)  
J. Chammi K. Jayasuriya (Mahamaya Balika Vidyalaya, Kandy)  
Shakila M. Gunaratne (Mahamaya Balika Vidyalaya, Kandy)

## FORTHCOMING EVENTS

- Short Course on Business Mathematics (April 2001)
- Postgraduate Certificate Course in Advanced Biochemistry - Part II (May 2001)
- M.Sc. Programmes (May 2001):
  - Analytical Chemistry
  - Environmental Science
  - Fish & Wildlife Management
  - Industrial Chemistry

- Physics of Materials
  - Science Education (with specialty in Biology/Chemistry/Mathematics/Physics)
  - Workshop on Microbial Pesticides (August 2001)
  - Workshop on JAVA Programming (2001)
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## FOREIGN APPLICANTS FOR PGIS PROGRAMMES

PGIS entertains applications from foreign students for admission to its M.Sc., M.Phil. and Ph.D. Programmes. Special reduced rates of fees are available to students from SAARC countries.

For details, please contact Assistant Registrar, PGIS.

Fax: 94 8 389026; Phone: 94 8 387542; e-mail: [director@pgis.lk](mailto:director@pgis.lk)

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