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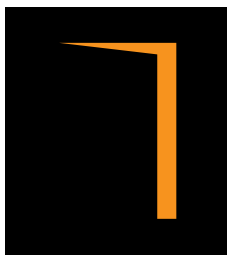
The Path Finder

Dawning Light for Sri Lanka



NATIONAL
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This publication meant for the general public, is the first of a series of publications highlighting the achievements of Sri Lankan scientists who have been recipients of Research Grants from the National Science Foundation, Sri Lanka.

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National Science Foundation
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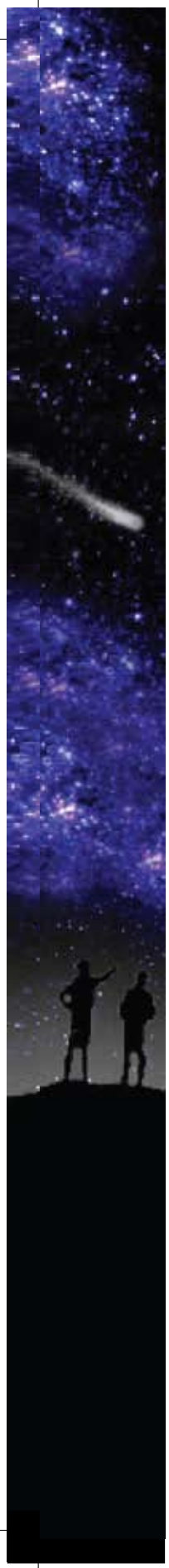
Colombo 07
Sri Lanka

THE PATH FINDER

Dawning light for Sri Lanka

Research is the Foundation of Knowledge



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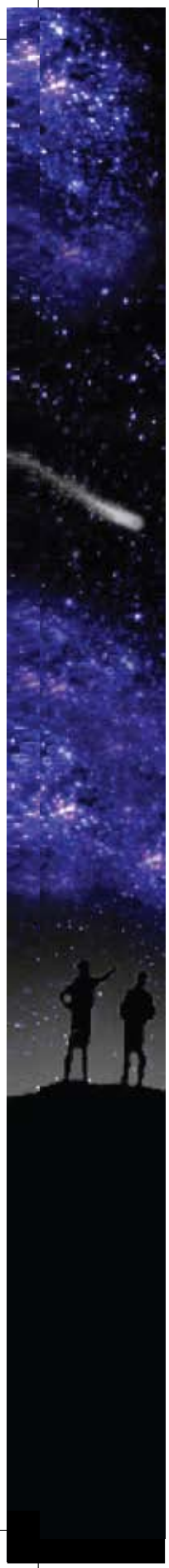


FOREWORD

The year 2008 was a special year for the National Science Foundation (NSF). It celebrated 40 years of dedicated service to Science and Technology in Sri Lanka. Founded in 1968 as the National Science Council (NSC) and then later re-designated by two Acts of Parliament, first to be called the Natural Resources, Energy and Science Authority (NARESA) from 1978 to 1997 and then the National Science Foundation from 1998 onwards, it has been serving Sri Lanka's scientific community as the premier state organization providing funds for research and development in science and technology.

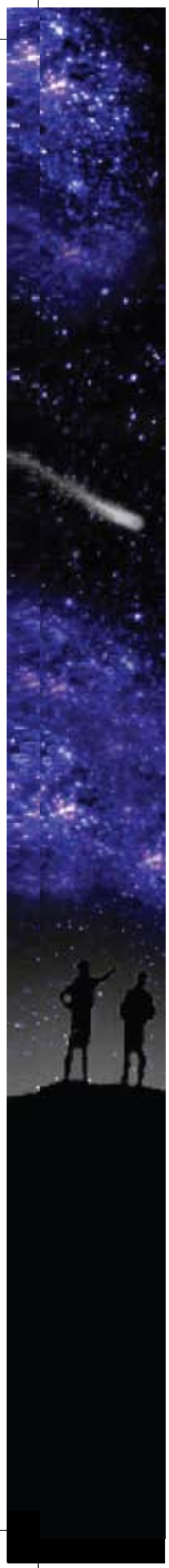
Two years after its establishment the NSC commenced awarding research grants to scientists in Universities and R&D institutions. To date the three successive institutions together have awarded over 1800 grants valued over Rs. 400 million.

A major complaint levelled at the NSF (as well as its predecessors) is that results from research undertaken by the scientific community have not been adequately communicated to the general public. Although in many instances research (eg. development of improved/ higher yielding crop varieties, insect and pest control methods in agriculture) has benefitted the common man and has lead to socio-economic development, the results have not been translated to simple language that could be understood by the general public. Often these results have been published in internationally recognized scientific journals and have brought in much credit and fame to the country. However, since scientists are often not journalists or have very little understanding of science journalism they have not been able to communicate these important findings to the people.

With a view to overcoming this deficiency NSF undertook the task of presenting in simple language some notable achievements from past research projects funded by the NSF. Results from some selected research projects are being presented to the general public in this publication.

This is the first of a series of publications meant to highlight achievements from some randomly selected research projects that have produced good final results. We believe that the outcome of these projects have a bearing on the socio-economic development of the country.

Dr. M.C.N. Jayasuriya
Director
National Science Foundation
March 2009



ACKNOWLEDGEMENTS

This booklet would not have been a reality without the support of recipients of NSF grants, who had carried out their research projects with dedication, enthusiasm and commitment. Therefore, first and foremost, we would like to extend our gratitude to them.

We are thankful to the Chairperson Prof. Sirimali Fernando and the Board of Management of the NSF for the guidance, constructive comments and encouragement given during the preparation of this publication.

This booklet was conceptualized by Dr. M.C.N. Jayasuriya, Director, NSF who firmly believed that the results of NSF funded Research projects should be disseminated to the general public in simple language. He edited all the reports included in this publication in spite of his busy schedule with unfailing interest. The support given by Dr. Jayasuriya at every stage in the preparation and printing of the publication is gratefully acknowledged.

We extend our gratitude to Dr. Preethi Randeniya, of the Department of Zoology, University of Colombo for preparing these reports for publication. She patiently and diligently went through them, sometimes going through several versions. Her contribution to this publication was invaluable.

A special word of appreciation and thanks should be extended to Prof. Tuley De Silva, Mr. Thusitha Malalasekara and Dr. C. Devadasan respectively, for English, Sinhala and Tamil language editing, Ms. M.A. Sameera Netali and Ms. Amali Bandara for page setting of the publication.

Finally the contributions made by Dr. Sachie Panawala, Dr. Gowry Moorthy, Ms. Lalani Lekha Munasinghe, and Ms. Amali Ranasinghe in bringing out this publication is gratefully acknowledged.

Dr. Geethika Yapa
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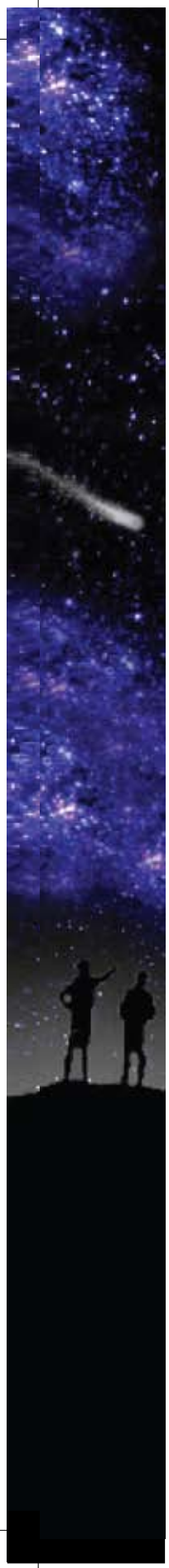


MALARIA MOSQUITO SIBLINGS IDENTIFIED!

The malaria mosquito (*Anopheles culicifacies*) has five siblings who look identical but are different in their ability to transmit the malaria parasite from one human to another.

A DNA probe to detect siblings of the malaria mosquito was developed at the Department of Biochemistry & Molecular Biology of the University of Colombo.

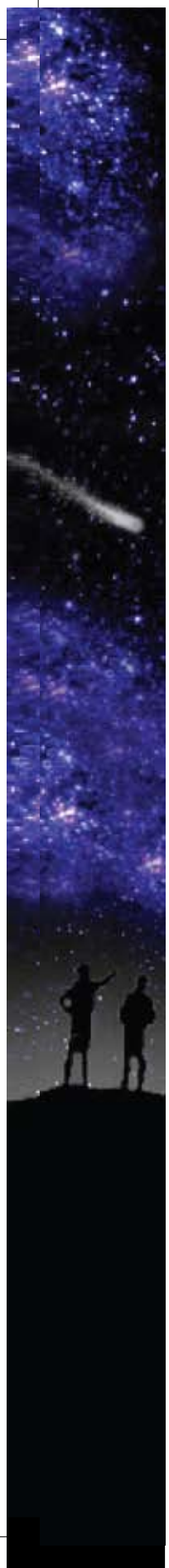
Malaria caused by a parasite is a major public health problem in Sri Lanka. It is transmitted from one human being to another through a bite of an infected female mosquito.

Studies have shown that the malaria transmitting mosquito has five siblings designated as: A, B, C, D and E; the last being a more recent addition to the list. Sibling species of the complex do not cross mate with each other and cannot be differentiated by their external features as they all look alike.

The usual taxonomic keys cannot be used to tell them apart. The conventional methods of identification of sibling species are tedious and limited by the sex and life cycle stage of the mosquito. Therefore, a project was initiated to look at the differences in these mosquito siblings' DNA, and to use these differences to develop DNA probes to identify the different sibling species.

Mosquito siblings look alike but play different roles in transmitting malaria (photo: courtesy Wikipedia)

DNA probes have several advantages over the conventional techniques of mosquito species identification: they are accurate, rapid, highly sensitive, and all life cycle stages can be identified by a single technique.



Accurate identification of the different siblings of Anopheles is important for any malaria mosquito control programme. This is because the siblings, despite their similarity in looks, play different roles in transmitting the malaria parasite. They show differences in their behaviour, in their ability to infect humans and in their capability to respond to insecticides. The three DNA probes developed in this study can be used to detect adult and immature stages of Anopheles culicifacies from those of other mosquito species. In addition, a DNA probe to distinguish sibling species A from B and C species of Anopheles culicifacies has also been developed. Field studies using more than 2000 individual mosquitoes screened with these DNA probes revealed that Anopheles culicifacies sibling species A was indeed absent in Sri Lanka.

On request, these probes have been sent to the Malaria Research Centre in India, and are now being used there in the field surveys on sibling species A.

Research Grant No: RG/93/BT/02

BATS - STUDY REVEALS THEIR AMAZING HABITS

A study of Sri Lankan bats carried out after a period of 70 years has revealed some significant information that would help conserve these truly amazing animals useful to mankind.

Bats like humans are mammals, delivering babies that feed on milk but are special due to their ability to fly.

Nearly 842,840 individual bats were identified during a survey carried out by a team of scientists from the University of Colombo, in all parts of Sri Lanka excluding the North and the East of the island. It covered all major climatic zones.There are two main groups of bats; the insect eaters that are smaller in size (microchiropterans), and fruit eaters that are much larger (megachiropterans). Bats are the most vulnerable group of animals to environmental changes due to their unique and specialized

Day roost of Flying Fox bats

resting, feeding and reproductive habits.

Bats help people in several ways. They eat thousands of insects harmful to humans and crops. They help disperse seeds and pollinate flowers. The blood thinning chemical in the saliva of vampire bats has been studied for its medicinal value. The echo-location mechanism of the insect eating type has helped in studies to assist blind people. In addition, bat dropping is the best plant fertilizer known to man. Sri Lanka being a tropical country accounts for a remarkable variety of bats. However, very limited information was available on bat types (species), population sizes, their habitats, feeding grounds and reproduction.

This work recorded 19 different types (species) of bats which accounts for only

Bat Species M lyra

A bat 'tent'

60% of bat types recorded in the 1920s by Phillip's survey. Population sizes of fruit bats had increased alarmingly, while those of the insect eating bats had strikingly declined during the last few decades due mainly to human interference: direct actions such as consuming bat meat and indirect actions such as new human settlement schemes, deforestation and population increase leading to loss of bat habitats.

This study also collected new information on selection of places for resting, their movements and reproduction. Bats were found in three types of day roosts: tree based, man made and rock based. Some bats were highly specific in roost selection whereas others were ambiguous in their choice of roosts. Some bats (Cynopterus bats) preferred to construct 'tents' by bending leaves of palm trees, which was recorded for the first time in Sri Lanka.

Breeding periods of some Sri Lankan bats were described for the first time. Two breeding cycles dependant on the geographic locations were found for two bat types. Some bats used separate 'maternity' caves to deliver their babies and to nurse them. Several such 'maternity' caves have been identified. Migration between 'maternity' and 'pre-maternity' caves was documented for the first time.

Every animal has a role in the environment, so do bats; therefore it is important that we protect them. The information gathered from this study will help conserve bats.

Research Grant No. RG/95/B/5

FOOD SAFETY - FISH EATERS BEWARE!

Study conducted at the Department of Food Science & Technology, University of Peradeniya has revealed that sea fish, dried-fish, canned fish, Maldive fish and "jadi" (fish preserved by an indigenous method) in Sri Lanka have unacceptably high concentrations of histamines and therefore could be a food safety concern.

Histamines can cause allergic reactions such as redness of the eyes, burning and tingling sensations around the mouth, swelling, itching, vomiting and diarrhoea.

According to the findings production of dried and Maldive fish increased the concentration of histamines. Beheading and washing of fish before salting appeared to minimize the production of histamine during drying. Furthermore, dark tissues of fish produced more histamines than the white tissues.

The histamine concentration in fish sausages, fish nuggets and fish curry in packets was less than the tolerance limits. Looking at ways of minimizing the histamine content of food, the researchers found that extracts or pieces of garcinia (*goraka*) fruit destroyed histamines in fish during cooking to safe levels. Tamarind (*siyambala*) and "*biling*" were less effective.

Maldive fish

Tamarind

Biling (in Sinhala)

Cooking in the extracts of "Kathurumurunga" or Murunga" (Moringa) leaves for 10 minutes or frying in coconut oil or soya oil for 4-5 min destroyed over 50% of histamines in the fish. Frying of small fish such as sardines (salaya), herrings (hurulla) and mackerels (kumbalawa) may provide a means of reducing histamines. Use of goraka pieces or paste could be recommended to reduce histamines in red-blooded fish varieties containing intolerable histamine concentrations.

Garcinia

The study also identified 30 histamine-producing bacteria. *Hafina* species were found to produce the highest amount of histamines in fish. *Micrococcus* species and *Flavobacterium* species were identified as histamine producing bacteria for the first time. Also, a new laboratory method has been introduced to detect histamines in fish.

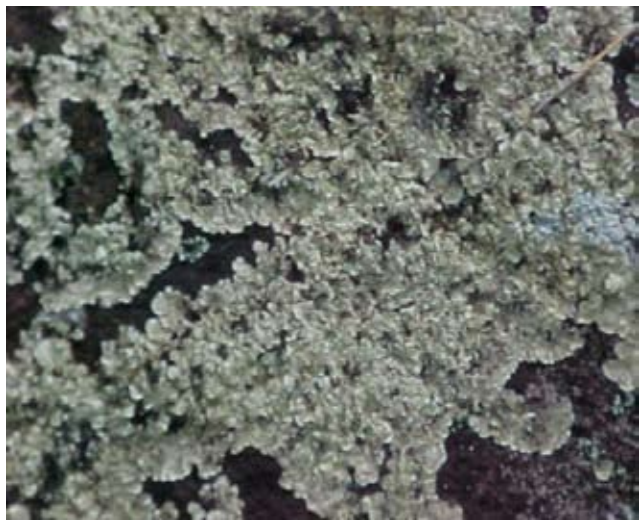
Research Grant No. RG/95/BT/10

PROMISING ANTI-CANCER COMPOUNDS FROM SRI LANKAN LICHENS

Tropical lichens which show great promise as a source of therapeutics are one of the least studied non-flowering plants. Lichen substances are known to have antimicrobial effects that inhibit bacterial and fungal infections.

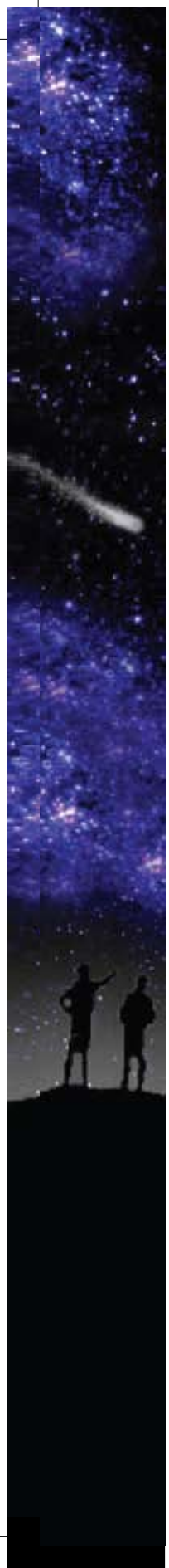
In Sri Lanka, both the classification and the chemistry of lichens remained completely unexplored until 1996 when a research programme was initiated at the Department of Chemistry, University of Peradeniya to explore the lichens of Sri Lanka for biologically active compounds. The most potent and promising anticancer compound to be discovered from any Sri Lankan source (land or marine) was isolated during this study, from a lichen in Ambewela.

Lichens are mutually benefiting associations of a fungus with another plant that can produce food for the lichen from sunlight. The plant is usually either a green algae or a cyanobacterium.



A lichen growing on a rock in Horton plains

In the natural environment, lichen "provides" the alga with water and minerals that the fungus absorbs from whatever the lichen is growing on, its substrate. As for the algae, it uses the minerals and water to make food for the fungus and itself. This is an intimate, continuous necessary association.



About 8% of land ecosystems are dominated by lichens. Lichens because of their small size and slow growth, thrive in places where higher plants have difficulty growing.

The research work of this project was undertaken to explore the potential of Sri Lankan lichens, a hitherto unexplored national resource, as a source of new bio-active compounds. The bio-active compounds of four lichens collected locally were separated and purified.

From the chemical extract of an Usnea type lichen collected from Ambewela, three compounds were separated. Two of these compounds, named Ambewelamide A and Ambewelamide B were found to be new members of a family of highly modified chemicals and are the first examples of this family of compounds isolated from a lichen. Ambewelamide A was found to have anti-fungal activity (more activity than a particular commercial preparation), mosquito larvae – killing (larvicidal) ability, anti-cancer properties. A Canadian patent application was filed based on the promising bio-activity of this compound. The third compound separated from this lichen, Usnic acid, shows antitermite activity in addition to antifungal and mosquito larvicidal activity.

The lichen scientifically known as *Leproloma sipmanianum* was collected in the upland area of Nuwara Eliya off rocks around the Beragala area. This is the first report of the lichen from the Asian region. The butterfly, Red Pierrot, was found to be closely associated with this lichen. Lichen substances were found in this adult butterfly indicating that their larvae (young insect stage) feed on this lichen. This is the first report of the butterfly family feeding on lichens.

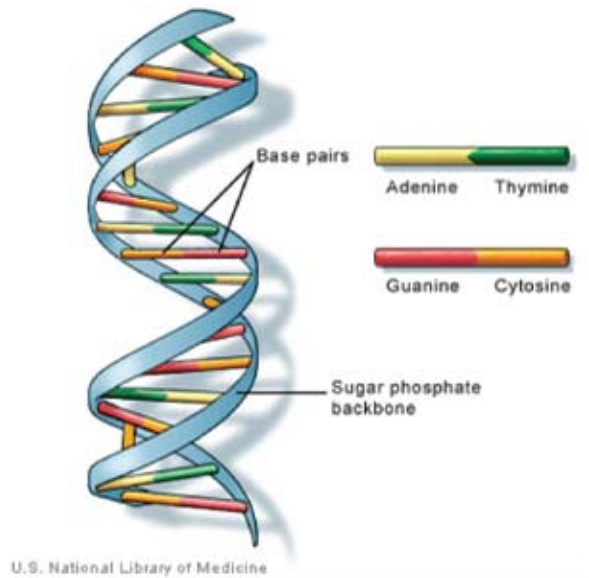
Also, from Ramboda in Nuwara Eliya district, a new lichen type growing on rocks was discovered. This was named as *Lepraria atrotomentosa*.

Another highlight of this research programme was the organization of the first ever National Workshop on Sri Lankan Lichens, in May 1999.

Research Grant No. RG/96/C/04

DNA FINGERPRINTING AS EVIDENCE IN A COURT OF LAW

The DNA fingerprinting carried out by a team of Sri Lankan Scientists has been successfully used as evidence for the first time in a court of law in Sri Lanka.

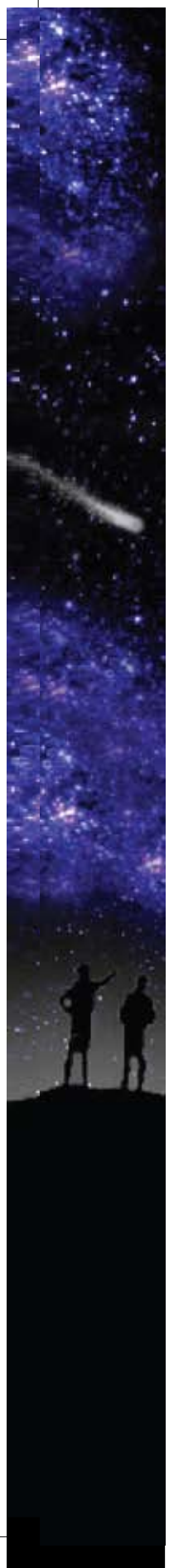


DNA fingerprinting or typing is the characterization of individuals using DNA. DNA typing has many advantages; it can establish that certain biological evidence (for e.g. from crime scenes) is from a human source, reveal whether it is a male or a female, and more importantly needs only a minute amount of biological material such as muscle, hair, semen, saliva or bone.

Found in the nucleus of each cell in our body, our genes are made up of tightly coiled threads of a substance known as deoxyribonucleic acid (DNA). DNA is the blue print of life that carries hereditary instructions. DNA of one person is unique to that person and therefore, DNA varies between individuals.

DNA typing can uniquely identify a person, and can also establish relationships between individuals. DNA typing, has a wide-ranging effect on both civil and criminal law, and has helped to improve human rights of individuals in society. The uses of DNA typing in the legal process are many; (i) convicting those guilty of crime, (ii) pardoning the innocently charged, (iii) speeding up the duration of legal trials, (iv) accurately identifying a rapist (v) determining the paternity of a child, and (vi) identifying human remains in mass graves.

Some of the well known forensic cases included the Hokandara multiple murder,



Colombo Royal Park murder and Judge Sarath Ambepitiya murder. Some of the paternity cases involved cases of rape and alleged incest. Identification of Baby 81 using DNA typing during the 2004 tsunami received international publicity.

To date, more than 1500 parentage tests and over 300 criminal case work tests have been performed using DNA typing technology. The researchers believe that DNA fingerprinting will be useful in sociological studies such as tracing the origin of different ethnic groups in Sri Lanka (for eg. Veddahs) and to check historical events, amongst many others. This field of study is known as Molecular Anthropology.

Research Grant No. RG/96/M/12

GARLIC REDUCES THE RISK OF LIVER CANCER

Garlic is a plant of high commercial value, both as a medicinal plant and a cooking ingredient. Bulbs of garlic are used for easing of various disease conditions including high blood cholesterol. Since introducing garlic tablets for treatment of high blood cholesterol, another interesting property of garlic, the ability to reduce cancer growth has received much attention.

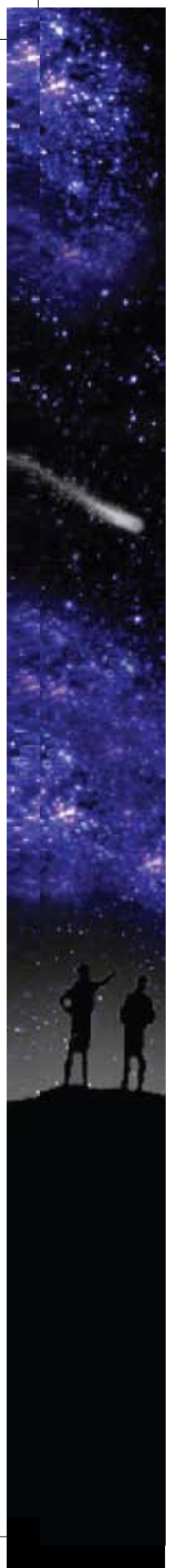
Garlic has been used both for cooking and medicinal purposes in many cultures for thousands of years, dating as far back as the time that the Egyptian pyramids were built. It is well known that garlic contains substances which are important for human health.

Among many other claims garlic is thought to help prevent heart disease, high blood pressure, and cancer. Since including garlic in the diet reduces blood cholesterol levels in normal and high cholesterol individuals, several commercial forms of garlic such as garlic tablets are used for the treatment of high blood cholesterol.

A study was undertaken by a team of scientists from the Department of Biochemistry, University of Sri Jayawardenepura to find out whether treatment with medicinal doses of garlic reduces liver cancer caused by chemicals in normal rats, and in rats with high cholesterol levels.

Garlic in the diet may reduce incidence of cancer (photo: courtesy Wikipedia)

The study looked into the claims of anti-



cancer properties of garlic using laboratory rats. A daily treatment of a medicinal dose of oven dried, powdered garlic was given to normal laboratory rats for two weeks. These rats were then injected with a chemical (DEN) to induce liver cancer in them. Garlic treatment was continued for eight more weeks. While another group of rats were given only DEN (no garlic), a third group of rats were given only garlic (no DEN). The livers of all these rats were examined for the growth of cancer. Those given DEN had developed cancer of the liver but the DEN plus garlic treated rats showed a remarkable lowering of the cancer formation in their livers. This study proved that garlic reduced the risk of liver cancer in normal rats.

A similar study was carried out on three groups of rats with high cholesterol. This study verified again the preventive properties of garlic on liver cancer. It further showed that the risk of development of liver cancer was higher in high cholesterol rats than in normal rats. Therefore, rats with high cholesterol levels were more prone to liver cancer.

This study, substantiates that garlic can reduce the risk of liver cancer and thus inclusion of garlic in our diet may be important for cancer prevention.

Research Grant No. RG/96/M/16

THE NEW CAGE WHEEL GIVES A BETTER GRIP FOR TRACTOR TYRES

The folding type cage wheel developed at the Faculty of Agriculture, University of Ruhuna can improve the grip of the regular rubber tyres of small and medium power tractors.

The use of these cage wheels with a 'face-lift' has been two fold: it can improve the use of tractors in wetland paddy field operations and in road transport. This product has been an important development for the farming community.

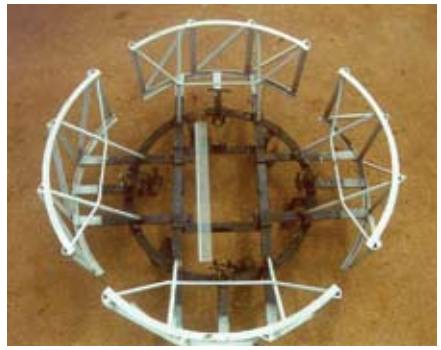
Rice is the staple food of 19 million Sri Lankans. It is also the livelihood of more than 1.8 million farmers. Over 7.3 million hectares are cultivated annually for paddy production in Sri Lanka. However, due to low productivity, farmers have not been able to supply the demand for rice in the country.

The buffalo is considered the poor man's tractor. But because of the dwindling buffalo population and sociological factors the small and medium sized tractors became an attractive alternative for land preparation by many paddy farmers in the country.

Majority of paddy farmers in Sri lanka are small holder farmers

The working of a tractor depends on a number of considerations; the soil surface on which the tractor operates is the main factor that decides how efficient the tractor would be. A tractor with ordinary high lugged rubber tyres works poorly in wetlands due to slip and sinkage. To overcome this problem, different types of gripping aids such as chains, tracks and cage wheels have been used.

The invented mud wheels consist of four foldable folders and an inner mounting



The cage wheel for four wheel tractor (expanded position)

The cage wheel for two wheel tractor

system. A spring loaded key mechanism locks the folders at both folded and unfolded positions.

The four wheel tractor equipped with the designed cage wheel gave 60% more field capacity and 28% more travelling speed when compared with the conventional cage wheel. The time taken to plough a hectare of land was decreased by 40% with the new cage wheels. Travelling time was also reduced by 14%.

The newly developed swinging lugs cage wheel has a quick mounting and dismounting system. The smaller diameter of the cage wheel in the retracted position compared to the tyre was advantageous in road transportation. It also gave an improved grip while ploughing fields as the cage wheel diameter was greater than the tyre in the expanded position.

This 'Multipurpose Cage Wheel' is a new traction aid for small and medium sized tractors used in both high and wet land conditions. The cage wheel has simple construction, good serviceability, high field performance in different soil conditions and low cost.

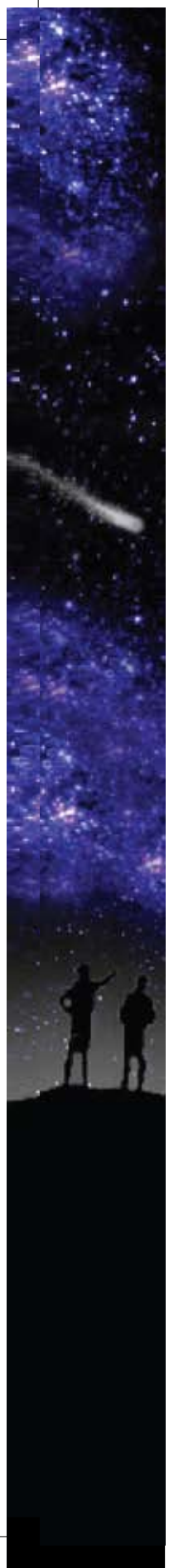
Research Grant No. RG/97/AG/02

YES, IT IS POSSIBLE TO CLEAN UP DIESEL FUMES

Fossil fuels are widely used for transportation and power generation. They are rich in chemical energy which can be extracted on combustion. However, one of the common problems associated with the combustion process is the generation of hazardous chemicals which can make a significant damage to the environment and to the health of the people. Incomplete combustion of fuels can introduce hazardous substances to the air that we breathe.

A research project was carried out by a team of scientists of the Department of Chemistry, University of Colombo to design and construct a low-cost air sampler for collecting toxic substances (pollutants) including polycyclic aromatic hydrocarbons from diesel fumes. They also developed a method to destruct the hazardous compounds before they are released to the environment.

Diesel exhaust is produced when an engine burns diesel fuel with air. It is a complex mixture of gases and fine particles (commonly known as soot) and may contain over 40 poisonous air pollutants. These include many known or suspected cancer-causing substances such as benzene, arsenic and formaldehyde. Diesel exhaust also contains other harmful gaseous pollutants, including nitrogen oxides that could be converted into more harmful products in the presence of sunlight. The exposure of diesel fumes is greatest for urban dwellers and the people living near roadsides. High levels of diesel exhaust in such environments may



be attributed to heavy traffic conditions, poor maintenance of vehicles and poor road conditions amongst many others. The levels of exposure can be controlled by controlling the emissions, and proper maintenance of vehicles (tuning of the vehicle which adjusts the air to fuel ratio for a complete combustion).

As we breathe, the toxic gases and small particles of diesel exhaust are drawn into our lungs. The microscopic particles in diesel exhaust are less than one-fifth the thickness of a human hair and are small enough to penetrate deep into the lungs, where they could contribute to a range of health problems. Immediate health effects of diesel exhaust lead to irritable eyes, nose, throat and lungs. It can cause coughs, headaches, light-headedness and nausea. Diesel exhaust particles can make people with allergies more prone to the materials to which they are allergic to, such as dust and pollen. Exposure to diesel exhaust also leads to inflammation of the lungs, which may worsen chronic respiratory symptoms and increase the frequency or intensity of asthma attacks. Long-term exposure to diesel fumes may lead to lung cancer.

The biggest challenge in the analysis of airborne pollutants is the collection of a representative air sample. Air sampling equipment are diverse and expensive and collection techniques are complex.

One of the objectives of this project was to develop a suitable air sampler for diesel fumes for collection from the tail pipe using commonly available low cost raw materials. Project was also designed to characterize the chemicals emitted to the environment from a diesel vehicle.

Incomplete oxidation of diesel during the combustion process in vehicles produces significant amounts of volatile organic compounds (VOC) that are cancer causing pollutants. Emission of VOCs can be controlled by catalytic oxidation of the diesel exhaust. The purpose of catalytic oxidation is to convert the harmful chemicals into less harmful products using a catalyst surface. Technology for the catalytic oxidation for petrol vehicles is available throughout the world. But the technology is lacking for diesel vehicles.

Scientists from the Chemistry Department of the University of Colombo have successfully developed a low cost air sampler which was used to characterize the hazardous chemicals expelled from a diesel vehicle. They also developed a low cost catalytic system which could oxidize the organic chemicals with little or no generation of carbon particles.

Research Grant No.RG/97/C/02

LANDSLIDES - BE FOREWARNED!

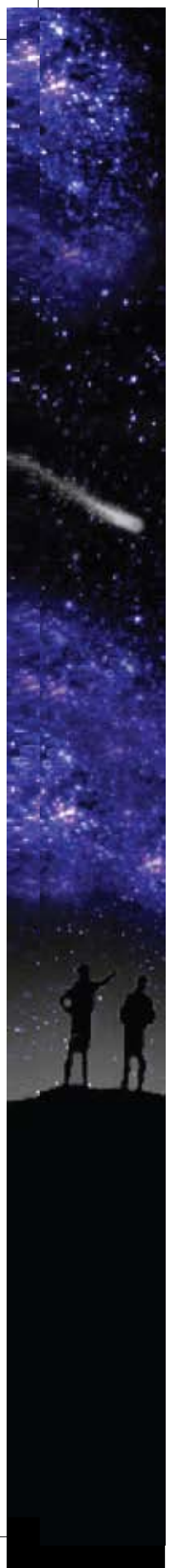
More than 350 lives were lost and about 15,000 families became homeless during the last two decades in Sri Lanka because of landslides. An area of nearly 12,500 km^2 spread over seven districts of the island is highly prone to landslides. Despite this, very little has been done to introduce methods to outline the degree of danger, to identify structures at risk and to estimate the risk of this natural disaster.

A damaged house due to a landslide at Yatiyantota

The National Building Research Organization (NBRO), has for the first time in Sri Lanka introduced methods to weigh up landslide risks, and ways and means to protect the environment in landslide prone areas. Methods have also been set up to give early warning to communities living in landslide prone areas.

Landslides are a pressing environmental problem in Sri Lanka. Seven districts, namely Badulla, Nuwara Eliya, Ratnapura, Kegalle, Kandy, Matale and Kalutara are at the risk of landslides. This natural disaster can ruin the economy of urban and semi-urban populations and cause loss of lives and property.

In practice when a landslide occurs the affected persons are relocated in other areas without much consideration to the



safety of these sites. This was because there was no reliable method to monitor landslide movements. Thus, there was an urgent need to develop a scientific method to know in advance landslide prone areas.

The landslide event of September, 1997 at Yatiyantota in Kegalle district was selected as the study site. Landslide hazard maps of the study area were prepared in detail to measure the risk of landslides. At the same time, the infrastructure map showing housing, agriculture, plantation and other public utilities was also prepared through aerial photographs and field surveys. Guidelines on how to assess landslide risk, to protect the environment and how to accomplish and maintain development in the area, were also developed for this problematic location.

The methods thus introduced by the NBRO to measure the risk of landslides will be able to forewarn the public of landslide risks in a given area. Examining risks before starting major housing development projects and setting up human settlements in landslide prone areas will invariably lead to improved land use and continued development of the hill country.

Through a follow up study carried out by the NBRO a method has also been developed to monitor landslide movements that will help design cost effective solutions and ways to lessen the aftermath horrors of landslides in prone areas of the island. Findings of this research can be used to provide effective and reliable early warning systems for communities living in landslide prone areas.

Research Grant Nos: RG/97/NR/01 & RG/99/NR/02

RUBELLA SHOT A MUST FOR INTENDED MOTHERS

Rubella (German measles) is a common childhood infection rarely leading to serious complications. However, a mother passing on the infection to her unborn baby across her placenta can lead to disastrous effects for the new born.

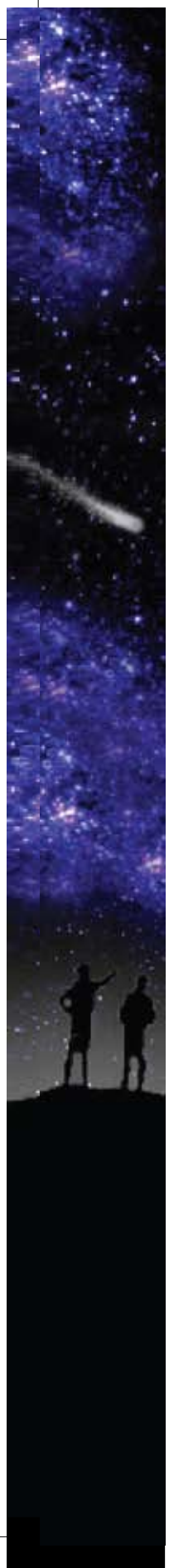
A collaborative study was undertaken by a team of researchers from the Faculty of Medical Sciences of the University of Sri Jayawardenepura to study the efficiency of rubella vaccination programme in the country. They screened mothers for rubella antibodies in their blood and in cord blood, just after child birth.

Rubella also known as German measles, because it was first described by German physicians in the mid-eighteenth century, is caused by the Rubella virus. It is often mild and attacks often pass unnoticed.

Infection of the mother by Rubella virus during pregnancy can be serious; many mothers who are infected within the first critical 16 weeks of pregnancy, either have a miscarriage or a still born baby. If the baby survives the infection, it can be born with congenital rubella syndrome (CRS) which includes severe heart disorders, blindness, deafness, or other life threatening organ disorders. CRS is the main reason a vaccine for rubella was developed.

Many developing countries do not have rubella vaccination programmes. In Sri Lanka rubella outbreaks are recorded from time to time and during the epidemic in 1994-1995, 444 cases of CRS were reported. Following this outbreak, rubella vaccination was introduced to the expanded program of immunization schedule in Sri Lanka in 2001.

This study screened 1000 cord blood samples collected from the labour room of the Colombo South Teaching Hospital, and 500 blood samples from expectant mothers (below 16 weeks of pregnancy) with their informed consent at the antenatal clinic, for antibodies to the rubella virus. Of the mothers, though only 82% had rubella antibodies only 75% had been vaccinated for rubella. It was revealed that 18% of pregnant mothers did not have rubella antibodies,



and were at risk of developing rubella infection during their pregnancy. Among the cord blood samples, three were positive for rubella antibodies where the mothers of these babies were not vaccinated for rubella. Therefore, we cannot be satisfied with the results achieved by the rubella vaccination program.

Every effort must be made to identify and immunize women not having antibodies to rubella before they become pregnant. Routine screening at antenatal, family planning, sub-fertility and occupational health clinics should be done. All women found at risk of rubella during pregnancy should be offered the rubella vaccine after delivery, before the next pregnancy

Research Grant No.RG/99/M/05

AUTOMATIC DETECTION OF LIGHTNING STRIKES

Every year local newspapers and other media report damages due to lightning strikes in various parts of Sri Lanka. The frequency of such strikes is generally higher during the inter-monsoon season. However, there are no institutions that maintain accurate records on lightning parameters such as strike locations, flash strengths or hazardous areas in the country. Such information is critical when selecting sites to establish industries, especially related to electronics and IT.

A team of scientists from the Department of Physics, University of Colombo implemented a lightning detection network that is capable of recording the point of strike of lightning flashes that strikes in and around Sri Lanka.

Several lightning Direction Finding (DF) stations donated by IPPS Uppsala University Sweden were utilized in implementing the lightning locating network. A DF station consists of a crossed loop antenna, a flat plate antenna, and a set of electronic units to process the detected lightning generated electromagnetic (EM) fields. The electronic units are capable of identifying cloud-to-ground flashes that occur within its typical range of about 400 km with 80% efficiency. Each DF station is capable of finding the

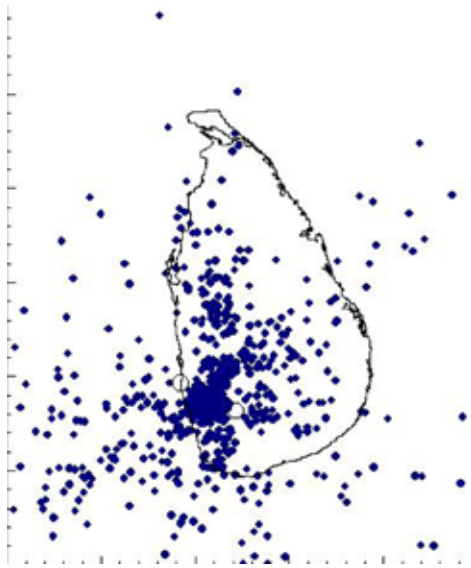
time of the occurrence, direction, strength and the multiplicity or the number of return strokes in a single flash. If there are at least two DF stations at a considerable distance from each other with known locations, one can localise the striking point of the lightning.

With the lightning data recorded during 1999-2002, several studies were carried out, namely the study on the activity of lightning strikes in this region, the measurement of lightning peak currents over Sri Lanka, and the seasonal variations and characteristics of lightning observed during monsoon and inter-monsoon thunderstorms.

The research work conducted under this project produced results that can be utilized at National level. Some of the parameters studied have yielded valuable data that could be used in designing lightning protection systems for Sri Lankan conditions.

In a subsequent study, the possibility of using compact Anisotropic Magneto-Resistive (AMR) sensors to measure the magnetic fields generated by lightning flashes were tested. It was concluded that due to easy maintenance and higher accuracy, the new setup could be used to implement a real time lightning detection and monitoring system in Sri Lanka.

Research Grant No: RG/99/P/02



Reconstructed ground flash data
(North-East Monsoon)

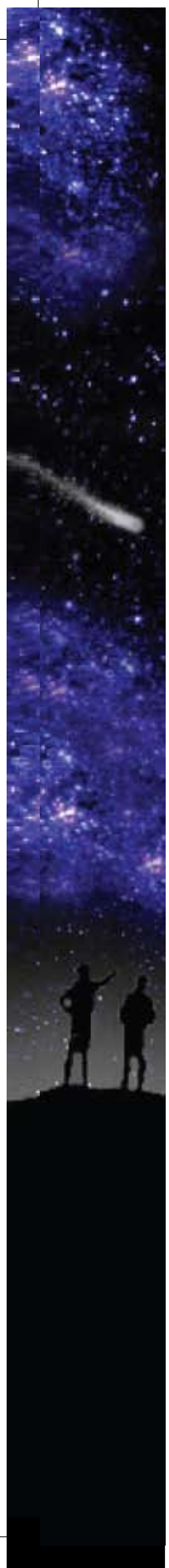
DF station at Weligatta, Hambantota (2001)

A FERTILIZER FROM RICE STRAW

Decomposition of rice straw

Microbiologists from the Faculty of Agriculture, University of Peradeniya have isolated indigenous soil bacteria and fungi that can accelerate the decomposition of rice straw in wetland rice fields.

Inoculant mixtures have been formulated with several bacteria and fungi. These inoculents can be recommended for fresh rice straw from new improved varieties used in wetland rice fields.



For more than four decades, high yielding rice varieties were widely grown with the use of chemical fertilizer in all rice cropping systems of Sri Lanka. However, yield stagnation of rice was recorded in many parts of the island in the early 80's, due partly to the decreased fertility of rice soils. It has been shown that adding rice straw at a rate of 4 tons per hectare could provide the total potassium requirement and 30% of the nitrogen requirement of the rice crop.

Recycling of rice straw is not practiced by many farmers mainly due to high labour costs involved in bringing straw to the field and the difficulty in harrowing and ploughing the field in the presence of fresh straw. The best option to overcome this situation is to have the straw decompose quickly. However, under natural conditions, fresh straw should undergo decomposition for a period of about a month to become brittle. The slow decomposition of rice straw is due to its high lignin and cellulose contents. Only a few types of bacteria and fungi can decompose cellulose and lignin in rice straw. Therefore, speeding up of the decomposition process of rice straw by introducing such organisms would help overcome difficulties arising in land preparation for paddy cultivation.

The mixed inoculants of bacteria and fungi isolated by the researchers from the Faculty of Agriculture, University of Peradeniya decomposed straw rapidly with a weight reduction of up to 50% in 20 days. The decomposed material was also found to be high in nitrogen.

Incorporation of composted material in rice fields increased plant growth, number of tillers and yield under field conditions. Since these inoculants performed equally well at Kegalle in the absence of chemical fertilizer, and at Peradeniya in the presence of chemical fertilizer they could be recommended for both production systems.

Research Grant No. RG/2000/AG/02

HERBAL EXTRACTS HAVE ANTI-CANCER PROPERTIES

Liver plays a crucial role in our lives. It helps to digest food and remove harmful substances from the body. Therefore, any damage to the liver can lead to severe health problems.

Cancer of the liver is among the eight leading causes of cancer deaths worldwide. Viral hepatitis infection (hepatitis B or C) or cirrhosis associated with consumption of alcohol are two of the major causes of liver cancer.

A study to scientifically test the anti-cancer properties of some herbal extracts used in traditional medicine was carried out on rats with chemically induced liver cancer, jointly by the Departments of Biochemistry of the Universities of Sri Jayawardenepura and Kelaniya.

Several plant based treatments are being recommended for cancer by traditional medical practitioners of Sri Lanka. However, none of these has been subjected to scientific testing for their anti-cancer properties.

A decoction that contained seeds of Black cumin (*Nigella sativa:* Kalunduru in Sinhala Karungiragam in Tamil), root of Indian sarsaparilla (*Hemidesmus indicus:* Iramusu in Sinhala / Arakkan in Tamil) and rhizome of Chinese sarsaparilla (*Smilax glabra:* Cheena ala in Sinhala), was prepared according to the methods recommended by traditional medical practitioners given to cancer patients. The decoction was tested for protective effects against chemically (DEN) induced cancer of the liver in laboratory rats. A normal medicinal dose and a higher dose of this brew were tested on cancer induced rats.

Overall results indicated that the anti-cancer effects of the medicinal dose was good but was better with the higher dose which was similar to that produced by garlic (please see write up on Research Grant No.RG/1996/M/16).

Long term (for 9 months) treatment of the decoction on tumour development too showed promising results in rats. Tests also confirmed that there were no toxic effects of the decoction on the liver, kidneys, lung, heart, stomach and gut. Blood components were also not affected by three months

Indian Sarsaparilla (photo: courtesy Wikipedia)

Black Cumin seeds

treatment of this decoction, with both the medicinal as well as the high dose.

No unfavorable effects were seen on the fertility /breeding of both male and female rats. Long term (3 months) treatment of the herbal brew also did not change the food intake, average body weight gain and general behaviour of the animals. Also, a dose 40 times the highest dose did not cause any death.

Two possible modes of action by which the decoction imparts its anti-cancer activity have been recognized.

Research Grant No.RG/2000/M/01

DIFFERENCES IN GRAVITY DETECTED BY SATELLITES HELP TO DEMARCATE OUR OCEAN BOUNDARIES

Gravity is the force that attracts a body to the centre of the earth. Differences in gravity detected by satellites (satellite gravity anomalies) over the Indian ocean around Sri Lanka provide information about the thickness of sediments deposited below the sea floor. This information would be useful in marking out the Indian Ocean region belonging to Sri Lanka.

Two scientists from the Department of Physics, University of Sri Jayawardenapura conducted a study to explain the gravity differences detected by satellites over the Indian Ocean around Sri Lanka. They developed relevant mathematical techniques and computer software and modified existing software for this purpose and estimated the thickness of sediments over this region. Results of this study are directly useful in identifying the sea area that Sri Lanka can claim according to the United Nations Convention of the Law of the Sea.

The Indian Ocean around Sri Lanka is part of the world's largest deep sea sediment fan known as the Bengal fan with a length of about 3000 km and a width of about 1000 km. The Bengal fan has been studied since the nineteen sixties by ship-borne seismic (vibration) surveys, and gravity and magnetic surveys. The collection of more and more such geophysical data and their careful interpretation will help to gather an improved picture of the Bengal fan.

One of the aims of this study was to contribute towards this end. Further, results of this study would also provide valuable information that would be useful to delimit the extended economic zone (the outer edge of the continental margin) of Sri Lanka according to the United Nations Convention on the Law of the sea (UNCLOS).

UNCLOS that came into force in 1994 defines the rights and responsibilities of nations in their use of the world's oceans. The convention introduced a number of requirements; one among the most important issues was the extent (jurisdiction) of the continental shelf. Article 76 of the convention provides the basis for a maritime country to demarcate its maritime boundaries. Accordingly, the continental margin of a maritime state consists of an undersea continuation of the seabed that includes the continental shelf, slope and rise (see Figure 1).

The maritime nations that signed the UNCLOS have ruling rights over their continental shelves up to 350 nautical miles from the coast. Due to the inequity that would result in applying article 76, countries that satisfy certain conditions are allowed to use the Annex II of the Final Act of UNCLOS to demarcate their continental margins. According to Annex II, a maritime country that satisfies certain conditions can claim the ownership of the surrounding sea area up to a boundary at which the sediment thickness is 1 km. Sri Lanka is perhaps the only country that is eligible to claim its sea area the using Annex II, of the Financial Act of UNCLOS.

UNCLOS recommend the use of multi-channel seismic technique as the most suitable method for delimitation purposes. However, this method is very expensive as the cost of hiring a seismic vessel (ship) is very high. Therefore it is cost effective to first estimate an approximate delimitation boundary using results of any previous studies available and also using an inexpensive method such as interpretation of satellite gravity anomalies. Thereafter, a seismic survey can be carried out only over a narrow region around the approximate boundary and determine a more accurate boundary. This will drastically cut down the cost of the seismic survey and make it affordable to Sri Lanka.

The two scientists computed the thickness of sediments in the Indian Ocean region around Sri Lanka modeling satellite gravity anomalies and compiled a map of sediment thickness over the region (see figure 2 below). Information provided in this map has been used by the DEOCOM project, the project that carries out delimitation of the continental margins of Sri Lanka, in determining an approximate delimitation boundary. Cruise tracks of the research vessel that carry out the accurate seismic survey were planned using this approximate

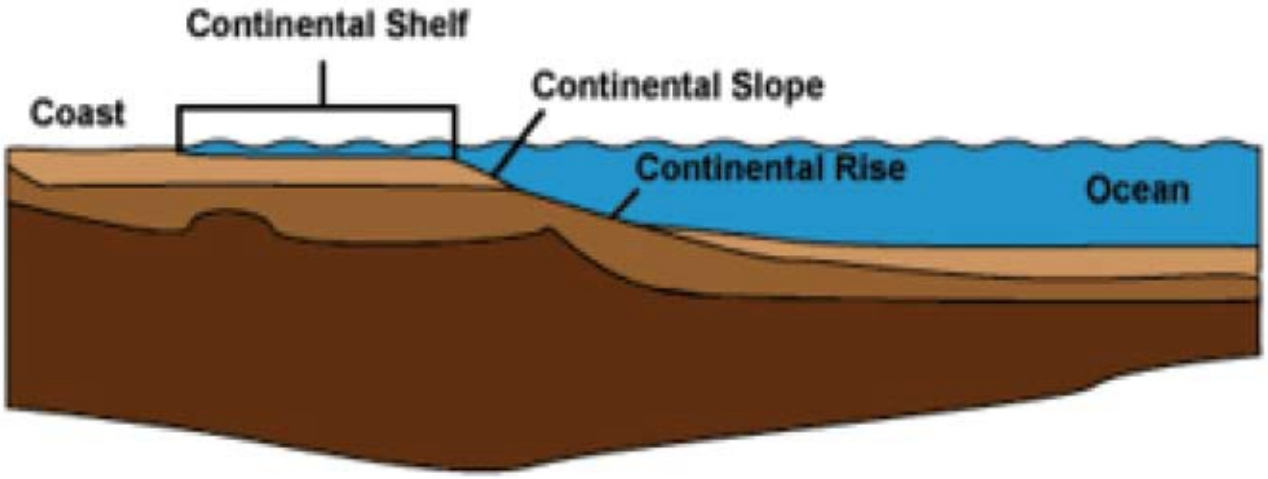


Figure 1. The Continental shelf, slope and rise (photo: courtesy - Wikipedia)

boundary and results of geophysical studies previously carried out by various marine geophysical research institutes of the sea area up to a boundary at which the sediment thickness is 1 km.

Research Grant No. RG/2000/P/03

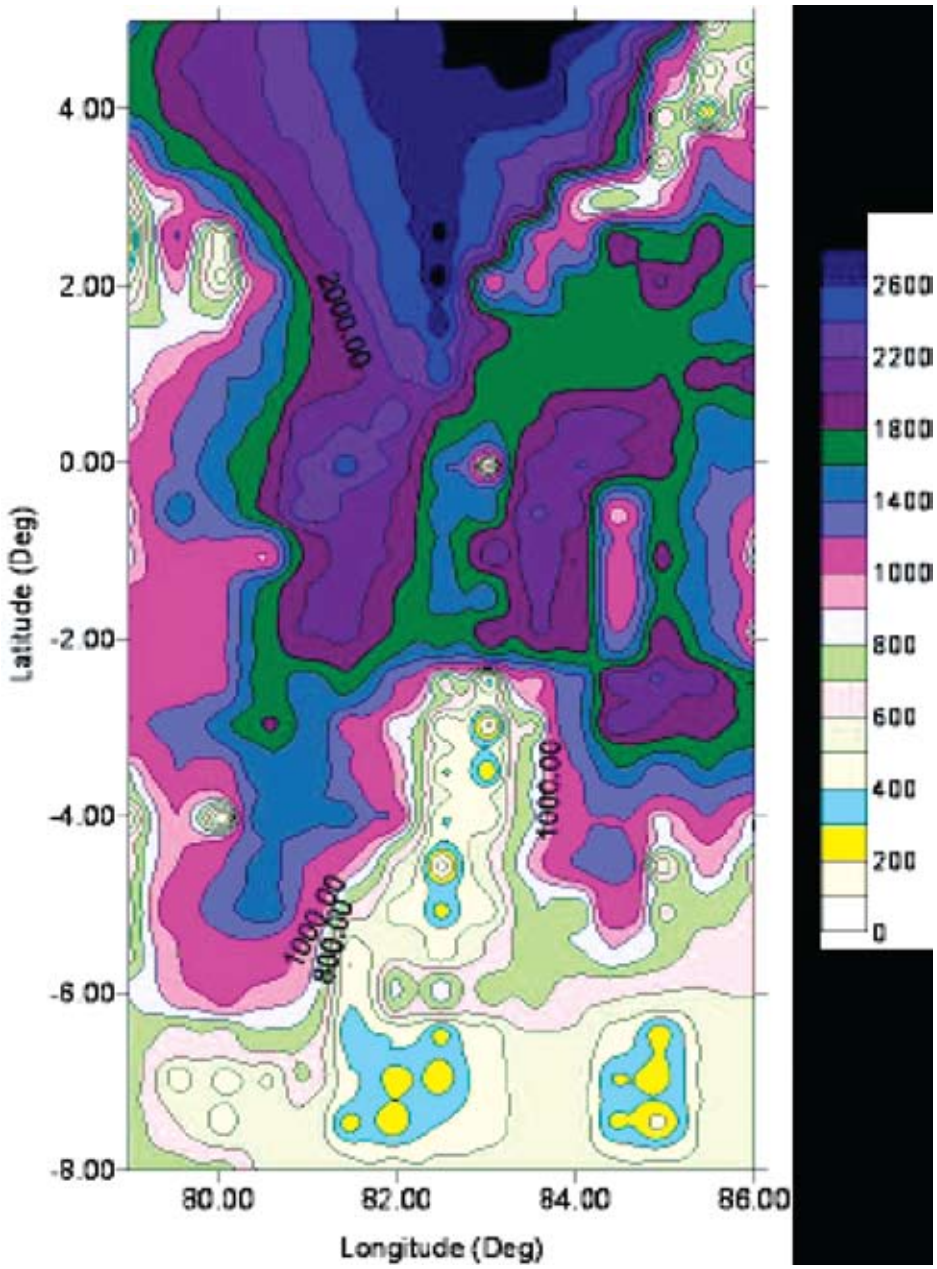


Figure 2. Thickness of sediments in the Indian Ocean around Sri Lanka as revealed by satellite gravity study Contours are in 200 m intervals

BETTER MANAGEMENT CAN LOWER THE COST OF PRODUCTION OF RICE

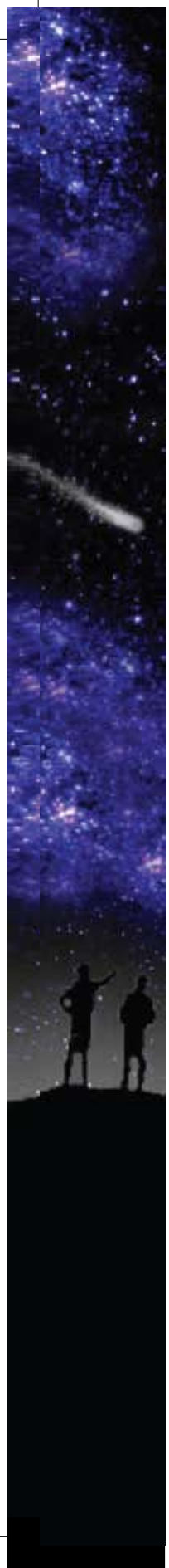
In Sri Lanka the annual per capita consumption of rice is around 100 Kg/year. Rice production is falling behind the national requirement, mainly due to increased under cultivation and decreased yields. This has resulted in increased imports.

This project studied the factors that influenced the cost of production of rice, and ways and means of reducing this cost while increasing the yield in the Amparai and Batticaloa districts.

Rice has been the staple food of Sri Lankans since 2500 B.C. An average consumer spends nearly 25% of food expenditure on rice.

Demand for rice is steadily increasing due to expanding population. At present, Sri Lanka has reached a stage where no additional land can be used for paddy cultivation. It is also not possible to increase the number of cropping seasons. Therefore, increase of harvest per unit area is the only method left to meet the demand. At present, one of the problems faced by the paddy sector is high cost of production and low profitability.

Increased production can be achieved by better management



To find remedial measures to ease this situation, a researcher from the Faculty of Applied Science, South Eastern University of Sri Lanka conducted a survey amongst 150 randomly selected farmers each from the Amparai and Batticaloa districts, two major rice producing areas of the country.

The study showed that more than half of the farmers had less than the average yield level. Many farmers did not use resources efficiently. The average cost of production of paddy increased over the years due to increase in labour wages, tractor hiring charges and price of agro-chemicals. Labour costs accounted for 50% of the total cost of production. There was a significant variation in cost of production between the districts. Debts and poor participation in farmer organization activities strongly influenced productivity of low performing farmers in both districts.

These results suggested that increasing cost of rice production should be counteracted by:

- Improving soil fertility
- Adopting soil conservation practices
- Use of family labour
- Mechanization of harvesting
- Better extension services (on the use of fertilizer, agro-chemicals and soil management practices)
- Strengthening farmer organizations, by encouraging farmer action groups and farmer co-operatives, to engage in marketing, credit, input use and organizing cultivation
- Participation of Government institutions in paddy marketing to give the farmers better prices

It was concluded that increasing production while reducing costs is possible through better management.

Research Grant No. RG/2001/AG/01

SRI LANKANS STUDY BEES FOR THE FIRST TIME: A NEW BEE SPECIES IDENTIFIED

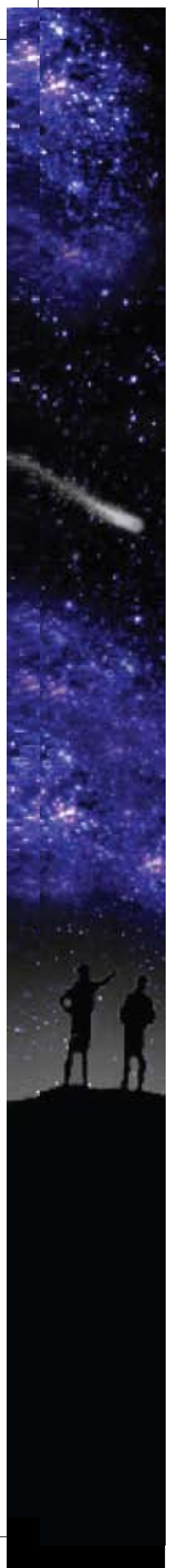
Though many are not identified, there are nearly 20,000 known types (species) of bees in nine recognized families. They are found world over (on every continent except Antarctica), in every surrounding that contains insect-pollinated flowering plants. Studies on Sri Lankan bees were but a few.

A team of scientists from the Departments of Zoology and Botany of the University of Peradeniya for the first time extensively collected and identified Sri Lankan bees to record their organization, distribution, relationships with flowers and nesting habits.

Bees are invaluable as agents of cross polination of plant species (photo: courtesy Wikipedia)

Bees are invaluable as agents of cross-pollination, and many plants are entirely dependent on particular kinds of bees for their propagation. Bees pollinate mostly flowering plants, many food plants, cultivated plants and natural vegetation in tropical forests. Pollinating bees not only increase the yield but also the quality of the harvest. Honey from bee colonies are extensively used in Ayurvedha medical practice. Beeswax is used in the cosmetic industry, and in candle making as well as in medicines, polishes, furniture wax etc. Bees may also be useful as biological-indicators of the quality of surroundings.

Commencing in 1897 studies on the



identification and categorization of Sri Lankan bees were done by foreign scientists. The Smithsonian Institute, USA carried out a survey from 1975-1986. These studies recorded 137 bee species of which only a few specimens were deposited in Sri Lanka.

In the present study bees were collected using standard insect nets on flowers and plants, in 29 sites within 13 districts of the island. These included agricultural habitats, farmer fields, cemeteries, coastal areas, home gardens, Botanical gardens at Peradeniya, three types of natural forests including Sinharaja, rice fields, roadside vegetation and weedy surroundings.

A total of 137 bee species were recorded that included 20 previously unrecorded species from the country. A bee species native to Sri Lanka that is new to science was also recorded. The scientific name of this bee is *Lipotriches sp.*

The low country dry zone, the middle peneplain and the agricultural habitats harboured the highest number of bee species. Floral hosts to these bees comprised of 167 species. Weeds were the most preferred hosts followed by crops and trees. Flowers of 6 naturalized plants attracted an unusual number (more than 20 species) of bees.

According to pollen relationships, 131 bee species were generalists (feeding on many types of unrelated flowers and collecting pollen) and 7 were found to be pollen specialists. Twelve species were buzz pollinators of crops whose pollen is hidden away in anthers. These bees gather pollen from such flowers by vibrating them.

Bee nests are the places where their young are reared under protection. Several stem nesting (16 species), ground nesting (13) and hive building (4 species) bees were recorded.

Descriptions of these 137 bee species, keys for identification, locality details and flower hosts were recorded. Information on flower / pollen relationships of bees would help to conserve, manage and encourage bee pollinators of crops and natural vegetation.

Research Grant No. RG/2001/B/02

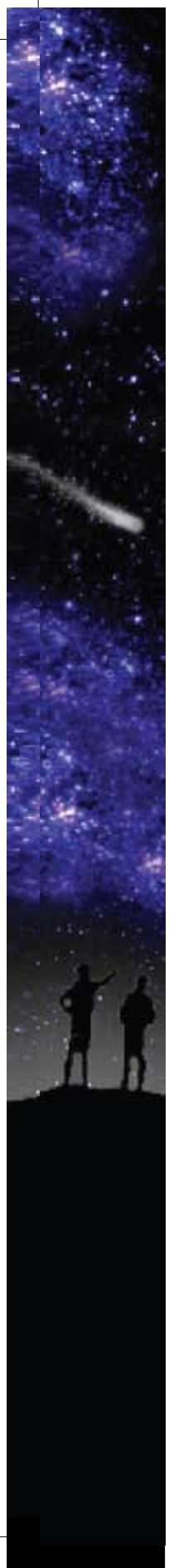
A NEW ANTI-MALARIAL DRUG REGIMEN TO CONTROL MALARIA

Malaria is a major public health problem in the tropics and the sub-tropics. The World Health Organization has estimated that there were about 250 million malaria cases and nearly a million deaths around the world in 2006. The control of this disease has become a challenge globally as malaria parasites refuse to give into anti-malarial drugs such as chloroquine. They also continue to develop 'resistance' to the next line of drugs.

A group of researchers from the Department of Parasitology of the Univsersity of Kelaniya, studied the genetic makeup of malaria parasites from Mannar district in the Northern Province and characterized the drug resistant strains of the parasite, in order to help improve malaria control programmes in the country.

In Sri Lanka, malaria has been a 'curse' for several centuries and has resulted in considerable economic and social setback. The country experienced several epidemics which caused a large number of deaths, the last one being in 1992/93.

Only four types of the malaria parasite can infect humans; the most serious forms of the disease are caused by two of them - *Plasmodium falciparum* and *Plasmodium vivax*. These two are the only malaria parasites found in Sri Lanka. Among the total number of cases reported in Sri Lanka each year, *P. vivax* accounts for about 80% and the balance is due to *P. falciparum;* the latter being responsible for a number of deaths each year.



Drug resistance is the reduction in effectiveness of a drug in curing a disease or relieving a patient's symptoms. Malaria parasites are said to be drug-resistant when drugs meant to kill them have a reduced effect.

Resistance to Chroloquine - the drug of choice for treating malaria - was first reported in 1984. About 10 years later the parasites developed resistance to S-P (sulfadoxine pyrimethamine) which is the drug for treatment of chloroquine resistant falciparum malaria infections. Studies done in 1996 and 2003 have shown that more than 50% of falciparum infections found in the country were drug resistant.

This study demonstrated for the first time in Sri Lanka, the high prevalence of falciparum malaria and chloroquine resistance among security forces personnel in an operational area in the Northern Province. Follow up surveys found that the occurrence of chloroquine resistant falciparum malaria had almost doubled from 2002 to 2004. Furthermore, some of the chloroquine resistant infections diagnosed in 2004 showed the most severe grade of chloroquine resistance.

The continuous use of chloroquine in the presence of low grade resistance had encouraged the emergence of more strongly resistant strains. This was further confirmed by genotyping (studying the genetic makeup) of the parasites which showed that the two dominant parasite drug resistance is the reduction in effectiveness of a drug in curing a disease genotypes were the ones responsible for the majority (82.4%) of chloroquine resistant infections. The study also showed for the first time in Sri Lanka, genetic changes of the malaria parasite that may lead to resistance to S-P, the second line drug for treatment of malaria.

With the increase of the movement of the people between the Northern Province and the rest of the country the danger of the spread of these chloroquine resistant malaria parasites to other parts of the island is increasing.

The study highlighted the urgent need to revise the policy regarding the use of antimalarial drugs for treatment of malaria. Since the frequency to chloroquine resistance was well above the recommended levels and that the genetic process for development of resistance to S-P was also well developed within the parasite populations of the Northern Province, it was recommended that a new antimalarial drug policy based on treatment with a combination of at least two drugs be adopted for treatment of malaria.

This change has now been introduced with the release of new treatment guidelines by the Anti-Malaria Campaign of the Ministry of Healthcare and Nutrition.

Research Grant No. SIDA/2001/BT/01

AN ENVIRONMENTAL MANAGEMENT SYSTEM FOR LOCAL ASBESTOS INDUSTRY

Asbestos is very popular among builders and public as it can withstand damage from heat, electricity and chemicals, is very strong and flexible and is relatively cheap. Although used in a wide range of products, unfortunately, asbestos can cause cancer, and poses a major threat to the health of those involved in the manufacture of asbestos products and construction workers.

In Sri Lanka the asbestos industry is almost limited to the manufacture of asbestos-cement roofing sheets, accessories and flat ceiling sheets. However, in view of the health concerns during the production process a study was carried out by the Department of Civil Engineering, University of Moratuwa in order to propose steps to minimize the harmful effects of the production process. The study lead to the development of an Environmental Management System (EMS) for the local asbestos industry to meet the ISO 14001 standards.

Health risks due to asbestos is well recognized. Nearly 1.3 million employees, around the world in construction and general industry face significant on-the-job asbestos exposure. Breathing of air containing asbestos dust is a potential health risk. Continued exposure for long periods can increase the amount of asbestos fibres inhaled and over time it may cause serious lung diseases such as 'asbestosis' - leading to the enlargement of the heart, lung cancer and other such illnesses. The workers are generally exposed to asbestos dust during manufacturing and processing, warehousing and distribution. General public are normally exposed to negligible levels compared to those in the manufacturing industry.

Most industrial organizations with adverse environmental impacts, like the asbestos industry, achieve environmental standards such as ISO 14001 by practicing Environmental Management Systems (EMS) that introduce systems to protect the environment through flexible, internally set policies, objectives and targets for the organization.

Asbestos is a popular roofing material

This study recommends detailed regulations and guidelines by way of EMS for the local asbestos roofing industry. For example, the manufacturing process must be carried out in an enclosed system to limit the exposure to recommended levels within the factory and dust level should be controlled by extraction with automatic plant shutdown when dust levels exceed specified limits.

Considering the end users, construction workers, have to wear personal protective equipment to avoid breathing asbestos dust. Workers engaged in automobile repairs should be aware of the exposure to asbestos dust when replacing gaskets, clutch facings, brake pads that contain asbestos.

Environmental issues linked to asbestos surface again during disposal. Asbestos waste should be sealed after collection and disposed at controlled sites through licensed asbestos waste collectors. The controlled asbestos landfills should specially be designed to prevent fibres mixing with the atmospheric air. Presently, there are no asbestos disposal landfills in the country; hence both authorities and manufacturers should pay attention on developing these.

It is essential to introduce and apply strict and practicable rules and regulations through environmental management systems to minimize harmful effects from asbestos.

Research Grant No. RG/2001/E/07

SALT WATER PONDS CAN TRAP SUNLIGHT FOR PRODUCING SOLAR ENERGY

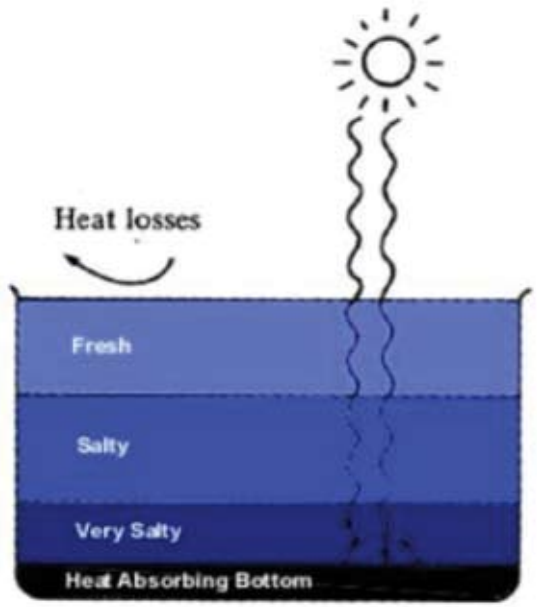
The entire world is facing an 'energy crisis' at present because of the shortage and high prize of fossil fuels. The depletion of available energy sources, coupled with the increasing prizes and increasing demand, the search for alternative energy sources is vital. For tropical countries, trapping sunlight to generate solar energy is a possible alternative.

A study carried out by a team of researchers from the Department of Physics, University of Kelaniya has shown that the operation of a large area solar pond could be a feasible solution for generating energy for industrial application.

The rapid use up of conventional fossil energy sources such as petroleum, natural gas and coal, and the environmental pollution caused by them have prompted scientists to search for relatively cheap energy sources that will lead to less pollution. Although hydropower make up a major portion of the total electricity generated in Sri Lanka, an increase in production of hydropower is limited due to lack of new hydro power sources. Nuclear power, is not a viable option for Sri Lanka at present because of the huge initial capital cost and problems associated with disposal of nuclear waste.

Solar energy can be harnessed through solar cells, converting sunlight directly into electrical energy. An alternative is to use thermal energy collectors for storing solar energy. The use of 'solar ponds' – artificial or natural ponds filled with salt water - is a unique method of collecting and storing solar energy.

A solar pond has 3 separate layers of water: A top layer, has a low salt content. The bottom



layer, is high salt content. The middle is the insulating layer with a salt gradient, which prevents heat exchange.

When solar radiation is absorbed, this middle layer prevents heat in the lower layers from moving upwards and leaving the pond. Thus, the temperature at the bottom of the pond will rise to over 90 °C while the temperature at the top of the pond will remain around 30 °C. The heat trapped in the salty bottom layer can be used for many different purposes, such as industrial process heating, electricity generation and desalination of sea water.

A large-area deep pond used for salt production by the Puttalam Salt Ltd at Palavi, and a large area (2450 m^2) deep salt pond constructed at the Palatupana salt production site were used in this study. The maintenance and operation of these solar ponds were studied which showed that this is practically possible only if the location is within or close to a salt production site. This is because the ponds needed to be filled up with heavy and light sea water at several times of the year. These activities are practically easier if the pond is located at a salt production site where sea water at different salt contents is available without much difficulty. It is possible to produce about 55 kW of electricity for at least 5 hours during day time. Since the operation of a solar pond costs little, energy usage is very economical. Also, this renewable energy production is environmentally very friendly with almost no pollution to the surroundings.

The preliminary studies carried out so far have shown that thermal energy can successfully be stored in very large amounts particularly in large area deep solar ponds with less effort. If this group of researchers succeed in converting this stored energy to practical use, for example, electricity production, then the raw material for the process will not be a big problem because sea water and sunlight are available in plenty in the coastal areas of the island.

Research Grant No. RG/2001/Ep/02

A NATIONAL LABORATORY TO ENSURE SAFETY OF ANIMAL PRODUCTS

Anti-microbial agents used in the treatment of animals or feed additives used as growth promotors may remain in processed food products and cause unfavourable health conditions to the consumer.

Consumers both in Sri Lanka and other developing countries have become more and more quality conscious when selecting food for consumption. This is specially true for animal products since todays animal food industry uses intensive methods of production that may involve the use of feed additives, antimicrobials and growth promotors.

There is an increased demand for producing animal proteins as food, to meet the worldwide food shortage. To fulfil this consumer demand, today's food industry uses many intensive methods of animal production.

Quite often farmers use drugs such as antimicrobials, feed additives and growth hormones without adequate veterinary supervision. In such instances there is a possibility that some of these drugs will remain in animal products and when people eat such food, several unfavourable reactions may result. Direct effects such as toxicities and allergies, or indirect effects such as developing antibiotic resistance occur. This therefore, is a significant public health concern.

Routine residue testing is therefore a necessity to ensure the quality of food products. Anti-microbial residue monitoring programs of food commodities are well established in developed countries where they maintain high standards for their food products. Such residue monitoring facilities were not available in Sri Lanka until a team of scientists from the Faculty of Veterinary Medicine and Animal Science, University of Peradeniya embarked on setting up bioassay methods for detecting drug residues in food commodities.

Routine testing for residues will ensure safe animal products (photo: courtesy Wikipedia)

Bioassay methods to identify six different types of anti-microbial agents namely penicillin, tetracycline, sulphonamides, streptomycin, quinolones and erythromycin in milk, milk products, meat, eggs, fish and shrimps have now been set up.

The studies have also shown that a majority of the tested samples were free of measurable levels of residues. The tested samples included broiler samples from processing plants and retail markets and shrimp samples from export consignments.

The anti-microbial residues in food can be further reduced through farmer education and regular veterinary inspection.

Veterinarians should promote alternative management practices such as vaccination of poultry, Good Agricultural Practices (GAP) and Good Veterinary Practices (GVP) that would reduce the use of antimicrobials in the poultry and shrimp industry.

The screening tests thus set up are now used by quality certified poultry processors and shrimp exporters in order to meet the standards. This method is also in use at Regulatory Authorities including the Ministry of Fisheries and the Quarantine Division of the Department of Animal Production and Health. The facility serves as the National Center for testing livestock and aquatic food commodities for antimicrobial residues which is a must for food quality assurance.

Research Grant No. RG/2001/M/02

HERBAL PLANT EXTRACTS CAN PROTECT THE LIVER

The liver is the largest and an important organ of our body. Damage to the liver can lead to severe health problems. Therefore a number of plants used in traditional medicine were investigated for their protective action on liver disorders.

A study done by a team of scientists from the Department of Biochemistry, University of Ruhuna have shown the liver healing properties of five common herbal plants used in traditional medicine in Sri Lanka.

The liver plays many crucial roles in our life. It helps to change food into energy. Bile, a yellowish-green liquid, produced by the liver helps in digestion. It also clears harmful substances from the body. Therefore, if the liver is damaged it is unable to perform these essential functions thus leading to severe health problems.

Certain chemical substances and viruses like the one that causes hepatitis can trigger liver damage. Over use of drugs such as paracetamol is another reason for liver damage.There are few drugs used in the treatment of liver diseases but they are costly and often not very effective. They also have side effects. Therefore, there was a need to search for safe, inexpensive, alternative liver protective drugs. It is claimed that in traditional medicine herbs have remarkable ability to restore liver health.

Studies were carried out on mice to scientifically evaluate the claims of traditional medical practitioners that the following five herbal plants have anti-toxic effects on the liver: Hatawariya (*Asparagus falcatus*), Neeramulliya (*Asteracantha longifolia*), Heen Mudamahana (*Epaltes divaricata*), Kottamalli (*Corriandrum sativum*) and Sevendara (*Vertiveria zizanioides*).

Two liver toxins were selected for the study: carbon tetrachloride and paracetamol. Of these two toxins, paracetamol is a painkiller but an overdose can damage the liver.

Damage caused by carbon tetrachloride is

similar to that of viral hepatitis. The liver protective effects of these five plant extracts were compared using laboratory mice. Plant extracts were orally fed to mice, both before inducing liver injuries and after. Liver enzymes and pathological changes were studied to find out the effects of plant extracts.

The overall result of this study showed that all five plant extracts used in this study have some ability to protect the liver against injuries caused by an overdose of paracetamol and carbon tetrachloride. The level of protection shown varied among different plant extracts.

Research Grant No. RG/2001/M/10

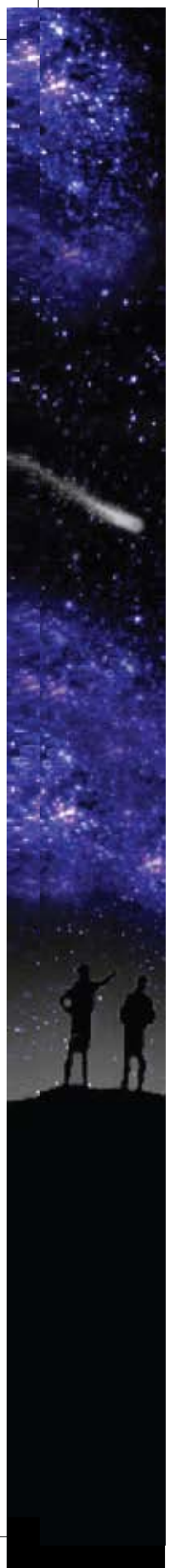
FORECASTING CONDITION OF BRIDGES AVOIDS FAILURES AND SAVES MAINTENANCE COSTS

Many of the bridges in Sri Lanka are very old, built during the colonial period, over 50-100 years ago. They are often not in good and serviceable condition and need regular repair and maintenance or sometimes replacement.

Our national road network consists of several types of bridges

Our national road network (class A and B) has about 5000 bridges. The network consists of several types of bridges; reinforced concrete bridges, steel bridges, prestressed bridges etc., where their structure and load carrying capacity are entirely different from each other.

Conditions of bridges are assessed by mere visual inspection. Based on such observations the relevant authorities carry out maintenance and repair work. There has



not been a proper system for estimation of their condition and serviceability.

A team of engineers from the Department of Civil Engineering of the University of Peradeniya, has developed a reliable scientific method to assess the condition and serviceability of a bridge.

This study has proposed two accurate approaches to estimate the condition and remaining life span of bridges, using 'plasticity theory' and 'reliability theory'. The plasticity theory has been used to estimate the condition and remaining life span of steel truss bridges whereas the reliability theory has been used for same purpose but for four other types of bridges. By using these theories a mathematical model has been proposed to uncover the condition of a bridge, and also to predict its life span and serviceability.

Having assessed the condition of bridges in all provinces except the north and the east, the researchers were able to prepare an inventory of the bridge network for Sri Lanka.

Bridges that need urgent attention have thus been prioritized. This will help the government to allocate funds on a priority basis and thereby be more effective in the rehabilitation of bridges and road networks.

Currently, in addition to the visual inspections, the Road Development Authority uses these methods to determine the life span and current serviceability of bridges in Sri Lanka.

Research Grant No. RG/2002/E/01

A BIO-PESTICIDE FROM BANANA FRUIT PEEL

A team of scientists from the Faculty of Agriculture, University of Peradeniya has developed a bio-pesticide from the banana fruit peel that can control post-harvest diseases in banana.

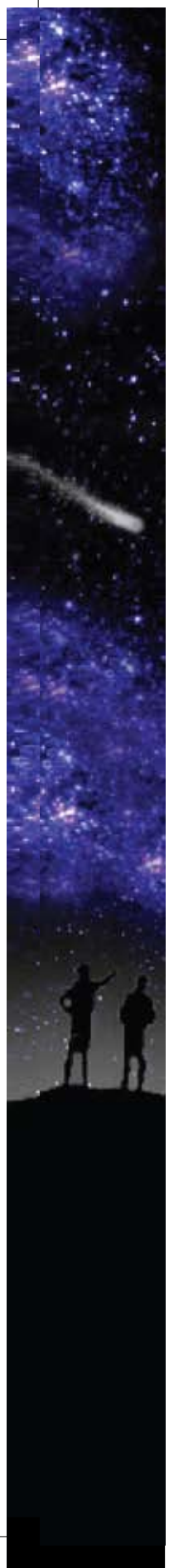
An uninfected bunch of banana

The bio-pesticide dip developed from harmless microorganisms living on the banana fruit peel competes with and destroys the disease causing pathogens, extending the life of the banana.

Banana, is a widely consumed fruit in Sri Lanka. Approximately 50,000 ha are under banana cultivation, producing 450,000 metric tons of edible fruits annually. *Anthracnose*, most common post-harvest diseases seen in dessert banana.

Banana which was considered a home-garden crop several decades ago is now given a high national priority among food crops. Approximately 28 cultivars belonging to two principal types of banana (i.e. cooking type and dessert type) are available locally.

The banana industry is affected by several diseases, caused by both bacteria and fungi, that set in after harvesting the fruits. This



crown rot and blossom end rot are the leads to the reduction of post-harvest life and quality of the fruits.

The bacterium *Burkholeria spinosa,* the most effective of all isolates has certain other advantages too:

a) The edible parts of banana are not contaminated by the bacterium when the fruits are treated with *B. spinosa* post-harvest dip,

b) the bacterial dip treatment effectively controls three postharvest diseases of banana that develop on a range of banana cultivars,

c) more effective control of post-harvest diseases can be achieved by pre-treatment with hot water (50^0 C) for 3 minutes, prior to the bacterial dip treatment,

d) the *B. spinosa* bacterial dip can also control several post-harvest fungal diseases of other tropical fruits such as mango, pineapple and avocado.

Research Grant No. RG/2004/FS/02

HEALTH BENEFITS FROM BLACK TEA

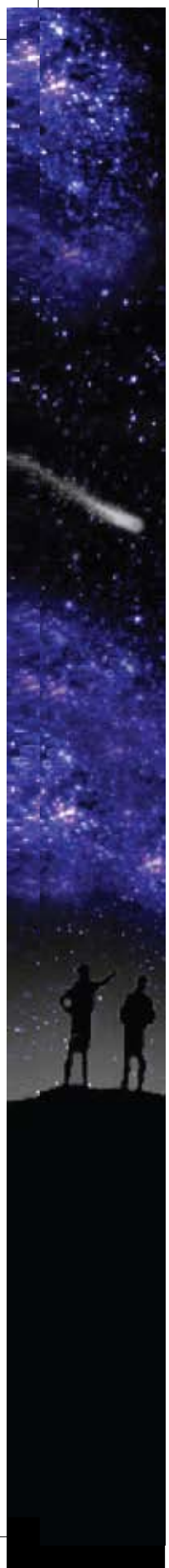
Tea is the most commonly consumed beverage in the world after water. A study, has shown for the first time that Sri Lankan black tea possess a plethora of bio-activity that could be of potential health benefit to man.

'Two leaves and a bud' - Sri Lanka produces best tea in the world

Sri Lanka is well known for its high quality tea and as the 3rd biggest tea producing country globally, has a production share of 9% in the international market and one of the world's leading exporters with a share of around 19% of the global demand. Black tea accounts for 78% of world's tea production and about 80% of global tea consumption. Sri Lanka produces about 310 million kg of black tea per year.

Studies conducted with mice and rats at the University of Colombo have provided convincing evidence that Sri Lankan Black tea has the following potential health benefits. It can:

- prevent blood clots
- dissolve blood clots
- protect stomach lining from ulcer formation
- heal gastric ulcers
- reduce anxiety
- lower the sugar level in blood
- reduce fever condition
- reduce pain
- prevent diarrhoea
- increase urine quantity passed
- reduce elevated blood cholesterol levels
- increase sexual desire
- prolong the onset and shorten the duration of sleep



- increase head movement or lateral head displacement of sperms

The ability to dissolve blood clots, protection given to the stomach lining, reduction of fever condition and influence on sexual desire (the aphrodisiac properties) of Sri Lankan black tea are new findings for any type of black tea, produced in the world. However, no antimalarial activity was exhibited.

This study also proved that drinking tea even in large quantities does not cause harm to kidneys or to the liver. Furthermore, it was established that drinking tea was not disruptive to female oestrous cycle, pregnancy or to male fertility.

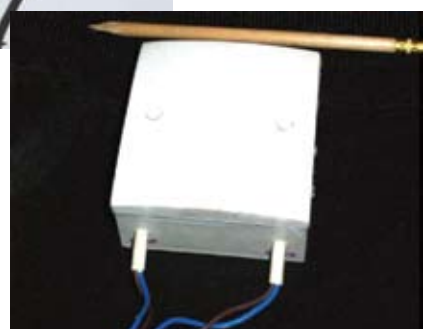
NSF Fellowship No. NSF/Fellow/2005/01

NEW ELECTRONIC DEVICES CAN SAVE ELECTRICITY

Reducing energy wastage is the main force behind a sustainable electricity supply. A research team at the University of Moratuwa has developed three electronic devices that could help save electricity.

The demand for energy in Sri Lanka has increased steeply over the years. The total capacity of the country's electricity generation system is rising each year at an approximate rate of 8%. This is expected to grow at around 10% annually during the next decade due mainly to energy wastage in the industrial, commercial and domestic sectors.

Device installed on street lamp



Electronic controller

Switching-on-and off of street lamps in most places in Sri Lanka is done manually and it is quite often possible to see street lamps not switched off even at mid day. This project has developed a low cost electronic controller for automatically switching on and off of street lamps. The principle, although widely applicable to street lighting can also be used at home.

According to the researchers these automatic controllers can save about an hour's electricity every day by promptly switching off unnecessary lights. The device needs no additional wiring. Being completely solid state it has no mechanical components. The device consumes very little energy and is highly reliable and requires hardly any maintenance.

The second device is a timer for ceiling fans. Although timers are commonly found

in many industrial and domestic equipment, timers have not been incorporated into a ceiling fan regulator. The researchers have incorporated an Auto Timer Controller in a ceiling fan regulator. The timer can be set at the time of going to sleep so that it will switch off the fan at a preset time. In addition to saving energy it would avoid inconvenience of having to get up to switch off the fan. The device can replace the normal fan speed regulator. No additional wiring is required. It can also be useful in offices where fans could be switched off at the end of work.

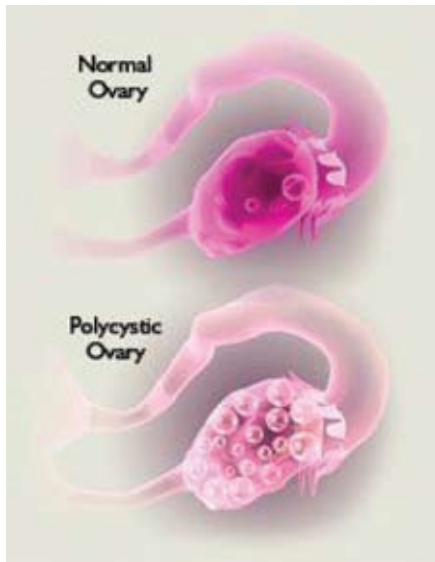
Timer for ceiling fan

The third device is an Alarm to indicate unnecessary use of electricity with an optional tripping facility. This device sets off an alarm to warn the user when excessive lamps or equipment are switched on. The level of current at which the alarm should go off can be pre-set based on the requirement of the household. Thus, the user could be reminded to switch off some lights or other devices and reduce his electricity bill. Such a device would also be invaluable to save electricity in an office or any other industrial site.

Research Grant No. RG/2005/E/05

CAUSES AND OCCURRENCES OF OVARIAN CYSTS IN SRI LANKAN FEMALES

Polycystic Ovary Syndrome (PCOS) that affects about 10% of all females is the most common hormonal disorder among women of child bearing age. It is a leading cause of infertility. Awareness of PCOS has increased in the western world but very limited studies have been done in the South Asian region.

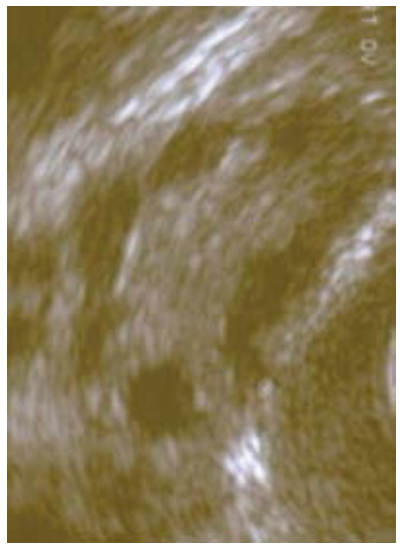


The ovaries are the female reproductive organs that produce eggs and sex hormones, mainly oestrogen and progesterone. Ovaries also produce androgen or "male" hormones but in small quantities. These hormones regulate a woman's menstrual cycle and the release of eggs from the ovary (called ovulation).

In normal menstruation, eggs are released from follicles - cysts that burst to release the egg. One dominant follicle develops with each menstrual cycle and after ovulation the follicle remnant shrinks and disappears.

However, if an ovary produces abnormal quantities of hormones, especially androgen, it interferes with egg development and release from the ovary.

The failure to ovulate - the release of the egg - would mean that follicles remain in the ovary for long periods of time. The accumulation of follicles lead to the condition called PCOS (ovarian cysts) where the cysts may appear as a 'string of pearls'



Polycystic ovary shown on ultrasound image

on ultrasound examination. Thus, women with PCOS are not ovulating or releasing an egg each month, but instead will show irregular or missed menstruation periods.

The prominent symptoms of PCOS are over weight, lack of regular menstruation and excessive production of male hormones. The symptoms and severity of the syndrome vary greatly between women.

This community based study carried out by a team of researchers from the Faculty of Medicine, University of Colombo, in 4 Divisional Secretariat areas in the Gampaha district on a sample of 3030 women of the age group 15-39 years revealed that irregular menstrual cycle was a common problem in 8.1% of women. 6.2% of them had reproductive hormone related disorders. PCOS being the most common, accounted for 6% of such disorders. This study also found that if PCOS is not treated it can lead to many health problems. Women with PCOS were more likely to be childless, over weight, suffer from high blood pressure and diabetes. Cancer of the womb is associated with prolonged menstrual cycles occuring over a long period of time. There is also a less well defined association with breast cancer. Since there is an increasing diabetic trend and most cases of PCOS occur in young girls it is important to diagnose PCOS early.

Although the women with PCOS bear up the symptoms in silence the impacts it could have on the society, economy and the nation as a whole could be enormous.

Findings of this study would be useful for health planners to develop programmes to diagnose PCOS in the early stages in order to properly manage the disorder.

Research Grant No. RG/2005/HS/05

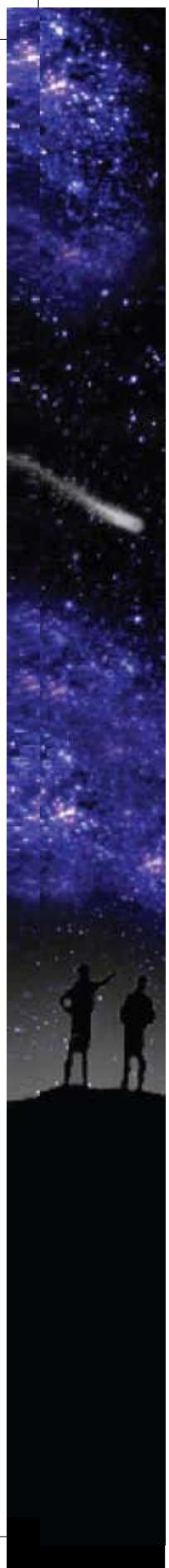
PLANTS CAN MOP UP POISONOUS METALS FROM WATERWAYS: AN ECO-FRIENDLY APPROACH FOR A CLEANER ENVIRONMENT

Contamination of water bodies by heavy metals that come from industrial waste is a severe environmental problem, worldwide. These offenders are usually removed by chemical methods. A promising alternative to this conventional clean-up method has been identified by a group of researchers from the Open University of Sri Lanka.

Common duckweed in the waterways

In a project funded by the NSF, researchers from the Department of Chemistry, Open University of Sri Lanka, have identified several water plants, growing in urban waterways,that can take up and collect toxic heavy metals.

Phytoremediation is a modern technology, using plant processes to remove, breakdown and make harmless (detoxify) offensive metals and other toxic substances from contaminated surroundings. Some plants have the ability to collect massive amounts of heavy metals in their tissues without showing toxic symptoms. This method has



been widely practised to fix, restore and preserve polluted sites throughout the world.

Laboratory studies have confirmed that some water plants such as common duckweed (Lemna sp.) can absorb heavy metals like chromium, cadmium, lead, mercury and nickel. It appears that specific plants can be used to remove specific metals from the polluted water source. The plants that were examined, effectively absorbed these noxious metals within 3-4 days.

Experiments are now underway with the chosen water plants to check out their ability to mop up industrial waste contaminated with these heavy metals.Some of these plants are also able to take up heavy metals as their non-living biomass (dry matter), which offers greater potential of these to be used as biofilters.

Research Grant No. RG/2005/W&E/04

PREVALENCE OF GOITRES IN SRI LANKA

Goitre, the enlargement of the thyroid gland, causing a prominent swelling at the throat, is common in Sri Lanka. The thyroid can grow to 50 times its normal weight and interfere with breathing and swallowing and cause a choking feeling. The most common, goitre is due to low Iodine intake.

A Goitre is an enlargement of the thyroid gland

A team of scientists from the Department of Surgery, Faculty of Medicine, University of Kelaniya carried out a survey involving a wide cross-section of the Sri Lankan population (5200 individuals) to gather information on the occurrence and distribution of goitres in the island.

Adding iodine to salt sold in Sri Lanka was made compulsory in 1995. Studies done before the "iodization age" (prior to 1995) showed a goitre "belt" in the country limited to the Western, Central and Sabaragamuwa provinces. More recent studies, carried out in 2001, showed a shift in this goitre belt. For the present study, 108 Grama Niladhari (GN) divisions were randomly selected island wide excluding the North and Batticaloa districts due to security concerns. In each GN area 50 people over the age of 10 were interviewed using a pre-tested questionnaire and examined for the presence of goitre. If goitre was detected, a 'goitre form' was completed, thorough assessment of the goitre was done and samples of blood and urine were collected. With informed written consent a Fine Needle Aspiration Cytology (FNAC) was done in the field on every goitre and 4 slides prepared for examination. FNAC is a diagnostic procedure sometimes used to study superficial (just under the skin) lumps or masses. In this technique, a thin, hollow needle is inserted into the mass to

extract cells that will be examined under a microscope.

FNAC are safe, minor surgical procedures. This is the first time such a study was done in Sri Lanka.

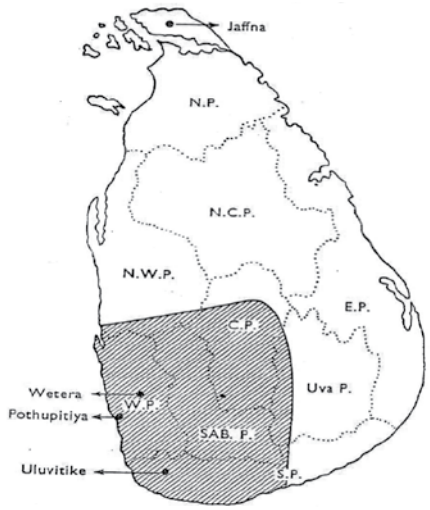
The most important findings of this study were:

- The overall adjusted prevalence of goitre was 6.8%. 426 goitres were detected in a sample of 5200 that consisted of 66% females and 34% males.
- The distribution of goitres according to the World Health Organization categorization – Grades 1, 2, 3 and 4 was 18.6, 68.0, 12.5 and 0.9 percent, respectively.
- More females (11.2%) had goitres than males (2.3%).
- There were no goitre belts and the distribution of goitres was nearly even throughout the different climatic zones of the island.
- There are some areas where the prevalence was more than twice the normal. These patches of high prevalence need further study.

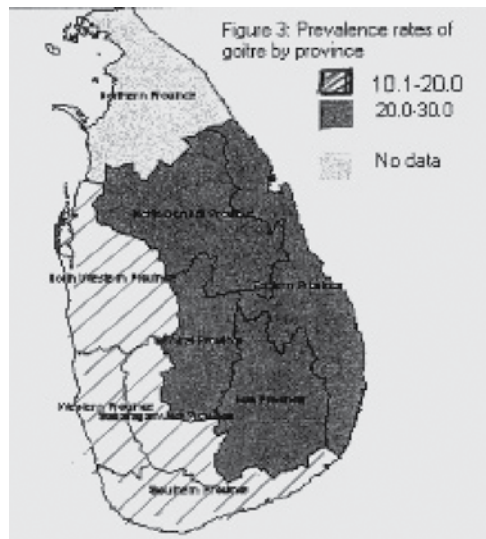
The question we need to ask is:

Are there other causes of goitre than Iodine deficiency, especially in the patches of high prevalence?

NSF Fellowship No- NSF/Fellow/2006/4



Goitre "Belt" recorded in 1968
(Mahadeva & Karunanayake (1968)



Shift of Goitre "Belt" in 2001
(Jayatissa et al 2001)

Annexure

** The reports are arranged in ascending order according to the year of award of grant

1. "Malaria Mosquito Siblings Identified"

Grant No: RG/93/BT/02
Grantee/affiliation:
Dr(Ms) M.B. Gunasekera
Department of Chemistry, Faculty of Science, University of Colombo

Title of the Project:
Development of DNA probes for the identification of *Anopheles culicifacies* species complex

2. "Bats – Study Reveals Their Amazing Habits"

Grant No: RG/95/B/05
Grantee/affiliation:
Prof. W.D. Ratnasooriya,
Dr (Ms) P. Randeniya and
Dr Wipula Yapa
Department of Zoology, Faculty of Science, University of Colombo

Title of the Project:
Ecology and biology of Sri Lankan bats in Sri Lanka: A survey on the distribution of mega and micro – chiropterans in Sri Lanka

3. "Food Safety – Fish Eaters Beware"

Grant No: RG/95/BT/10
Grantee/affiliation:
Dr Upali Samarajeewa
Department of Food Science & Technology, Faculty of Agriculture, University of Peradeniya

Title of the Project:
A study on histamine production in fish and dried-fish and the effect of processing on histamine

4. "Promising Anti-cancer Compounds from Sri Lankan Lichens"

Grant No: RG/96/C/04
Grantee/affiliation:
Prof. V. Karunaratne
Department of Chemistry, Faculty of Science, University of Peradeniya

Title of the Project:
Bioactive natural products from Sri Lankan Lichens: culturing of the Mycobiont in the laboratory

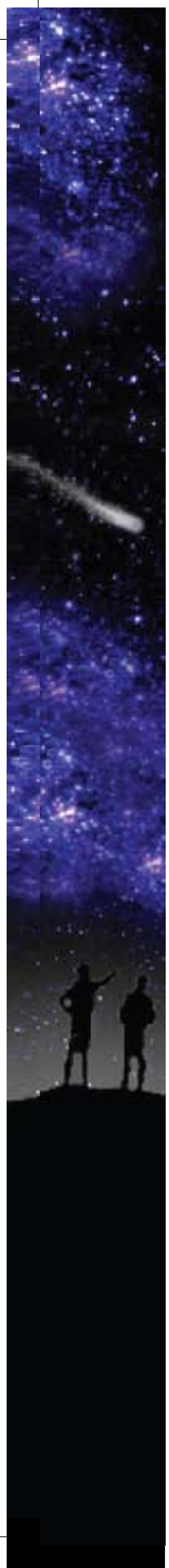
5. "DNA Fingerprinting as Evidence in a Court of Law"

Grant No: RG/96/M/12
Grantee/affiliation:
Dr (Ms) M. B. Gunasekera and
Dr N. C. W. Goonasekera
Department of Chemistry, Faculty of Science, University of Colombo

Title of the Project:
Development of DNA markers for the Sri Lankan population for human identification

6. "Garlic Reduces the Risk of Liver Cancer"

Grant No: RG/96/M/16
Grantee/affiliation:
Dr (Ms) S. M. D. N. Wickramasinghe
Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayawardenepura
Ms. A. G. D. H. Seneviratne
Department of Zoology, Faculty of Science, University of Sri Jayewardenepura
Dr (Ms) S. Jayasekera
Medical Research Institute, Animal Centre



Title of the Project:
The effects of garlic on chemically-induced hepatocarcinogenesis in normal and hypercholestrolameic wistar rats

7. "The New Cage Wheel Gives a Better Grip for Tractor Tyres"

Grant No: RG/97/AG/02
Grantee/affiliation:
Dr P. L. A. G. Alwis
Department of Agricultural Engineering, Faculty of Agriculture, University of Ruhuna

Title of the Project:
Development of swinging lugs reversible cage wheels for small and medium power tractors

8. "Yes, it is Possible to Cleanup Diesel Fumes"

Grant No: RG/97/C/02
Grantee/affiliation:
Dr K. R. R. Mahanama and
Dr D. Dissanayake
Department of Chemistry, Faculty of Science, University of Colombo

Title of the Project:
Method development for analysis and control of organic pollutants in diesel exhaust

9. "Landslides – Be Forewarned"

Grant No: RG/97/NR/01 and RG/99/NR/02
Grantee/affiliation:
Mr. N. M. S. I. Arambepola and
Mr. R.M.S. Bandara
National Building Research Organization, Colombo

Title of the Project:
Monitoring of landslide movements using geophysical methods (MLMGM)

10. "Rubella Shot a Must for Intended Mothers"

Grant No: RG/99/M/05
Grantee/affiliation:
Prof. D. Weerasekera and
Prof. Sirimali Fernando
Department of Microbiology, Faculty of Medicine, University of Sri Jayewardenepura

Title of the Project:
A study to determine the prevalence of congenital infection due to rubella among new born and proportion of women at risk of giving birth to babies with congenital infection caused by rubella at the Colombo south teaching hospital

11. "Automatic Detection of Lightning Strikes"

Grant No: RG/99/P/02
Grantee/affiliation:
Dr U. Sonnadara and
Prof T. R. Ariyaratne
Department of Physics, Faculty of Science, University of Colombo

Title of the Project:
Implementation of an automated lightning detection network for Sri Lanka

12. "A Fertilizer from Rice Straw "

Grant No: RG/2000/AG/02

Grantee/affiliation:
Dr R. M. C. P. Rajapaksa
Department of Soil Science, Faculty of Agriculture, University of Peradeniya

Title of the Project:
Composting of rice straw using inoculants of indigenous soil microorganisms

13. "Herbal Extracts Have Anti-cancer Properties "

Grant No: RG/2000/M/01
Grantee/affiliation:
Dr S. M. D. N. Wickremasinghe
Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayewardenepura
Prof. I. Thabrew
Department of Biochemistry and Clinical Chemistry, Faculty of Medicine, University of Kelaniya

Title of the Project:
Investigation of the anti-tumor properties of some traditional medicines in Sri Lanka

14. "Differences in Gravity Detected by Satellites Help to Demarcate Our Ocean Boundaries "

Grant No: RG/2000/P/03
Grantee/affiliation:
Prof. D. A. Tantrigoda
Department of Physics, Faculty of Applied Sciences, University of Sri Jayewardenepura

Title of the Project:
Interpretation of gravity anomalies over the Indian Ocean region around Sri Lanka

15. "Better Management Can Lower the Cost of Production of Rice"

Grant No: RG/2001/AG/01c
Grantee/affiliation:
Dr S. Thiruchelvam
Department of Agricultural Economics, Faculty of Agriculture, University of Peradeniya

Title of the Project:
Study on the factors affecting cost of production of rice in Anuradhapura and Polonnaruwa districts in Sri Lanka

16. "Sri Lankans Study Bees for the First Time: A New Bee Species Identified"

Grant No: RG/2001/B/02
Grantee/affiliation:
Prof. Jayanthi Edirisinghe
Department of Zoology, Faculty of Science, University of Peradeniya
Dr C. V. S. Gunatilleke
Department of Botany, Faculty of Science, University of Peradeniya

Title of the Project:
Taxonomy and ecology of bees in Sri Lanka

17. "A New Anti-malarial Drug Regimen to Control Malaria"

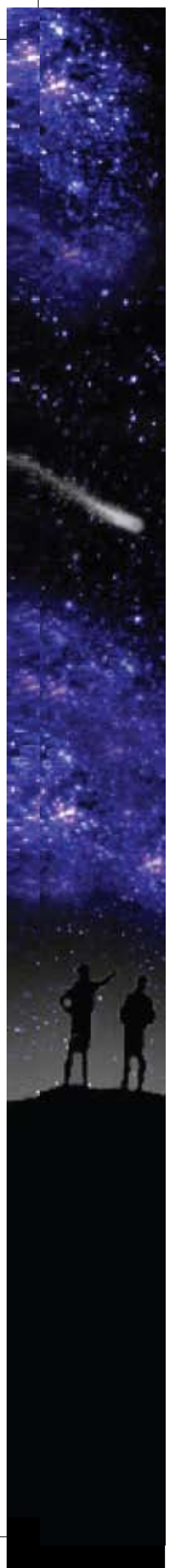
Grant No: SIDA/2001/BT/01
Grantee/affiliation:
Prof. N. R. de Silva and
Dr W. Abeyewickreme
Department of Parasitology, Faculty of Medicine, University of Kelaniya

Title of the Project:
Genetic composition of Plasmodium falciparum in relation to drug resistance and disease transmission in Sri Lanka

18. "An Environmental Management System for Local Asbestos Industry"

Grant No: RG/2001/E/07
Grantee/affiliation:
Dr S. P. Samarawickrama
Department of Civil Engineering, Faculty of Engineering, University of Moratuwa

Title of the Project:
Environmental management system (EMS) for Sri Lankan asbestos industry



19. "Salt Water Ponds Can Trap Sunlight for Producing Solar Energy"

Grant No: RG/2001/EP/02
Grantee/affiliation:
Dr J. R. P. Jayakody,
Dr P. A. A. Perera and
Dr M. A. Punyasena
Department of Physics, Faculty of Science, University of Kelaniya

Title of the Project:
A study of collecting and storing of solar energy in salt pan solar ponds in Sri Lanka

20. "A National Laboratory to Ensure Safety of Animal Products"

Grant No: RG/2001/M/02
Grantee/affiliation:
Prof. Preeni Abeynayake and
Dr. R.H. Priyankarage
Department of Veterinary Pathobiology, Faculty of Veterinary Medicine and Animal Science, University of Peradeniya

Title of the Project:
The establishment of detecting facility for chemical residues and their monitoring in livestock products

21. "Herbal Plant Extracts Can Protect the Liver"

Grant No: RG/2001/M/10
Grantee/affiliation:
Prof. C. Pathirana,
Dr K. A. P. W. Jayatilaka
Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Title of the Project:
Antioxidative and hepatoprotective effects of some Sri Lankan medicinal plants in chemically induced hepatotoxicity in mice

22. "Forecasting Condition of Bridges Avoids Failures and Saves Maintenance Cost"

Grant No: RG/2002/E/01
Grantee/affiliation:
Dr P. B. R. Dissanayake,
Dr K.R.B. Herath and
Mr. R.B. Rathnayake
Department of Civil Engineering, Faculty of Engineering, University of Peradeniya

Title of the Project:
Reliability assessment and lifetime prediction of bridges in Sri Lanka

23. "A Bio-pesticide from Banana Fruit Peel"

Grant No: RG/2004/FS/02
Grantee/affiliation:
Dr Devika M. De Costa
Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya

Title of the Project:
Screening indigenous antagonists for development of bio-pesticides against postharvest diseases of banana

24. "Health Benefits from Black Tea"

Grant No: NSF/Fellow/2005/01
Grantee/affiliation:
Prof. W. D. Ratnasooriya
Department of Zoology, Faculty of Science, University of Colombo

Title of the Project:
An assessment of potential health benefits of Sri Lankan black tea by studying its bioactivities

25. "New Electronic Devices Can Save Electricity"

Grant No: RG/2005/E/05
Grantee/affiliation:
Prof. K. K. Y. W. Perera
Department of Electronic and Telecommunication Engineering, Faculty of Engineering, University of Moratuwa

Title of the Project:
Electronic devices for energy saving design and prototype fabrication

26. "Causes and Occurrences of Ovarian Cysts in Sri Lankan Females"

Grant No: RG/2005/HS/05
Grantee/affiliation:
Prof. Rohini de A. Senevirathne
Department of Community Medicine, Faculty of Medicine, University of Colombo
Dr C. N. Wijeyarathne
Department of Gynaecology and Obstetrics, Faculty of Medicine, University of Colombo
Dr K. A. D. D. V. L. Kumarapeli
Department of Community Medicine, Faculty of Medicine, University of Colombo

Title of the Project:
A study on reproductive endocrine diseases among women in the reproductive age

27. "Plants Can Mop Up Poisonous Metals from Waterways: An Eco-friendly Approach for a Cleaner Environment"

Grant No: RG/2005/W&E/04
Grantee/affiliation:
Dr (Ms) Sithy S. Iqbal and
Ms. Meena Thayaparan
Department of Chemistry, Faculty of Applied Sciences, Open University of Sri Lanka, Nugegoda

Title of the Project:
Phytoremediation of toxic heavy metals in the polluted aquatic environment

28. "Prevalence of Goitres in Sri Lanka"

Grant No: NSF/Fellow/2006/04
Grantee/affiliation:
Dr Ranil Fernando
Department of Surgery, Faculty of Medicine, University of Kelaniya

Title of the Project:
Study of Goitres in Sri Lanka