

Volume : 14

**JAFFNA SCIENCE ASSOCIATION**

**Abstracts of Research Papers**



**SUBMITTED**  
**AT THE**  
**14<sup>th</sup> ANNUAL SESSIONS**  
**HELD ON**  
**APRIL 26, 27 & 28, 2006**  
**JAFFNA, SRI LANKA**  
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The Annual Sessions of the Jaffna Science Association held yearly contributes to popularize scientific thinking and encourage scientific research oriented projects. This volume perpetuates the memory of the 14th Annual Sessions of the Jaffna Science Association; to be held from 26 - 28 th April 2006.

It consists of fifty seven Abstracts of Papers; comprising 28 from Section A (Pure Science), 23 from Section B (Applied Science), 05 from Section C (Medical Science) and 01 from Section D (Social Science) for presentation at the 14th Annual Sessions of the Jaffna Science Association.

I express my sincere thanks to the General Secretary Dr. G. Mikunthan and executive committees for their assistance in getting these abstracts refereed in time for presentation at this Annual Sessions. My special thanks due to Prof. A. Sanmugadas, President of Jaffna Science Association and Mrs. T. Mikunthan for their kind assistance in bringing this volume in time.

My gratitude and sincere thanks are to the People's Bank, Regional Office, Jaffna for the contribution made to this Association.

Dr (Mrs).S.Sivapalan,  
Chief Editor.

Unit of Siddha Medicine  
University of Jaffna,  
Jaffna, Sri Lanka.  
April 2006

# CONTENTS

## Section A

A1	Growth and mortality parameters of <i>Gerres filamentosus</i> (Cuvier, 1829) *Kuganathan, S. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	1
A2	Inhibitory effect of bacteria, <i>Pseudomonas</i> sp. against some fungal pathogens *Thuraiathan, S. and Niranjan, K. <i>Department of Botany, Faculty of Science, University of Jaffna</i>	2
A3	Distribution of intertidal microinvertebrate fauna during monsoon seasons in a soft muddy shore *Sivatharshan, Y. and Krishnarajah, P. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	3
A4	Lipid content of different organs in <i>Gerres filamentosus</i> (Cuvier) during sexual maturity) *Kuganathan, S. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	4
A5	Thermal optical and electrical characterization of different types of paints *Manivarma, V. and Ravirajan, P. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	5
A6	Semiconducting behaviour of some natural organic resins *Gnanapragasam, G. Thevakaran, A. Sivaraya, S. Ravirajan, P. and L. Jeyanathan <i>Department of Physics, Faculty of Science, University of Jaffna</i>	6
A7	Fabrication of electrical characterization of A1-A <sub>2</sub> O <sub>3</sub> -Ag metal insulator metal diodes *Vijayakumaran, P. and Sivaraya, S. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	7
A8	Controlling recombination kinetics of hybrid polymer/metal oxide solar cells by molecular interface modification *Ravirajan, P. and Nelson, J. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	8
A9	Theoretical Simulation of Miniband Formation in Superlattices *Uthayathan, T. and Sivaraya, S. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	9
A10	Prevalence and insecticide resistance of <i>Aedes aegypti</i> and <i>A. albopictus</i> in a residential area in Jaffna peninsula *Kajatheepan, A. Sanjeevkumar K.F.A. and S.N Surendran. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	10
A12	Influence of Cow dung and Neem leaf litter on the Histology of Neurosecretory cells of Brain in the Earthworm, <i>Lampito mauritii</i> (Oligochaeta; Megascolidae) *Thabothini, V. and Krishnarajah, P. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	11
A13	Preliminary studies of electrical and low magnetic field transport process in red soils (Latosols) in Northern Sri Lanka *Ketheeswaren, S. Rajendram, K. Srikanan, R. and Ahilan, K. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	12
A14	Preliminary study of the water absorption of the coated concretes *Sarathchandran, S. and Ahilan, K. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	13
A15	Study of electrical properties of clay of a local deposit *Rajasingham, V. and Ahilan, K. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	14
A16	Suitable method to evaluate blood plasma levels of 11-ketotestosterone in male broodstock spotted wolfish ( <i>Anarhichas minor</i> ) *Kugathas, S. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	15
A17	Preliminary documentation of snakes from bi-catch fisheries at Kakaitivu of the Jaffna lagoon *Balasubramaniam, A. and Krishnarajah, P. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	16
A18	Influence of cortisol on the production of gonadal steroids and spermatogenesis in male spotted wolfish ( <i>Anarhichas minor</i> ) *Kugathas, S. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	17
A19	Characterization of properties to identify suitable red - clay in north and east of Sri Lanka for a brick and tile industry *Santhirapiragasam, J., Regis, E.C.J. and Ahilan, K. <i>Department of Physics, Faculty of Science, University of Jaffna</i>	18
A20	Survey and identification of dragon flies (Odonata: Anisoptera) in Valigamam region Jaffna *Sundralingam, P. and Gnanewaran, R. <i>Department of Zoology, Faculty of Science, University of Jaffna</i>	19



A21	Identification of spider families found in the University of Jaffna premises *Gajapathy, K. <b>Department of Zoology, Faculty of Science, University of Jaffna</b>	20
A22	Impact of variation in aerial temperature, precipitation and wind speed on the abundance of three spider families (Araneidae, Pholcidae and Salticidae) found in University of Jaffna *Gajapathy, K. <b>Department of Zoology, Faculty of Science, University of Jaffna</b>	21
A23	A preliminary study on plant hopper fauna of rice ecosystem in Chunnakam, Jaffna *Piranavamalar, T. and Gnaneswaran, R. <b>Department of Zoology, Faculty of Science, University of Jaffna</b>	22
A24	Electrical and optical characterization of TiO <sub>2</sub> *Kukan, S. and Ravirajan, P. <b>Department of Physics, Faculty of Science, University of Jaffna</b>	23
A25	Influence of temperature on performance of hybrid Titanium dioxide/ fullerene: polymer solar cells *Haridas, K., Sivaraya, S. and Ravirajan, P. <b>Department of Physics, Faculty of Science, University of Jaffna</b>	24
A26	Screening of medicinal plants for anti-cancer activity by [ <sup>3</sup> H] Thymidine Incorporation assay on HL-60 cells *Pathmanathan, K. <b>Department of Botany, Faculty of Science, University of Jaffna</b>	25
A27	DNA fragmentation and Cytotoxicity assay to study apoptosis in HL-60 cells induced by Ethyl Acetate Extract and pure compound of <i>Vitex negundo</i> *Pathmanathan, K. <b>Department of Botany, Faculty of Science, University of Jaffna</b>	26
A28	Isolation and characterization of novel anti-cancer lead molecule from ethyl acetate extract of <i>vitex negundo</i> *Pathmanathan, K. <b>Department of Botany, Faculty of Science, University of Jaffna</b>	27
A29	Surveillance of dengue fever vector mosquito breeding sites in the Vavuniya town area *Thuraisingam, T. Thayaseelan, K. and Srikrishnarajah, K.A. <b>Vavuniya campus, University of Jaffna</b>	28

## Section B

B1	Species composition of home garden in Kandy, Vavuniya and Kilinochchi *Loganathan, P. <b>Dept. of Biological Sciences, Faculty of Applied Sciences, Vavuniya</b>	29
B2	Changes in fat and fatty acid content of soyabean under different processing conditions *Vasantharuba, S. and Sivakanesan, R. <b>Dept. of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna</b>	30
B3	Minimal processing in ash plantain *Kentheeswaran, P. and Sarananda, K.H. <b>Dept. of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna</b>	31
B4	The effect of carbohydrate and amino acids on production of $\alpha$ -amylase from <i>Bacillus licheniformis</i> ATCC 6346 *Vengasaramana, A. Balakumar, S. and Arasaratnam, V. <b>Dept of Biochemistry, Faculty of Medicine, University of Jaffna</b>	32
B5	A preliminary study on the changes in chemical and physical parameters of soil samples on prawn farms at Puttalam district *Mariagnanaseelan, M., Senthilnathanan, M., Jeyadevan, J.P. Thayaparan, S. and Mageswaran, R. <b>Department of Chemistry, Faculty of Science, University of Jaffna</b>	33
B6	Identification of suitable industrial sites in Jaffna peninsula: Usage of GIS as a tool in spatial decision making process *Pratheeban, S. Partheepan, K. Amalraj, N. Jeyakumar, P. and Thivyatharsan, R. <b>Dept. of Agronomy, Faculty of Agriculture, Eastern University of Sri Lanka, Chenkalady.</b>	34
B7	Development of fruit leather using Bael fruit ( <i>Aegle marmelos</i> ) *Kumudini, S. and Ekanayake, S. <b>Dept. of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna</b>	35
B8	Plant growth enhancement of selected fungi and pathogenic fungal inhibition by <i>Trichoderma</i> sp. *Thuraiatnam, S. and Niranjana, K. <b>Department of Botany, Faculty of Science, University of Jaffna</b>	37
B9	Study on post harvest dip treatments of Willard mangoes *Ambalavanar, S. and Krishnapillai, N. <b>Department of Botany, Faculty of Science, University of Jaffna</b>	38
B10	Purification of extracellular $\alpha$ -amylase produced by <i>Bacillus licheniformis</i> ATCC 6346 *Vengasaramana, A. Balakumar, S. and Arasaratnam, V. <b>Dept of Biochemistry, Faculty of Medicine, University of Jaffna</b>	39

B11	Cross inoculation of different isolates of bacterial wilt pathogen ( <i>Ralstonia solanacearum</i> ) *Ponnampalam, N. and Ariyaratne, I. Dept. of Agricultural biology, Faculty of Agriculture, University of Jaffna	40
B12	Quality assessment of karthakolomban mangoes ( <i>Mangifera indica</i> L.) in different markets of Jaffna *Mahathevan, T. and Krishnapillai, N. Department of Botany, Faculty of Science, University of Jaffna	41
B13	Preliminary studies on the selection of thermostable alkaline xylanase producing bacteria *Kapilan, R. and Arasaratnam, V. Dept of Biochemistry, Faculty of Medicine, University of Jaffna	42
B14	Production of $\alpha$ -amylase by <i>Bacillus licheniformis</i> ATCC 6346 in fermenter under controlled conditions *Vengasaramana, A. Balakumar, S. and Arasaratnam, V. Dept of Biochemistry, Faculty of Medicine, University of Jaffna	43
B15	Evaluation of the okra ( <i>Abelmoschus esculentus</i> L.) germplasm on calcic red yellow lactosol under the recommended cultural practices *Arooran, K. and Arulnandy, V. Dept of Agricultural Biology, Faculty of Agriculture, University of Jaffna	45
B16	Comparison of kinetic properties of crude and purified $\alpha$ -amylase from <i>Bacillus licheniformis</i> ATCC 6346 with commercial amylase from <i>Bacillus licheniformis</i> *Vengasaramana, A. Balakumar, S. and Arasaratnam, V. Dept of Biochemistry, Faculty of Medicine, University of Jaffna	46
B17	Isolation of $\alpha$ -amylase producing bacteria by Gel Micro Droplet method *Arasaratnam, V. and Thayanathan, K. and Balakumar, S. Dept of Biochemistry, Faculty of Medicine, University of Jaffna	47
B18	Newtonian behaviour analysis of soybean oil in degumming *Prabhakaran, M. and Rakshit, S.K. Dept. of Agricultural Engineering, Faculty of Agriculture, University of Jaffna	48
B19	Physico-Chemical changes during extraction and clarification of guava juice *Mahendran, T. and Grandison, A.S. Dept. of Agronomy, Eastern University of Sri Lanka, Chenkalady	49
B20	Effect of pressure trajectory angle and riser height on uniformity co-efficient of sprinkler irrigation *Punitharajah, M. and Mikunthan, T. Dept. of Agricultural Engineering, Faculty of Agriculture, University of Jaffna	50
B21	Health care demand behaviour of household in Valikamum area of Jaffna district *Thayalan, Y and Sooriyakumar, K. Dept. of Agricultural Economics, Faculty of Agriculture, University of Jaffna	51
B22	Determinants of fuel choice for cooking in Valikamum area of Jaffna district *Selvaratnam, J. and Sooriyakumar, K. Dept. of Agricultural Economics, Faculty of Agriculture, University of Jaffna	52
B23	Consumer's willingness to pay for low pesticide fresh vegetable products in Jaffna municipality area *Thanapalan, A. and Sooriyakumar, K. Dept. of Agricultural Economics, Faculty of Agriculture, University of Jaffna	53

## Section C

C1	The location of coronary arterial ostia in the normal hearts of Sri Lankans *Udhayakumar, S. Department of Anatomy, Faculty of Medicine, University of Jaffna	54
C2	Prevalance and insecticide resistance of sibling species B in <i>Anopheles subpictus</i> complex in a malaria endemic and tsunami affected area in Jaffna Peninsula *Surendran, S.N. and Kajatheepan, A. Department of Zoology, Faculty of Science, University of Jaffna	55
C3	Active case study at Arivial Nagar: A malaria endemic locality in the district of Kilinochchi *Kannathasan, S., Sri Krishnarajah, K.A., and Surendran, S.R. Department of Pathology, Faculty of Medicine, University of Jaffna	56
C4	Larvicidal effect of crude extract from <i>Holothuria atra</i> against <i>Aedes aegypti</i> *Srikaran, R. Sivarajah, R. Krishnarajah, S.R., Krishnarajah, P., Kajatheepan, A. and Surendran, S.N. Department of Zoology, Faculty of Science, University of Jaffna	57
C5	Preliminary report of identification of Scrub typhus in Jaffna *Murugananthan, K. and Ganeshamoorthy, J. and Thevanesam, V. Dept of Microbiology, Faculty of medicine, University of Jaffna	58

## Section D

D1	Satisfactional factors in inducing people: An empirical study of Sri Lankan organizations *Velnamby, T. Department of Commerce, Faculty of Commerce and management studies, University of Jaffna	59
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## Growth and mortality parameters of *Gerres filamentosus* (Cuvier)

Kuganathan, S.

Determination of growth and mortality parameters is an important part of studying the dynamics of fishes. The present study was undertaken to get information on the maximum size, age and growth parameters and mortality of *Gerres filamentosus*.

The length frequency data were grouped sex wise into 10 mm class intervals, sequentially arranged for two years and used for estimation of growth and mortality.  $L_{\infty}$  and K values were obtained by electronic length frequency analysis (Pauly and David, 1981) of computer based method. Value of ' $t_0$ ' (age at '0' length) was estimated by substituting the  $L_{\infty}$  and K in the Pauly's empirical equation (Pauly, 1983). Natural mortality was estimated by the Pauly's method (Pauly, 1980). Fishing mortality rate (F) was calculated from the  $F = Z - M$  relationship.

The asymptotic length ( $L_{\infty}$ ) and growth coefficient (K) were found to be 269.0 mm and 1.55 year<sup>-1</sup> respectively in male and 270.0 mm and 1.68 year<sup>-1</sup> in female. The ' $t_0$ ' values estimated by substituting the  $L_{\infty}$  and K in Pauly's equation were -0.05515 in males and -0.05067 in females. Instantaneous rates of mortality (Z) estimated by length converted catch curve for male and female were 3.29 and 3.48. Natural mortality (M) estimated by Pauly's empirical equation for male and female were 1.288 and 1.359 and the estimated fishing mortality for male and female were 2.0 and 2.121. The computed current exploitation ratios (E) were 0.607 and 0.609.

It is concluded that because computed current exploitation rates (E) are lower than the predicted E, shows that the stock is not overexploited and the fishing pressure on the stock is not excessive. As the *G. filamentosus* is exploited under this condition, below the optimum level indicating scope of slight increase in efforts.

### References:

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- Pauly, D., 1983. Some simple methods for the assessment of tropical fish stocks. FAO Fish. Tech. Pap., 234:52 pp.
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### Inhibitory Effect of Bacteria, *Pseudomonas* sp. against Some Fungal Pathogens

Thurairatnam, S. and Niranjan, K..

Many bacteria control the growth of other microorganisms by producing special protecting metabolites or antibiotics. The Fluorescent *Pseudomonad* bacterium was isolated from rhizosphere of one month old potato plant on King's medium and pure cultures were maintained on King's medium slant. The fungi *Fusarium* sp., *Rhizoctonia* sp. and *Pythium* sp. were isolated from leafspot of *Thespesia*, wilted tomato plant and damping off of mungbean seedlings respectively. Stock culture of *Gliocladium* sp. was used. Pure cultures were cultured on Potato Dextrose Agar medium and these were maintained under the laboratory conditions. Agar disc method was used to test antagonistic effect of fluorescent *Pseudomonad* bacterium against the soil borne plant pathogenic fungi.

The experimental results indicated that there is no fungal growth observed in the plates with fluorescent *pseudomonad* bacterium. This suggests that this bacterium, suppress the growth of these soil borne fungal plant pathogens (100% growth inhibition). But the control plates showed normal growth of fungi. The results indicated that fluorescent *Pseudomonad* bacterium exhibited antagonistic effect against the soil borne fungal plant pathogens. This organism can be employed as biocontrol agent to control the soil borne plant pathogenic fungi.



## Distribution Of Intertidal Macroinvertebrate Fauna During Monsoon Seasons In A Soft Muddy Shore

Sivatharshan, Y. and Krishnarajah, P.

In Sri Lanka, the information regarding the invertebrate ecology is scanty. There are chiefly two monsoons that determine the climate namely the South West Monsoon and the North East Monsoon. The objective of this study is to find the influence of seasonal variations on the distribution of the macroinvertebrate fauna, (which is defined as invertebrates retained on 0.5 mm or coarser meshes) in a soft muddy shore.

A monthly survey was performed over a period of one year from October 2003 to September 2004 in Pallimunai coastal area in Mannar Island. Six sampling sites were selected and vertical transect (with  $0.5 \times 0.5 \text{ m}^2$  quadrant in 1.5 m uniform interval) were laid with 100 m distance along the shore. To ensure the sampling areas during every sampling, permanent marks were set in the study site. Random sampling was also performed and the samples were identified with the help of invertebrate keys and references. Wherever appropriate student t-test was done to compare the differences.

It was found that *Littorina* sp. is significantly high in number per square meter ( $(394.7619 \pm 74.07)$ ) during the South West Monsoon-season ( $p = 0.049465$ ), but *Gammarus* sp. ( $263.6311 \pm 36.28554$ ) is significantly high in number during the North East Monsoon ( $p = 0.003879$ ). *Balanus* sp. more or less shows no variation in distribution. The other organisms are negligible.

It is concluded that monsoon seasonal changes influence in the distribution of intertidal amphipod crustacean *Gammarus* sp. during North East Monsoon season and the Gastropod Mollusc, *Littorina* sp. in South West Monsoon season, but *Balanus* sp. is not influenced by the seasonal variations. This shows that the monsoon affect the intertidal fauna indirectly by the other factors such as exposure areas, tides, wind, salinity and temperature in association with the morphodynamics of the seashore.

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Department of Zoology, Faculty of science, University of Jaffna

## Lipid content of different organs in *Gerres filamentosus* (Cuvier) during sexual maturity

Kuganathan, S.

The lipid stores are typically used for long spawning migrations and building of gonads of fishes. Information on quantitative variation in lipid is lacking for gerreid fishes and therefore the present study was carried out to quantify changes in lipid deposition during ovarian maturation, especially of gonad, liver and muscle of adult *Gerres filamentosus*.

Fishes were first categorized as immature, maturing, matured and spent fishes mainly on the basis of histological preparations of gonads. Following morphometric determinations, 0.5 g sample of muscle was subjected to lipid extraction with the chloroform – Methanol (2:1 v/v) mixture and the total lipid content of tissue samples was estimated by the method of Folch *et al.* (1957). The variations in total lipid content of gonad, liver and muscle of *G. filamentosus* during different maturity stages, such as maturing, matured and spent stage were studied. Statistical analysis was done by ANOVA / Duncan's multiple range test.

Results showed that the lipid content of liver, gonad and muscle of male and female of *G. filamentosus* in different maturity stages is significantly different. Liver and muscle lipid increased significantly from immature to maturing stage but declined from maturing to matured stage. A slight but significant increase ( $P < 0.05$ ) in liver lipid in spent stages could be seen. Muscle and gonad lipid increased significantly ( $P < 0.05$ ) from maturing to matured stage, but declined in spent significantly ( $P < 0.05$ ).

It is concluded that the energy for gonadal growth is probably derived from lipid deposits and that lipid reserves are used for the maturation of ova. The difference in the lipid cycles between males and females is that females usually have a larger lipid cycles than males.

### Reference:

Folch, J., M. Lees and G. H. S. Stanley, 1957. A simple method for the isolation and purification of total lipid from animal tissue. *Journal of Biological Chemistry*, 266:497-509.



## Thermal, optical and electrical characterisation of different types of paints

Manivarman, V. and Ravirajan, P.

Paint has been in use since prehistory. However, no systematic study has yet been reported of thermal and electrical characterisation of paint. This study focuses on thermal, electrical and optical characterisation of water paints, oil paints and spray paints. We use UV-VIS optical absorption spectroscopy, four probe resistivity technique and Lee's disk method to characterise the optical transmission, electrical and thermal insulation of the paints respectively.

Paints were coated on chipboards for thermal characterisation and we observed that there is no significant change in thermal conductivity when chipboard is painted with spray paints. However, thermal conductivity is decreased considerably when chipboard is painted with water paint and oil paint. Both water and oil paints are suitable to use as a thermal insulator to block heat as they have better thermal insulation properties than spray paint. Electrical conductivities of the spray paints ( $10^{-6} \Omega^{-1} \text{cm}^{-1}$ ) are similar to the conductivity of porous  $\text{TiO}_2$  (50 %). Most of the water and oil paints are, however, two-order of magnitude smaller than electrical conductivity of water and oil based paints. This probably due to better particles arrangement by spray paint. Optical absorption studies of paints show that spray paint which has glucose polymer has strong absorbance in the visible region. This study shows that spray paints appear to be promising material composites for optoelectronic application.

Authors thanks to the Asian Paints Lanka limited for providing paints for this study.

## Semiconducting behaviour of some natural organic resins

Gnanapiragasam, G., Thevakaran, A., Sivaraya, S., Ravirajan, P. and Jeyanathan, L.

Several organic resins were extracted from trees and films of resins were prepared by spinning them on a carbon substrate. Electrical contacts were made by lightly pressing another identical carbon substrate on to the film without damaging the surface topology of the film.

Current-voltage characteristics of the investigated materials (Fig.1) display characteristic behaviour of a semiconducting material. The difference in current is partly due to the difference in thickness of the material. The slight asymmetric nature of the characteristics could be attributed to the different nature of the electrical contacts of the front and back side of the film.

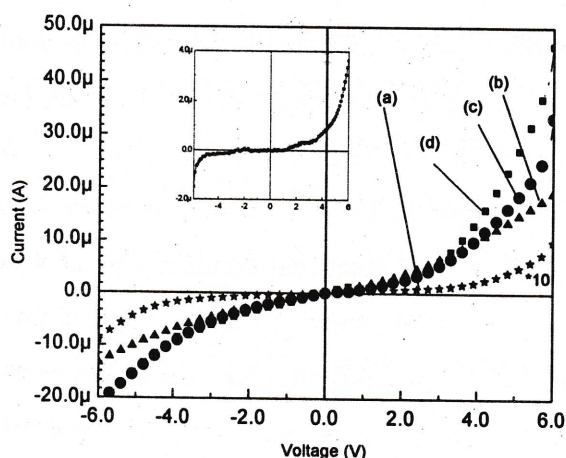


Fig.1 Current-voltage characteristics of thin films of (a) Mango (*Mangifera indica*) (b) Jhingan gum (*Lennea coromandelica*) (c) Temple tree (*Plumeria acuminata*) (d) Neim (*Azadirachta indica*) resins

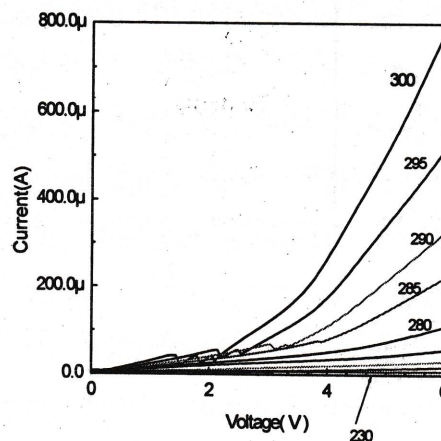


Fig. 2 Current-voltage characteristics of Neim (*Azadirachta indica*) resin at temperature from 230K to 300K in steps of 5K

Inset shows the electrical characteristics of extensively studied synthetic organic material called Poly (3-hexylthiophene) (P3HT). It is evident that the electrical behaviour of our samples is similar to that of the P3HT.

Current-voltage characteristics of Neim (*Azadirachta indica*) resins at different temperatures (Fig.2) indicates that the currents flowing through the sample at a constant bias voltage increases with the increasing temperature. The same characteristic behaviours were observed in all the samples. This behaviour is a clear signature of semiconducting nature of the material.

Department of Physics, University of Jaffna, Jaffna, Sri Lanka



**Fabrication and electrical characterization of Al-Al<sub>2</sub>O<sub>3</sub>-Ag Metal-Insulator-Metal diodes**

<sup>1</sup> Vijayakumaran, P. and <sup>2</sup> Sivaraya, S.

We have fabricated Al-Al<sub>2</sub>O<sub>3</sub>-Ag Metal-Insulator-Metal diodes by anodizing Aluminum (Al) and depositing conducting silver (Ag) paste on the top of the anodized Al<sub>2</sub>O<sub>3</sub>. Electrical characterization was performed using a computer-controlled Keithley 2400 source meter.

The forward bias current-voltage characteristics displays typical behaviour of Metal-Insulator-Metal (MIM) diodes. The forward bias characterisation was performed by applying varying positive voltages on the Ag electrode with respect to the Al electrode. In the reverse bias a typical rectification is observed.

The observed electrical behaviour have been explained using Schottky conduction and Poole-Frenkel type of conduction mechanisms.

Authors wish to thank the Third World Academy of Science (TWAS) for their financial support.

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<sup>1</sup> Vembady Girls' High School, Jaffna, Sri Lanka

<sup>2</sup> Department of Physics, University of Jaffna, Jaffna, Sri Lanka

## Controlling recombination kinetics of hybrid polymer / metal oxide solar cells by molecular interface modification

<sup>1</sup>Ravirajan, P. and <sup>2</sup>Nelson, J.

Composites of conjugated polymers with nanostructured metal oxides are promising material combinations for low-cost solar energy conversion. However, the performance of devices based on such structures is still limited by several factors, including inefficient exciton dissociation and interfacial charge recombination. One strategy to address this issue is to control the interfacial charge transfer rates by modifying the electronic properties of the interface. Modification of interfacial energetics can influence solar cell performance.

We use self-assembled monolayers (SAMs) of benzoic acid based molecules to modify the  $\text{TiO}_2$ -polymer interface in a hybrid conjugated polymer /  $\text{TiO}_2$  photovoltaic device structure. This controls the energy separation between highest occupied molecular orbital of a polymer and conduction band of  $\text{TiO}_2$ . The data show that methyl-benzoic acid (MBA) treatment suppresses the dark current significantly relative to the control, while nitro-benzoic acid (NBA) treatment increases the dark current. These observations are consistent with our Kelvin probe measurements. We find that the SAM treatment modulates the charge transfer yield as expected from the sign of the interface dipole. Photovoltaic device performance is enhanced by over 100 % using nitro-benzoic acid (NBA) with permanent dipole, pointing towards the  $\text{TiO}_2$  surface, compared to a control device with no interface modification. Methyl-benzoic acid (MBA) coating also improves the device performance, mainly through the increase in open circuit voltage.

The authors wish to thank Dr. James R. Durrant, Imperial College London and Prof. H. Horhold, University of Friedrich Schiller, Germany for providing the colloidal  $\text{TiO}_2$  paste the polymer material respectively

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<sup>1</sup>Dept. of Physics, University of Jaffna, Jaffna, Sri Lanka,

<sup>2</sup>Department of Physics, Imperial College London, London SW7 2BW, UK.



## Theoretical Simulation of Miniband Formation in Superlattices

Uthayathan, T. and Sivaraya, S.

A theoretical investigation of electron tunneling in semiconductor superlattices have been carried out. The transmission coefficient of electron tunneling through the superlattices for different incident electron energies were calculated based on the exact solution of the Schrödinger equation by the use of transfer matrix technique [1]. Fig.1 shows the plot of logarithmic of transmission coefficient versus incident electron energy for a 19 period GaAs(80Å) / Al<sub>0.3</sub> Ga<sub>0.7</sub>As(40Å) superlattice structure.

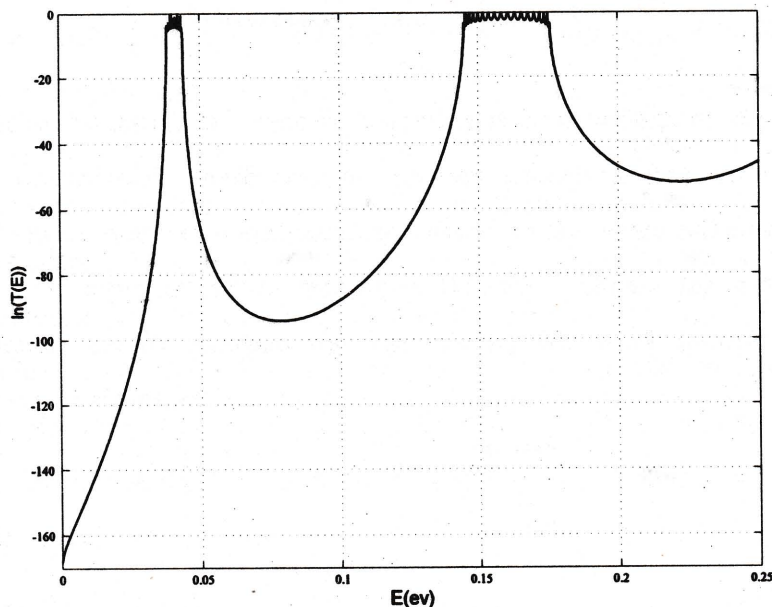


Fig. 1. Logarithmic of transmission coefficient,  $\ln T(E)$ , as a function of incident electron energy for a 19 period GaAs(80Å) / Al<sub>0.3</sub> Ga<sub>0.7</sub>As(40Å) superlattice structure.

Effective mass of electron within the GaAs and Al<sub>0.3</sub> Ga<sub>0.7</sub>As are assumed to be  $0.067m_e$  and  $0.092m_e$  respectively, where  $m_e$  is the mass of a free electron. The minimum offset potential between GaAs and Al<sub>0.3</sub> Ga<sub>0.7</sub>As conduction band edges is along  $\Gamma$ - $\Gamma$  direction and is equal to 0.2319 eV. Fig. 1 shows that the minibands of widths 6 meV and 30 meV are formed at 38 meV and 145 meV respectively, above the conduction band edge of GaAs.

We have also simulated the influence of the biasing applied across the superlattice structures on the miniband. It was found that the applied bias breaks the extended states of the adjacent quantum wells into Stark ladder type states.

[1] Allen, S.S. and Richardson, S.L. 1996, *J. Appl. Phys.* 79, 886

Department of Physics, University of Jaffna, Jaffna, Sri Lanka

**Prevalence and insecticide resistance of *Aedes aegypti* and *Ae. albopictus*  
in a residential area in Jaffna Peninsula**

Kajatheepan, A., Sanjeefkumar, K.F.A. and Surendran, S.N

In Jaffna Peninsula, unprecedented incidences of dengue have been reported in recent years. *Aedes aegypti* (L.) and *Ae. albopictus* (Skase) are the vectors of dengue hemorrhagic fever (DHF) in Sri Lanka. Thirunelvely, a residential area in the Kopay Health Division in which 29 patients were identified for DHF during the year 2003, was selected as the study site.

Collections were done fortnightly from July 2005 to October, 2005. In order to study the prevalence and abundance of *Ae. aegypti* and *Ae. albopictus* conventional ovitraps were placed inside and outside of randomly selected five houses. Adults resulting from collected larvae were identified to species status and used for insecticides resistance studies. Susceptibility of 1-2 days old female progeny was determined by WHO tests with 4% DDT and 5% malathion.

A total of 389 *Ae. aegypti* and 50 *Ae. albopictus* were collected in outdoor ovitraps. In the indoor ovitraps, a total of 507 *Ae. aegypti* and 101 *Ae. albopictus* were collected. The highest positive ovitrap percentage of 80 was recorded in October just before the onset of northeast monsoon. *Ae. aegypti* was found to be the predominant species throughout the study period. Both species were highly resistant to 4% DDT and completely susceptible to 5% malathion.



**Influence of Cow dung and Neem leaf litter on the Histology of Neurosecretory cells of Brain in the Earthworm, *Lampito mauritii* (Oligochaeta; Megascolicidae)**

Veluppillai, T. and Krishnarajah, P.

Experiment was carried out to study the influence of cow dung and neem leaf litter on the histology of the neurosecretory cells of brain in the earthworm *Lampito mauritii* (Kingberg). Three treatments namely, cow dung, neem leaf litter and control were used with five replicates. Ground food substances (cow dung and neem leaf litter) were separately mixed with equal amounts of soil. The cross sections of brain were obtained at 5, 10 and 15 days interval to observe the histology of neurosecretory cells of brain. The tissues of brain were processed, sectioned (6µm) and stained with Heidenhain's hematoxylin and phloxin.

Three types of neurosecretory cells were identified in the brain, of which the cells whose nucleus stained light with a darkly stained central nucleolus were numerous and showed marked changes in the histology on 5, 10, and 15 days interval in worms reared in cow dung.

The diameter of neurosecretory cells and their nucleus were measured for randomly selected 5 cells in each day interval using calibrated ocular micrometer. The volume of cell and nucleus were obtained and nucleocytoplasmic index was calculated as an indicator of neurosecretory activity.

The volume of cell, nucleus and nucleocytoplasmic index were higher on 10<sup>th</sup> day than that of 5 and 15 days interval. Nucleocytoplasmic index was significantly higher in worms reared in cow dung (0.45) and significantly lower in worms reared in neem leaf litter (0.25).

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*Department of Zoology, Faculty of Science, University of Jaffna.*

**Preliminary Studies of Electrical and Low Magnetic field Transport Process in Red Soils  
(Latosols) in Northern Sri Lanka**

<sup>1</sup>Ketheeswaran, S., <sup>2</sup>Rajendram, K., <sup>2</sup>Srikaran, R. and <sup>1</sup>Ahilan, K.

The scope of the studies is to explore the electric and low magnetic field transport properties of  $\text{Fe}^{3+}$  ion rich red soils in Northern Sri Lanka. Samples for these studies were collected at six different locations in Northern Jaffna peninsula. Chemical studies reveal a significant  $\text{Fe}^{3+}$  ion variation among the samples. Studies further reports that the  $\text{Fe}^{3+}$  ions are the major contributor in these soils than others.

Reported studies involve current-voltage (IV) measurements of these samples at room and at high temperatures (up to  $185^\circ\text{C}$ ) of fresh, moisture-freed ( $115^\circ\text{C}$  at 48 hrs), and annealed ( $1000^\circ\text{C}$  at half an hour) conditions. The same studies extended to low magnetic fields (up to 1500 G) as well.

At the fresh condition moisture dominates and responsible for much of its transport properties. Also we reported that  $\text{Fe}^{3+}$  ions are more responsible for the electrical and magnetic transport properties in the moisture-freed and annealed conditions. Further, significant variation in current-voltage characteristics at room temperature were observed among the samples. Even though these characters follow linear behaviour the quantitative values suggest that the samples are very close to insulators (or semiconductor-insulator boundary). High temperature measurements also support the claim that these ions are influencing in the transport properties.

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<sup>1</sup>Department of Physics, University of Jaffna

<sup>2</sup>Department of Chemistry, University of Jaffna



### Preliminary study of the water absorption of the coated concretes

Sarathchandran, S. and Ahilan, K.

The moisture transfer in concrete materials is the major cause for the building damages. Any coating on a concrete specimen serves as a protective barrier to the transport of water into the concrete. The influence of the variety and thickness of the paint coatings, the composition of the concrete mixture and the surface area of the concrete exposed to the water on the amount of water absorbed by the concrete were explored to a fair extend.

Experiments were carried out with different colours of emulsion, enamel, and weather coat. The effect of applying fillers and the lime mixtures were also investigated. Two moulds with different sizes were designed to make concrete blocks with two different dimensions. Concrete blocks with two different mixtures were cast for this purpose.

The variation of the amount of the water absorbed ( $R$ ) with time ( $t$ ) was measured experimentally for the concrete blocks. Variation with the variety of paints, composition of concrete, the thickness of the coating was studied. The mechanism involved in the absorption process was also explored qualitatively. The following are the major outcomes of the work.

Initial water absorption ( $R$ ) of almost all the coatings can be fitted to the equation of the form  $R(t) = R_s (1 - \exp(-t/\delta))$  where  $\delta$  is a time parameter depending on the nature of the coating as well as the concrete and  $R_s$  is the saturation water absorption.

The emulsion paints show higher water absorption property compared to others. The enamel shows the least water absorption.

The concrete blocks having identical mixtures show variation on the surface area. This suggests two factors are responsible for the water absorption, the porous nature of the coating and the diffusion process.

The composition having gravel stones as a mixture shows higher water absorption than that without the stones.

### Study of Electrical Properties of Clay of a Local Deposit

Rajasingham, V. and Ahilan, K.

This study was mainly aimed on electrical properties of fresh and annealed (at 750 °C, 1000°C and 1150 °C) clay samples of Karainagar location. The conductivities of the powdered fresh and annealed clay samples were studied by using the current-voltage (I-V) measurements with stress applied on an electrode in the axial direction. The variation of conductivity of clay disc with the temperature (R.T-100°C) was studied.

Dielectric behavior of fresh clay and annealed clay were studied with LCR resonance method. Piezo electric behavior was also studied. It was found that the external stress plays a major role in electrical conductivity of powder samples of fresh clay. Piezoelectric effect was observed. At room temperature (RT), the resistivity of fresh clay (powdered sample) is decreased with stress in order of  $10^3 \Omega m$ . Annealed clays showed insulating behavior at RT at which resistivity was in the order of  $10^5 \Omega m$ . Dielectric constant and dielectric loss factor of the fresh material were 66.33 and 10.18 respectively. Dielectric constant is nearly 2.51 for the sample annealed at 750°C and 1000°C and 1.88 for annealed at 1150°C. Dielectric loss factor of the annealed samples were smaller in compared with fresh sample. The values are nearly 0.452 at 750°C, 0.088 at 1000°C and 0.157 at 1150°C. According to the plot( Fig 6(c)) , the resistivity of the disc sample increases in order of  $10^6 \Omega m$  below the temperature 80°C and in order of  $10^7 \Omega m$  from 80 °C to 100°C.



**Suitable method to elevate blood plasma levels of 11-ketotestosterone  
in male broodstock spotted wolffish (*Anarhichas minor*)**

Kugathas, S.

Three experiments were performed to develop a method to elevate the plasma levels of 11-KT in male broodstock of spotted wolffish, *Anarhichas minor*, which are as follows:

- i. Intraperitoneal implantation of silastic capsules containing 11-KT - coconut butter mixture
- ii. Intraperitoneal implantation of silastic capsules containing 11-KT - sesame oil mixture
- iii. intramuscular injection of 11-KT – propylene glycol mixture. In the experimental fish blood plasma 11-KT levels were quantified by radioimmunoassay using tritium ( $^3\text{H}$ ) labeled antigens.

Low and medium doses (c. 0.09 mg/kg and c. 0.18 mg/kg) of 11-KT-coconut butter mixture administered in silastic capsules did not elevate the plasma 11-KT levels. High dose (c. 0.37 mg/kg) of 11-KT – coconut butter mixture produced an increase ( $6.48 \pm 1.89 \text{ ng/ml}$ ) of about 3 times pretreatment level ( $1.83 \pm 0.36 \text{ ng/ml}$ ) for one week. 11-KT- sesame oil mixture (1 mg/kg) elevated the plasma 11-KT levels ( $22.58 \pm 4.69 \text{ ng/ml}$ ) compared to the controls ( $14.98 \pm 3.45 \text{ ng/ml}$ ) for one week. Silastic capsule implants did not maintain the elevation more than one week irrespective of dose or vehicle (coconut butter, sesame oil). Intramuscular injection of 11-KT dissolved in propylene glycol (1mg/kg) increased pre-injection mean level ( $13.10 \pm 9.25 \text{ ng/ml}$ ) to about 15times ( $202.44 \pm 108.32 \text{ ng/ml}$ ) after one week of treatment and the elevation was maintained for rest of the weeks.

This results with economic and convenience considerations while endeavoring to minimize trauma, indicate that intramuscular injection of 11-KT dissolved in propylene glycol is a more effective method than silastic capsule implantation

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*Department of Zoology, University of Jaffna, Sri Lanka.*

## Preliminary documentation of snakes from bi-catch fisheries at Kakaitivu of the Jaffna lagoon

Balasubramaniam, A and Krishnarajah, P.

Apart from an old report of *Atretium schistosum* (Daudin, 1803) by Deraniyagala (1955), no records are available on snakes inhabiting the Jaffna lagoon. The present study is to document the snakes inhabiting the Jaffna lagoon – one of the major lagoons intersecting the Jaffna Peninsula. The investigation was carried out from April 2004 to November 2004 at Kakaitivu landing centre. This was a part of the marine snake faunal survey made in the Vadamarachchi coast line of the Jaffna Peninsula. The landing centre was visited once a month in the morning from 0630 hrs to 0900 hrs to check the bi-catch of fisheries as other landing centres in the lagoon were inaccessible due to the security problems. All the collected sea snakes were caught by different types of gill nets. A total of 16 specimens were examined, of which *Atretium schistosum* (Daudin, 1803) and *Cerberus rynchops rynchops* (Schneider, 1799) of the family Colubridae, *Lapemis curtus* Shaw, 1802 of the family Hydrophiidae and *Acrochordus granulatus* (Schneider, 1799) of the family Acrochordidae were recorded. Three out of the 4 species are reported for the first time from Jaffna lagoon. *L.curtus* and *C. rynchops rynchops* are poisonous (front and back fanked respectively) and the other two are non poisonous snakes. Entanglement into the fishing nets along with accidental and deliberate killing by fishermen are the major threats to the sea snakes observed in this part. A more intense survey in the future in other parts of the Jaffna lagoon will probably reveal more species.

The grant of NSF of Sri Lanka RG/ 2003/ZOO/ 07 is gratefully acknowledged.

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**Influence of cortisol on the production of gonadal steroids and spermatogenesis  
in male spotted wolffish (*Anarhichas minor*)**

Kugathas, S.

Spotted wolffish is a promising fish-type for aquaculture but their males produce very low sperm count in captive conditions. Under such conditions they are known to produce high plasma levels of cortisol due to stress (Nagahama, 1994). The present study was carried out to investigate the effect of cortisol on the production of gonadal steroids and spermatogenesis in wolffish. This experiment was conducted with completely randomized design in two levels, control and treatment with 15 replicates. For the treatment group of fish intramuscular injection of cortisol dissolved in propylene glycol was given via dorsal musculature. Control group was treated similarly without cortisol. At the end of the experiment blood sampling and Radioimmunoassay using tritium ( $^3\text{H}$ ) labeled antigen were performed to measure the plasma level of cortisol, 11-ketotestosterone (11-KT) and Maturation Inducing Hormone (MIH) according to the procedure described by Schultz (1984, 1985). All the fish were stripped and spermatocrit was assessed in percentage scale. Sperm motility was scaled in percentage of forwardly moving sperm cells.

Treatment successfully elevated the blood levels of cortisol ( $12.98 \pm 4.22$  ng/ml) compared to controls ( $2.63 \pm 0.86$  ng/ml). Increased level of cortisol significantly reduced the 11-KT levels in treated group ( $18.31 \pm 8.26$  ng/ml) compared to controls ( $37.72 \pm 9.83$  ng/ml), but did not make any significant differences in the MIH levels in treated ( $15.80 \pm 5.09$  ng/ml) and control ( $14.66 \pm 4.40$  ng/ml) group fish. Spermatocrit in treated group ( $14.99 \pm 4.25$  %) was significantly reduced from that of controls ( $27.6 \pm 8.44$  %). Sperm motility in treated group ( $36.73 \pm 11.31$  %) was also significantly lower than that of controls ( $65.8 \pm 6.16$  %).

It is concluded that elevated levels of cortisol significantly reduced the plasma levels of 11-KT in spotted wolf fish but did not make any change in the MIH levels. Increased plasma cortisol significantly reduced the spermatocrit which positively correlate with 11-KT levels. Increased plasma cortisol significantly reduced the sperm motility which is irrespective to MIH levels.

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*Department of Zoology, Faculty of Science, University of Jaffna, Sri Lanka.*

## Characterization of properties to identify suitable red - clay in north and east of Sri Lanka for a brick and tile industry

<sup>1</sup>Santhirapiragasam, J., <sup>2</sup>Regis, E.C.J. and <sup>1</sup>Ahilan, K.

The purpose of the investigation is to identify suitable clays in North and East of Sri Lanka for the brick and tile industries by studying its relevant mechanical properties. The mechanical properties of the clays are determined the surface cracks, surface smoothness, strength and workable condition etc. The following mechanical and some physical properties such as particle size, critical moisture content (C.M.C), strength, shrinkage, water absorption are investigated by suitable and standard methods at ceramic Research Development Centre, Boralasgamuva for this identification.

Investigations were carried out for the samples collected from various locations in North and East Provinces from our investigations we found that sample D (kokadicholai) has

- 1) Fine particles, surface smoothness at dry and fired conditions and has the highest fired strength compare with other samples even the test sample C
- 11) Low grit content even the test sample C
- 111) Higher fired strength and green strength even the test sample C
- 1V) C.M.C value grater than five

We are reporting that sample from particular location in kokadicholai clay in the Eastern province is the best sample and this clay can be even used for glazed roofing tiles. studies further confirm that sample from particular location even better than the test sample used for the comparison.

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<sup>1</sup>Department of Physics, University of Jaffna

<sup>2</sup> Ceramic Research Development Centre, Boralasgamuva



**Survey and Identification of Dragonflies (Odonata: Anisoptera)  
in Valikamam region, Jaffna.**

Sundralingam, P. and Gnaneswaran, R.

Dragonflies are predaceous insects and excellent indicators of an unpolluted environment. A field study of dragonflies was conducted to document the species composition and their distribution in Valikamam region, Jaffna. Six sampling sites (I – VI) were selected and each site was visited weekly from January through December, 2004 and adult dragonflies were sampled by sweep netting method. Body color, wing color, wing venation, shape of the head, distance between eye and other morphological features of collected dragonflies were carefully examined and specimens were identified up to generic level and where possible to species level based on morphological characters used in published keys (Borror *et al.*, 1976, Terence de Fonseka, 2000).

Nine species of two families, *Anax guttatus* (Burmeister) of family Aeshnidae, *Tramea limbata* (Desjardins), *Trithemis aurora* (Burmeister), *Trithemis festiva* (Rumbur), *Crocothemis servilla* (Drury), *Diplacodes nebulosa* (Fabricius), *Rhyothemis variegata* (Linnaeus), *Tholymis tillarga* (Fabricius), *Pantala flavescens* (Fabricius) of family Libellulidae with relative abundance of 1.84%, 3.31%, 18.38%, 6.62%, 4.05%, 11.76%, 3.67%, 6.25%, 44.12% respectively were not uniformly distributed in this region.

*P. flavescens* was the most abundant (44.12%) and widely distributed species and *A. guttatus* was restricted to Site II and found in lowest abundance (1.84%). *R. variegata* was restricted to Site V.

All nine species were already reported from various parts of Sri Lanka. However it is concluded that existence of *A. guttatus*, *T. festiva*, *D. nebulosa*, *R. variegata* and *T. tillarga* in Jaffna District is reported for the first time in this study.

## Identification of spider families found in the University of Jaffna premises

Gajapathy, K.

Records on taxonomic studies on spiders prevalent within northern Sri Lanka is not available. The last comprehensive study in Sri Lanka was done by Wijesinghe in 1990 (Benjamin, and Bambaradeniya, 2004).

The current study was performed in year 2004 from March to October in two isolated plots in the University of Jaffna premises. The first plot (plot I) in the south, and the second (plot II) in the north of the University premises. Plot I was divided into fifteen grids (each  $80 \times 100 \text{m}^2$ ), and plot II was divided into six grids (each  $70 \times 90 \text{m}^2$ ). Samples were collected twice a month from each plot to a maximum elevation of 2 m from the land level. Sample collection was done by Sweep net, Hand picking, Beat the bush, Litter collection, and Pit fall trapping. Traps were set in each grid with kerosene as killing agent.

Spiders were observed in Laboratory using light microscopes ( $\times 40$ ,  $\times 100$ , and  $\times 600$ ). Identification was done using taxonomical systematics keys (Borror *et al.* (1976), and Barrion, and Litsinger (1995)). Entrapped spiders were preserved with 75% ethanol in plastic vials. Photographs of whole spiders and prepared slides were taken.

Twelve families comprising of Therophosidae (Mygalomorpha), Dictyinidae (Aranaomorpha, Cribellata), Araneidae, Clubionidae, Lycosidae, Oxyopidae, Pholcidae, Salticidae, Sparrasidae, Thomisidae, and Zodaridae (Aranaomorpha, Acrobellata) were identified in this study.

The results illustrates a rich spider diversity within the University premises in 2004, although the impact by human activity prevailed throughout the day hours and limited in night hours.

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*Department of Zoology, Faculty of Science, University of Jaffna, Sri Lanka*



**Impact of variation in Aerial Temperature, Precipitation, and Wind Speed on the abundance of three spider families (Araneidae, Pholcidae, and Salticidae) found in University of Jaffna premises.**

Gajapathy, K.

In this study diversity and scarcity of spiders were studied in year 2004 from March to September in University of Jaffna premises.

The presence of three spider families namely Araneidae (common garden spiders), Pholcidae (daddy long legged spiders), and Salticidae (jumping spiders) were sampled twice a month by using Sweep net, Beat the bush, Litter collection, and Pit fall trapping from two plots (one in south, and one in north ) in University of Jaffna premises. Spiders were counted and set free in their original habitats.

Average aerial temperature was calculated by obtaining aerial temperature readings during sampling periods. Records of monthly precipitation (mm) and average wind speed per month (m/s) were gathered from the Meteorology Department, Jaffna.

One way ANOVA test was done for the variation in three families from March to September 2004. Biometric regression analysis was done to determine the correlation between the environmental parameters and the number of spiders collected from each family. Regression coefficient ( $R^2$ ), and probability (P) were calculated using Minitab package (Minitab 2003).

There was variation among families with month ( $P=0.000$ ). Observed P,  $R^2$  values in regression analysis for Araneidae, Pholcidae, and Salticidae with average aerial temperature ( $P = 0.052, 0.993, \text{ and } 0.204, R^2 = 56.48, 0.04, \text{ and } 29.9$  respectively), monthly precipitation ( $P = 0.405, 0.624, \text{ and } 0.185, R^2 = 14.28, 5.2, \text{ and } 32.1$  respectively), and average wind speed ( $P = 0.947, 0.364, \text{ and } 0.26, R^2 = 0.1, 16.6, \text{ and } 24.4$  respectively) for each family.

The results ( $P \text{ calculated} > 0.005$ ) concluded that there was no correlation between the abundance of these three families of spiders with the environmental parameters measured.

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*Department of Zoology, University of Jaffna, Sri Lanka.*

### **A preliminary study on plant hopper fauna of rice ecosystem in chunnagum, Jaffna**

Piranavamalar, T. and Gnaneswaran, R.

Planthoppers are sap feeding insects, cause direct and indirect damages to the crops. A preliminary survey was conducted in 2004 in order to assess the species composition of planthoppers in paddy field ecosystems of central area in Jaffna District.

A random weekly survey was performed for one year from January-December 2004. Planthoppers were collected from rice crops by sweep net and identified by using morphological characteristics.

In the present study seven different plant hoppers such as *Nisia nervosa* of family Meenoplidae, *Sogatella furcifera*, *Euidellana celodon*, *Sardina* sp., *Nilaprabata lugens*, *Perkinsiella* sp, *Harmalia anacharsis* of family Delphacidae. Among them, *Nisa nervosa* showed highest abundance in this area with 72.88% of abundance and *Sogatella furcifera* was the second most abundance comprising 21.18% of the total.

The plant hoppers which are at present said to be casual visitors, may attain pest status in due course. Therefore the accurate identification and host plant diversity in the rice ecosystem is essential to predict its pest status and to design pest management strategies.

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*Department of Zoology, Faculty of Science, University of Jaffna*

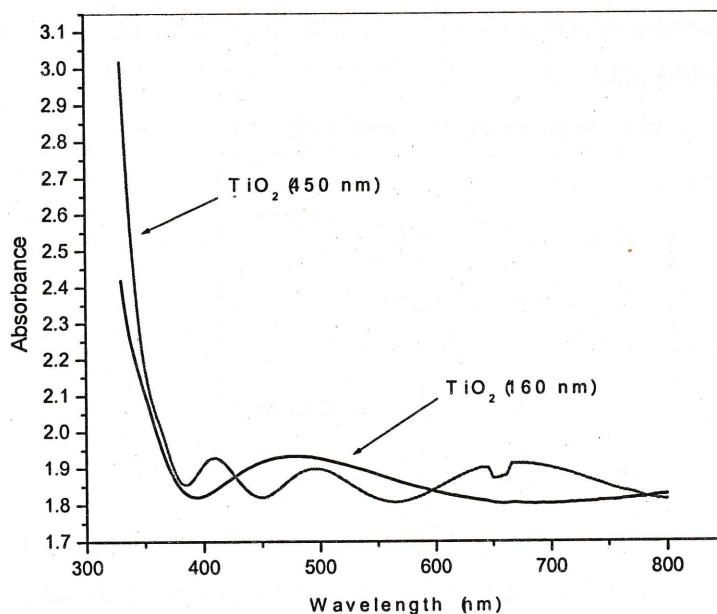


## Electrical and optical characterisation of TiO<sub>2</sub>

Kukan, S. and Ravirajan, P.

Porous TiO<sub>2</sub> materials have attracted significant interest for more than a decade due to their applications in photocatalysis, electrochromism, and gas sensing as well as dye sensitized solar cells. Interest in the application of porous TiO<sub>2</sub> to hybrid TiO<sub>2</sub> / polymer solar cells has also grown in recent years.

Here we study the electrical and optical properties of dense and porous TiO<sub>2</sub> (50 % porosity) films. Four-probe, Hall Effect techniques and UV-VIS optical absorption spectroscopy were used for electrical and optical characterisation of the TiO<sub>2</sub> films. The conductivity of porous TiO<sub>2</sub> films is about three orders of magnitude smaller than dense TiO<sub>2</sub> films at room temperatures. The conductivity of these films weakly varies upon heating in air, implying that free carriers in these films are determined by extrinsic dopants rather than nonstoichiometry. Hall effect measurement shows that the carrier concentration of dense and porous TiO<sub>2</sub> films reaches in the order of  $10^{18} \text{ cm}^{-3}$  and the both films show n-type conduction. The Hall mobility of porous TiO<sub>2</sub> is  $10^{-6} \text{ V/cm}^2$  which is in agreement with our previous measurement of time of flight mobility.



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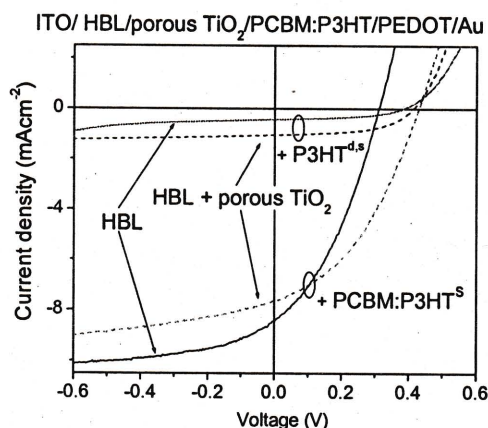
*Department of Physics, University of Jaffna, Jaffna*

## Influence of temperature on performance of hybrid Titanium dioxide / Fullerene: polymer solar cells

Haridas, K., Sivaraya, S. and Ravirajan, P.

Solar cells made from composites of conjugated polymer with nanostructured  $\text{TiO}_2$  are gaining interest on account of the stability, low cost and attractive electron transport properties of  $\text{TiO}_2$  as well as the potential for controlling interface morphology. However, the highest power conversion efficiency of this class of device has so far been limited to less than 1 % under one sun.

This study focused on the factors affecting the performance of hybrid  $\text{TiO}_2$  / poly (3-hexylthiophene) solar cells by introducing fullerene materials. Short circuit current density,  $J_{\text{SC}}$  of the solar cell is increased by more than a factor of six when fullerene material is introduced as mixed layer with polymer. The improvement is attributed due to increase in the number of interfacial sites by fullerene. The current-voltage characteristics of the improved cells were measured at wide range of temperature from 100 K to 350 K under lower light (white) intensity of  $4.5 \text{ mWcm}^{-2}$ .  $J_{\text{SC}}$  of the cell monotonically increases with temperature. This is due to increase in the mobility of the polymer at higher temperature. The improved cell incorporating fullerene material produced  $J_{\text{SC}}$  of  $0.59 \text{ mAcm}^{-2}$ , a fill factor of 0.22 and an open circuit voltage of 0.40 V under white light illumination of intensity  $4.5 \text{ mWcm}^{-2}$  at temperature of  $338^\circ\text{C}$ , resulting in an overall power conversion efficiency of 1.1 %. The poor fill factor may be attributed to an energy barrier at the  $\text{TiO}_2$  / fullerene interface.



The authors wish to thank Dr. J. R. Durrant and Prof. H. Horhold for providing the colloidal  $\text{TiO}_2$  paste and the polymer material respectively and to Dr. J. Nelson and Dr. Y. Kim for their useful discussion and help in preparing these samples in their laboratory. Authors acknowledge the Third World Academy of Science (TWAS), Italy and National Research Council (NRC), Sri Lanka for their financial assistance to the equipments we used.

*Dept. of Physics, University of Jaffna, Jaffna, Sri Lanka*



**Screening of Medicinal Plants for Anti-Cancer Activity by [<sup>3</sup>H] Thymidine  
Incorporation Assay on HL-60 Cells.**

Pathmanathan, K

A wide variety of medicinal plants have been identified to have the ability to cure various tumour cells of human origin. An attempt was made to evaluate various extracts of *Vitex negundo*, *Curcuma longa*, *Andrographis paniculata* and *Centella asiatica* for anticancer activity in HL-60 cells. In this study the rhizome powder of *Curcuma longa* and leaf powder of other plants were sequentially extracted using HPLC grade hexane, DCM, ethyl acetate, methanol and water. 25µg/ml of each extract was tested for their anti-proliferative effect on HL-60 (Human Leukaemia) cells using *in - vitro* bioassay by incorporating [<sup>3</sup>H]-thymidine into the cells at various time points. The radioactivity was measured using WALLAC 1409 Liquid scintillation counter. Protein estimation was done by Lowry's method and the results were expressed as counts per minute / milligram of protein. Dose response and time course analyses were done to the active plant extract.

The data revealed that out of five extracts from each of the four medicinal plants, methanolic extract of *C.longa*, and *A.paniculata* and ethyl acetate extract of *V.negundo* showed over 70% of inhibition when compared to control and solvent control. Whereas all other extracts including *C. asiatica* showed very less inhibitory effect. Dose response and time course analysis further revealed that a maximum of 65% inhibition was observed after 36 hours for *C.longa* and 63% and 58% maximum inhibition respectively for *V.negundo* and *A.paniculata* after 24 hrs with 10 µg/ml of each extract. Methanolic extract of *C. longa*, and *A. paniculata* and ethyl acetate extract of *V. negundo* can be taken to the next step of purification and bioassay.

I thank Department of Biotechnology, Government of India and Centre for Biotechnology, Anna University for all the assistance.

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*Department of Botany, Faculty of Science, University of Jaffna, Jaffna*

**DNA Fragmentation and Cytotoxicity Assay to Study Apoptosis in HL-60 Cells  
Induced by Ethyl Acetate Extract and Pure Compound of *Vitex negundo***

Pathmanathan, K.

Natural compounds appear to possess chemopreventive activity. Many of these agents act via programmed cell death (apoptosis). Cell death can be due to either by necrosis or apoptosis. The aim of the study was to check whether the cell death of HL-60 (Human Leukaemia) induced by ethyl acetate extract and pure compound of *Vitex negundo* is due to apoptosis or necrosis. Lactate dehydrogenase (LDH) release assay was performed using a cytotox 96 assay kit (Promega) in HL-60 cells with 10µg/ml of these two samples at two different incubation periods, 24hours and 48 hours to analysis the necrosis of the cells. Then the Percentage of cytoxicity was calculated. Internucleosomal cleavage of DNA was analysed to note the biological changes of genomic DNA on HL-60 cells by the same dose of above two samples. Actinomycin D was used as positive control. DNA was extracted using phenol chloroform and precipitated with sodium acetate. Rnase was used to remove all RNAs. DNA was run on a 2 % agarose gel containing ethidium bromide, visualized under UV and documented.

LDH assay quantitatively measures the activity of LDH, a stable cytosolic enzyme that is released upon cell lysis. Ethyl acetate extract and pure compound of *Vitex negundo* on HL-60 cells showed 9% and 5% (very less) cytotoxicity respectively at 24 hours of incubation and this was slightly increased to 12% and 7% at 48 hours. There was 3% - 6% of cytotoxicity detected in control and solvent control at both the time points. This study revealed that both the treatments induced DNA fragmentation similar to that found in positive control while control cells showed no fragmented DNA. The result indicated that the ethyl acetate extract and pure compound of *Vitex negundo* are non-toxic on HL-60 cells and the induced cell death was due to apoptosis and not necrosis.

I thank Department of Biotechnology, Government of India and Centre for Biotechnology, Anna University for all the assistance.

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*Department of Botany, Faculty of Science, University of Jaffna, Jaffna.*



**Isolation and Characterisation of Novel Anti-cancer lead Molecule from  
Ethyl Acetate Extract of *Vitex negundo***

Pathmanathan, K.

Medicinal plants have provided many effective anti-cancer agents like Vincristine, Vinblastine Taxol, Topotecan, Etoposide, Teniposide etc. which are currently in use. However a large number of medicinal plants are to be investigated further for their possible pharmacological value. This study has highlighted the bioassay-guided purification of ethyl acetate extract of *Vitex negundo* and characterisation of active pure compound using NMR and Mass Spectroscopy to obtain a lead molecule with potent anti-cancer activity. Thin Layer Chromatography (TLC) was performed to the extract, which was prepared using 100g leaf powder soaked in ethyl acetate for overnight, to find out the proper solvent system and this system was used to purify the extract using column chromatography. The compounds from this extract were separated by column chromatography and TLC for each fraction was done. Based on the TLC data all fractions showing similar profiles were pooled together and 25 µg/ml of each pooled fractions was tested for bioactivity in HL-60 (Human Leukaemia) cells at various time points. The active fraction was selected and further purification and bioassay were done. Finally active pure molecule was obtained. Dose response study was performed to the pure compound. NMR and Mass Spectrometry determined the structure of the compound.

TLC analysis revealed that 50% ethyl acetate in hexane was better solvent system for this extract. In the first stage column purification, nine fractions were obtained. The bioassay revealed that fraction No. 5 had more inhibitory effect on HL-60 cells compared to control than other fractions. Therefore this fraction was taken up for further purification by second stage column. Among the six different pure compounds obtained from fraction 5 one of the compounds markedly inhibited the growth of HL-60 cells at 24 hours of incubation. Dose response study revealed that 10 µg/ml of the pure compound inhibited 55% of the growth. Therefore the single compound was taken up for the structural elucidation. The NMR and Mass spectra confirmed the elemental composition as C<sub>14</sub>H<sub>12</sub>O<sub>5</sub>. Many more study with the pure compound at molecular level of induction of apoptosis should be performed in order to address about its activity.

I thank Department of Biotechnology, Government of India and Centre for Biotechnology, Anna University for all the assistance.

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*Department of Botany, Faculty of Science, University of Jaffna, Jaffna*

## Surveillance of Dengue Fever Vector Mosquito Breeding sites in the Vavuniya Town Area

<sup>1</sup>Srikrishnaraj, K.A., <sup>1</sup>Thurairajasingam, T. and <sup>2</sup>Surendran S.N.

Vavuniya, a populated town in Sri Lanka is known to be rapidly urbanized within the past few years due to the internally displaced people, increased commercial system and transport activities. Incidence of dengue fever has been reported in the Vavuniya district in recent years. Thus, a surveillance of environment for was carried out in houses within the Vavuniya urban area. The objective was to find out the potential breeding habitats of *Aedes aegypti* and *Aedes albopictus* mosquitoes, and *Stegomyia* indices and Breteau index in each study area.

The scope of the study was limited to the determination of distribution of Breteau

$$\text{The Breteau index} = \frac{\text{Number of positive containers} \times 100}{\text{Total number of houses searched}}$$

It considered as the best of the commonly used indices since it combines dwellings and containers and is more qualitative and of more epidemiological significance.

During the study period (December 2002 – May 2003) randomly selected 330 house holds and their backyards were searched for water holding containers and the presence of mosquito larvae/ pupae. Total of 362 water holding containers (excluding over head water tanks) were found in the study area. Among the various types of containers coconut shells (20.7%), discarded tins (20.4%), plastic containers (20.7%), and tyres (20.5%) accounted 82.3% and followed by clay pots (6.1%), ground cement tanks /fountains (4.4%), young coconut “ halves” (2.2 %), Barrels (1.7%), indoor vases (1.3%) found in the study area. Highest infestation of mosquitoes was found in ground cement tanks /fountains (68.8%) followed by tyres (58.8%), plastic containers (42.6%). However the proportion of infestation in these containers were not significantly different ( $p>0.05$ ). The Breteau index varied between nearly 22– 50% during the study period.

This study shows both *Ae. aegypti* and *Ae. albopictus* mosquito species were found in Vavuniya town area, and *Ae. aegypti* the dominant species (Larvae accounted for 87.2%). Tyres and plastic containers present in the backyard of houses play major key breeding sites in the town area.

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<sup>1</sup> Faculty of Applied Sciences, Vavuniya Campus, University of Jaffna

<sup>2</sup> Faculty of Science, University of Jaffna



## Species Composition of Home Garden in Kandy, Vavuniya and Kilinochchi

Loganathan, P.

Sri Lanka is recognized as a bio diversity “hot spot” of global and National importance. The population pressure on limited resource of land has resulted in encroachment on the forest lands converting them to plantations, settled and shifting agriculture, urban land and logging leading to deforestation. The depletion of forests has resulted in loss of bio diversity. The home garden is a typical example to conserve bio diversity. The study was carried out in Kandy, Vavuniya and Kilinochchi to study the species composition of home garden. Sixty house holds were selected in each district. The total number of species and individuals were counted in each home garden and species diversity index were calculated using Shannon- Wiener index (H). More than 237 useful plant species (99 food species, 51 medicinal species, 45 timber & firewood species, and ornamental species from 42 genera) were identified in the Kandyan forest garden, more than 141 useful plant species (59 food species, 27 medicinal species, 21 timber & firewood species, and ornamental species from 34 genera) in Vavuniya homegarden and more than 130 useful plant species (62 food species, 15 medicinal species, 25 timber & firewood species, and ornamental species from 28 genera) in Kilinochchi homegarden. The species diversity indexes of the home garden were 3.93, 2.97 and 2.23 in Kandy, Vavuniya and Kilinochchi respectively. The species composition of Kandyan forest garden is higher than Vavuniya and Kilinochchi due to distinct climatic disparities. The home garden provides a place for species conservation and conserve threatened species like *Diospyros ebenum* and *Syzygium umbrosum* and rare species like *Madhuca longifolia*, *Aegle marmelos*, and *Santalum album*. In addition to plant species home garden provide a place for birds, livestock and soil fauna. Species density increased with decreasing land size in study area and the most gardeners try to optimize their land by conserving many species. Therefore development of these types of garden with suitable crop selection for suitable climate provides a place for species conservation and it act as *in situ* conservation sites.

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*Faculty of Applied Science, Vavuniya Campus of the University of Jaffna*

### Changes in fat and fatty acid content of soybean seeds under different processing conditions

<sup>1</sup> Vasantharuba, S. and <sup>2</sup> Sivakanesan, R.

Soybean (*Glycine max*) has been considered an important world crop because it contains about 20 % fat with a high proportion of essential fatty acids such as linoleic and linolenic acids. Several studies have demonstrated that dietary essential fatty acids have many health benefits. The main objective of this experiment is to find out the changes in essential fatty acid contents with different processing conditions. Fat content and fatty acids like palmitic, stearic, oleic, linoleic and linolenic acid contents of the soybean seed samples of variety PM-25 processed under different processing conditions like baking, frying, boiling and pressure cooking and unprocessed control sample were determined. Fat and fatty acid contents were extracted by Soxhlet method and estimated by Gas Chromatographic (GC) method. When compared to control, fat content in boiled and baked samples were reduced by 3.5 and 3% respectively and they differ significantly from control. The fat content of pressure-cooked and fried samples did not differ significantly from control. The fat content of different processed samples ranged between 18.2- 19.1 %. Among different fatty acid contents of the processed samples, fried sample showed highest palmitic acid content (16.6 % of total fatty acids) and stearic acid content (4.4 % of total fatty acids) and baked sample showed highest oleic acid content (32.5 % of total fatty acids) compared with other samples. The essential fatty acids (linoleic and linolenic acid) content of processed samples, irrespective of the processing method was significantly lower compared to unprocessed sample. The percentage loss of essential fatty acids in frying, pressure cooking, baking and boiling was 9,9,15 and 15 % respectively. The linoleic and linolenic acid content of the different processed samples and control ranged between 45.9 – 52.8 and 6.0 – 9.5 % of the total fatty acids.

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<sup>1</sup>Dept. of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna

<sup>2</sup>Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya.



### Minimal processing in ash plantain

<sup>1</sup>Kentheeswaran, P. and <sup>2</sup>Sarananda, K.H.

Ash plantain is one of the major leading vegetable crop in our country. Due to its general perishable nature, it can not be stored for longer period without proper post harvest handling system in storability. On the other hand demand for minimally processed vegetable products have witnessed a rapid expansion in normal market.

Minimal processing is defined as application of post harvest handling operations while maintaining less loss in quality and quantity of products for better justification in cooking convenience. The operations were collecting, sorting, washing, cutting, peeling, slicing and packaging. The quality associated with marketing, nutritional, sensory, microbial and cooking. Therefore this study was directed to produce minimally processed ash plantain with the extension of shelf life at least one week in refrigerated condition  $8\pm 2^{\circ}\text{C}$ .

Minimal processing increases the degree of perishability of the processed products. In this different pretreatments like 1% citric acid, 0.1% citric acid, 1% lime and water (control) with different packaging materials low density polyethylene (LDPE), low density polypropylene (LDPP) were used to prevent undesirable changes and perishability.

Observations were taken out on 3<sup>rd</sup>, 5<sup>th</sup> and 7<sup>th</sup> days of storage on percentage weight loss, browning index of peel and flesh, visual quality rating, total plate counting and coliform counting. The best treatment combination was selected based on the results of the above observations.

Based on the results obtained from statistical analysis samples treated with 1% citric acid and packed in LDPE showed optimal result than others. However citric acid treated samples packed in both polyethylene, polypropylene packages provided satisfactory results. There was no significant difference observed on sensory properties like odour, flavour and overall acceptability between best-pretreated samples and freshly harvested ash plantain after one week.

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<sup>1</sup>Dept. of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna

<sup>2</sup>Senior Research officer, Food Research Unit, Gannoruwa

**The effect of Carbohydrate and Amino acids on production of  $\alpha$ -amylase  
from *Bacillus licheniformis* ATCC 6346**

Vengadaramana, A., Balakumar, S. and Vasanthy Arasaratnam

The present study is concerned with the effect of carbohydrate and amino acids on the production of  $\alpha$ -amylase by *Bacillus licheniformis* ATCC 6346. The fermentation medium was inoculated with *B.licheniformis* ATCC 6346 inoculum (20%, v/v) grown on nutrient agar medium and incubated at 42°C and 100rpm. The fermentation medium contained (g/l) soluble starch, 4.0; (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, 5.0; peptone, 6.0; FeCl<sub>3</sub>, 0.01; MgCl<sub>2</sub>.6H<sub>2</sub>O, 0.01; CaCl<sub>2</sub>.2H<sub>2</sub>O, 0.01; KH<sub>2</sub>PO<sub>4</sub>, 4.0 and K<sub>2</sub>HPO<sub>4</sub>, 7.5. When the peptone of the medium was replaced by different concentration (2-30g/l) of completely oil removed seed cakes of either sesamum or mustard, highest  $\alpha$ -amylase activities of 58.14 and 56.64 Uml<sup>-1</sup> were observed at 48 hours, at 42°C and 100rpm in 18g/l of mustard and sesamum containing media respectively. With increase in mustard and sesamum oil free cakes concentration the  $\alpha$ -amylase production also increased. The increase in  $\alpha$ -amylase production could be due to the difference in carbohydrate or protein contents, when increasing amounts of either oil cakes were added. The protein and carbohydrate content of sesamum oil free cake was 35.72 and 4.01% and that of mustard was 32.95 and 4.41% respectively. To evaluate whether the effect is due to difference in carbohydrate content to the media containing different concentration (2-18 g/l) of oil seed cakes of sesamum and mustard total carbohydrate content was kept constant by the addition of soluble starch. The highest  $\alpha$ -amylase activity obtained in the medium containing 18g/l<sup>-1</sup> mustard and sesamum were 59.27 and 50 Uml<sup>-1</sup> respectively at 48 hours, at 42°C and 100rpm. The results indicated that under these conditions the carbohydrate content had no effect on the production of  $\alpha$ -amylase. However the enzyme production in the mustard containing medium was better than that in a sesamum containing medium. As the protein contents of both sources were very clear to each other, the difference in this enzyme production could be due to the difference in the amino acid content of the proteins. Therefore the effect of amino acids on the production of  $\alpha$ -amylase was investigated. To the sesamum oil free cake (18g/l<sup>-1</sup>) the amino acids present in the mustard was supplied. When the amount of amino acids such as Tryptophan (0.11g/l<sup>-1</sup>), Histidine (0.15g/l<sup>-1</sup>), Valine (0.29g/l<sup>-1</sup>), Lysine (0.16g/l<sup>-1</sup>), Glutamicacid (1.15g/l<sup>-1</sup>), Proline (0.23g/l<sup>-1</sup>), Threonine (0.21g/l<sup>-1</sup>), Leucine (0.39g/l<sup>-1</sup>) and Alanine (0.27g/l<sup>-1</sup>) in 18g/l<sup>-1</sup> of mustard was supplemented to 18g/l<sup>-1</sup> of sesamum and mixture of these amino acids also added separately, production of  $\alpha$ -amylase in sesamum containing medium was increased by Alanine (57.42 Uml<sup>-1</sup>), Lysine (54.19Uml<sup>-1</sup>) & mixture of these amino acids (55.58 Uml<sup>-1</sup>) and decreased by Threonine (39.34 Uml<sup>-1</sup>), Leucine (34.51 Uml<sup>-1</sup>), Valine (42.48 Uml<sup>-1</sup>), Histidine (44.77 Uml<sup>-1</sup>) and Proline (36.40 Uml<sup>-1</sup>). Hence we can conclude that, Alanine and Lysine showed considerable increase on the  $\alpha$ -amylase production. Further investigation is in progress to study the effect of amino acids.



## A Preliminary Study on the Changes in Chemical and Physical Parameters of Soil Samples in Prawn Farms at Puttalam District

<sup>1</sup>Mariagnanaseelan, M., <sup>1</sup>Mageswaran, R., <sup>1</sup>Jeyadevan, J.P.,

<sup>1</sup>Senthilnathanan, M. and <sup>2</sup>Thayaparan, S.

Coastal regions of Sri Lanka such as Puttalam, Batticaloa, Jaffna and Mullaitivu have the suitable geographic and climatic conditions for prawn farming. However intensive prawn farming is observed only in Puttalam and Batticaloa districts. In our study the changes in chemical and physical parameters of soil samples in prawn farms at Puttalam district from April 2004 to October 2004 were investigated. The soil samples were collected once in a month during this period from Pinkattya, Udappu and Manalthivu areas in Puttalam district. In each selected area, four farms were chosen. Two ponds were selected in each farm and two sets of five soil samples were collected at 10cm depth from the surface of each pond; one set from the centre and others from the border/periphery. Colour and pH of the soil were noted at the site itself. Organic matter, pH, salinity, total dissolved solids (TDS), alkalinity and available magnesium, calcium, nitrate and phosphate contents of soil-water extract were measured in the laboratory.

The visual observation of the soil colour revealed that it changes from brown to black during the prawn culture period due to an increase in the organic matter [14 ( $\pm 3$ ) to 16 ( $\pm 5$ ) ppm] present in the soil. The pH of soil and soil-water extract and alkalinity did not show a uniform variation. The TDS [22 ( $\pm 8$ ) to 35 ( $\pm 14$ ) ppm] and salinity [17.5 to 25.0 ppm] increased, but the variation in the amount of magnesium and calcium was not regular. This may be due to the application of lime and dolomite during the prawn culture period and frequent exchange of water in the pond. In most of the locations the amount of phosphate [18.1 to 16.5 ppm] decreased by small quantities whereas the amount of nitrate [119.5 to 153.0 ppm] increased significantly during the prawn culture period studied.

In addition our study revealed that the chemical and physical parameters of soil samples could also vary with the farm management practices. Therefore further research need to be carried out in prawn farms with different management practices so as to find the best management practice to obtain the best harvest in prawn farming.

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<sup>1</sup>Department of Chemistry, University of Jaffna, Jaffna

<sup>2</sup>Aqua service Ltd (Pvt), Chilaw

**Identification of suitable industrial sites in Jaffna peninsula; usage of GIS  
as a tool in spatial decision making process**

Pratheeban, S., Partheepan, K., Amalraj, N., Jeyakumar, P. and Thiviyatharsan, R.

Jaffna peninsula is considered as an important region in the Sri Lanka due to its location, which points west towards the tip of Indian subcontinent and the way to the Bay of Bengal. It has suitable resources for agriculture, fishing and industrial development. The peninsula has experienced that the rapid reduction in its economy along with its past few decades due to the horrific civil war and undesirable political situation. If this district is to be an economically developed region, it is paramount to give the importance for industrial development like other sectors (agriculture and fishery etc). In this regards, an attempt was made to identify the suitable industrial locations in the peninsula through development of a computer spatial model by using Geographical Information System (GIS) as the model development tool. In this model, the importance is given to some criteria such as population density, transport facility, electricity facility, land use, land value, human health, waste management, impacts on agriculture and fishing and other beneficial surroundings.

ArcView GIS 3.2 Software was used to develop this spatial computer model. The maps for road, places, DS divisions, river and drainage channels, paddy and other field crop cultivation, and forest cover were collected and digitized to convert them as **themes**. Further, necessary buffer zones were identified by means of **buffer creator** and with the help of **geo-processing wizard**, created buffer zones were united, intersected and merged to identify the locations.



### Development of fruit leather using Bael fruit (*Aegle marmelos*)

<sup>1</sup>Kumudini, S. and <sup>2</sup>Ekanayake, S.

Bael (*Aegle marmelos*) has high medicinal value, but this belongs to underutilized or non-traditional fruit. It is neither grown commercially on large scale nor traded widely. Post harvest losses of bael are considerable the development of simple technology for small scale processors could help in reducing losses as well as being a source of income. This fruit has high vitamin C content and also has high medicinal value, when it just ripens, so leather preparation from bael will help to increase the consumption of this fruit.

The study was carried out to develop good quality fruit leather by changing sugar percent such as 10%, 20%, and 30% and boiling treatment such as boiled and not boiled (70 -75 oC for 2-3 minutes) and to evaluate the sensory properties as well as consumer acceptability of the developed product. Bael fruits were purred, sweetened, acidified and dried to these sheets of leather kms was added as a preservative to increase the shelf life of the product. Then the sensory properties were evaluated using a hedonic rating test. physical chemical properties of developed product were evaluated by proximate analysis important chemical properties such as moisture content, total soluble solid, pH, titratable acidity, reducing sugar and vitamin C content were evaluated. Treatment combination give high vitamin C content to this product. According to the statistical analysis there was a significant difference at 5% significance level among the different sugar percent and boiling treatment in terms of colour, odour, texture, appearance and overall acceptability but taste and chewingness among the different sugar levels and boiling treatment out of the six samples 10% sugar and un boiled pulp leather sample the best performance in terms of colour, appearance, texture, chewingness and overall acceptability.

Preliminary studies revealed that the 6mm to 7 mm initial thickness of the leather was best for further production of bael leathers. There is significant difference in terms of colour, odor, texture, appearance and overall acceptability among the leather produced with different sugar percent and boiling treatment. There is no significant difference in terms of taste and overall acceptability among different treatments. 10% sugar level and un boiled pulp leather sample was ranked as best for its sensory properties and has highest acceptability or extremely likes. 20% sugar and boiled pulp leather sample has moderate acceptability. 30% sugar and boiled and un boiled pulp leather sample are not very satisfactory or extremely dislikes.

When we increase the sugar percent up to 40% level, which gives the unsatisfactory product, so select low level of sugar percentage to product development which is advantage to the diabetic patient. Some sample were showed unsatisfactory odor and colour so this changed by adding artificial flavors and colouring materials. No significant difference among samples with different sugar percent and boiling treatment in terms of chewing ness. So this should be correct by increase the moisture content of the developed product by 15% to 20%. Further studies should be carried out to determine the shelf life of the developed product by giving different storage conditions and packaging.

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<sup>1</sup>Department of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna

<sup>2</sup>Senior Research officer, Food Research Unit, Gannoruwa



**Plant Growth Enhancement of Selected Fungi and Pathogenic Fungal  
Inhibition by *Trichoderma* sp.**

Thurairatnam, S. and Niranjana, K.

The fungus, *Trichoderma* sp. was isolated from soil and pure cultures were kept in Carrot Agar medium. The soil borne pathogenic fungi *Fusarium* sp., *Rhizoctonia* sp. and *Pythium* sp. were isolated from the infected leaf spots of *Thespesia*, wilted tomato plant and damping off of mungbean seedlings respectively. Stock culture of *Gliocladium* sp. was used. Pure cultures were kept in Potato Dextrose Agar medium and these were maintained under the laboratory conditions (temperature 30°C and relative humidity 70-80%). Viability test was performed to determine the percentage of viability of seeds of rice and green gram and the percentage of viability was 100%. All the experiments were done with four replicates for the accuracy.

An experiment was performed with *Trichoderma* sp. and *Rhizoctonia* sp. to test the growth enhancement effect on seed germination and seedling growth of rice and green gram. Testing was performed after 48 hours and 72 hours for the rice and 24 hours and 48 hours for the green gram. Another experiment with Agar Disc method was used to test antagonistic effect of *Trichoderma* sp. against the soil borne pathogenic fungi, and the interactions between *Trichoderma* sp. and these fungi were also tested. The data were analyzed statistically with the MINITAB software and wherever appropriate ANOVA and two sample t-tests were performed.

It is concluded that *Trichoderma* sp. induced the growth of coleoptyl and root growth in rice and hypocotyls and root growth in green gram. But *Rhizoctonia* sp. had no effect on either of the two. There is no fungal growth observed in the plates with *Trichoderma* sp. while the control fungi disc had growth. *Trichoderma* grew on the plate by coiling the hyphae of soil borne fungal plant pathogens. As a result it suppresses the growth of those pathogens either by coiling or secreting extracellular enzymes to digest them. This phenomenon is an important issue in acting as a biocontrol agent. So there is potential for the usage of this organism in controlling soil borne fungal plant diseases.

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*Department of Botany, Faculty of science, University of Jaffna.*

### Study on post harvest dip treatments of Willard mangoes (*Mangifera indica* L.)

Ambalavanar, S. and Krishnapillai, N.

135 fully mature green colour Willard Mangoes with red colour shoulder were harvested at Thirunelveli area, Jaffna, Sri Lanka for post harvest treatments. Fruits with length of 1 cm stalk were dipped in saturated NaCl solution, 10% garlic extract, 10 % ginger extract and 10 % pepper extract separately for 10 minutes. This study was carried out from February 2004 to February 2005.

Treated fruits and fruits with out treatment (control fruits) were allowed for normal ripening. They were stored at ambient condition (30-34°C and 70 – 85% RH). Storage life was 8 days in NaCl, garlic extract, ginger extract and pepper extract treatments and fruits with out treatment. The TSS (Total Soluble Solids) and pH of the fruits increased rapidly during ripening whereas TTA (Total Titratable acidity) decreased. There was significant difference observed in TSS and TSS: TTA ratio of fruits with out treatment and ginger, garlic treated fruits and no significant difference observed in pH and TTA. Colour development was high in fruits with out treatment and better colour development was in garlic and pepper treated fruits. Taste of fruits treated with ginger was excellent. Garlic treated fruits and fruits without treatments were also very good in taste.

TSS, TTA and pH of ginger treated fruits after ripening was 20.08°Brix,  $15 \times 10^{-5}$  g/ml, and 5.92 while in garlic treated fruits were 18.58°Brix,  $21 \times 10^{-5}$  g/ml and 5.86 respectively. TSS, TTA and pH of fruits without treatment they were 17.28°Brix,  $10 \times 10^{-5}$  g/ml and 5.98.

Low disease development was observed in garlic (score-4.83), ginger (score-4.75) and NaCl (score-3.83) treated fruits compared with fruits with out treatment. The spoilage percentage (30%) was high in fruits with out treatment compared with other treatments. Tasting panel results of fruits treated with ginger was excellent by 73% and it was 33% in fruits without treatments. Ginger treated fruits were best in quality due to the tasting panel results, low disease development and low percentage of spoilage.

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*Department of Botany, Faculty of Science, University of Jaffna*



**Purification of extracellular  $\alpha$ -amylase produced by *Bacillus licheniformis* ATCC 6346**

Vengadaramana, A., Balakumar, S. and Vasanthy Arasaratnam

This study was aimed at the purification of  $\alpha$ -amylase produced by *Bacillus licheniformis* ATCC 6346 in fermentation medium at 42°C and at 100rpm. The fermentation medium contained (g/l) soluble starch, 4.0;  $(\text{NH}_4)_2\text{SO}_4$ , 5.0; peptone, 6.0;  $\text{FeCl}_3$ , 0.01;  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ , 0.01;  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ , 0.01;  $\text{KH}_2\text{PO}_4$ , 4.0 and  $\text{K}_2\text{HPO}_4$ , 7.5. The spent medium contained 37.5  $\text{Uml}^{-1}$   $\alpha$ -amylase activity and 1.77  $\text{mgml}^{-1}$  protein. To purify the enzyme it was subjected to fractional precipitation by adding solid  $(\text{NH}_4)_2\text{SO}_4$  from 10 to 70% saturation. Highest enzyme activity was precipitated at 50% saturation with  $(\text{NH}_4)_2\text{SO}_4$ . Hence for the purification studies the enzyme was precipitated with 50% saturation of  $(\text{NH}_4)_2\text{SO}_4$ . The precipitate was dissolved in distilled water and dialysed against distilled water. The residue contained  $\alpha$ -amylase activity of 125  $\text{Uml}^{-1}$  and 1.907  $\text{mgml}^{-1}$  protein. The recovery of  $\alpha$ -amylase by  $(\text{NH}_4)_2\text{SO}_4$  precipitation was 66.6% showing specific activity of 65.54  $\text{Umg}^{-1}$  protein. The dialyzed enzyme was loaded on ion-exchange (DEAE-Sephrose) column (1 x 5 cm) and equilibrated with 0.01M Tris buffer (pH 8.0). The enzyme was eluted with the same buffer containing 0-0.8 M NaCl. Fractions 37-47 showed enzyme activity and poole of 11 fractions (purified) contained 38.33  $\text{Uml}^{-1}$  enzyme activity and 0.2205  $\text{mgml}^{-1}$  protein. The recovery of  $\alpha$ -amylase by ion-exchange was 55.2% showing specific activity of 174.14  $\text{Umg}^{-1}$  protein. The enzyme sample purified by ion-exchange chromatography was separated by Sodium dodecyl sulfate-polyacrylamide gelelectrophoresis. The electrophorogram showed a single band for the purified enzyme, with molecular weight of the purified enzyme was 55.54 kDa.

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*Department of Biochemistry, Faculty of medicine, University of Jaffna, Sri Lanka*

### Cross inoculation of different isolates of bacterial wilt pathogen (*Ralstonia solanacearum*)

<sup>1</sup>Ponnampalam, N. and <sup>2</sup>Indra Ariyaratne

The experiment was carried out under green house condition at HORDI, Gannouwa from 17<sup>th</sup> of July 2004 to 15<sup>th</sup> of November 2004, to find out the phylogenetic relationship between crops affected by *Ralstonia solanacearum*. Phylogenetic relationship was determined using Potato, Tomato, Bringal, Chilli, Ground nut, Ginger, Cucumber, Bittergourd, Luffa, Pumpkin and Snake gourd with its popular varieties. Complete Randomized Design was used for the experiment.

The tested plants were inoculated one month after planting when they were at five leaf stage, using three different isolates that collected from Brinjal, Tomato and Ginger.

Bacterial inocula were prepared using one day culture on SPA slant media. Two different inoculation methods were used, root and stem inoculations. The soil moisture was maintained at a high level and temperature was maintained at 32C. to 37C inside the screen house. The inoculated plants were observed daily, readings were taken in weekly interval and bacterial wilt symptoms were recorded according to a scale of 0-5. The disease percentage and disease index were calculated and data were used for the statistical analysis.

Most of the cucurbitaceous plants comparatively low susceptibility to tomato isolates. We can rotate cucurbits with tomato. Ground nut plants were highly affected by ginger isolate. We can't rotate ginger with ground nut. Bitter gourd was highly sensitive to ginger isolates; because of this we can't rotate ginger and bitter gourd. SM 164 Brinjal and KA2 Chilli show significant resistant to ginger.

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<sup>1</sup> Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna

<sup>2</sup> Head, Division of Plant Pathology, HORDI, Gannoruwa



**Quality assessment of karthacolomban mangoes (*Mangifera indica* L.) in  
different markets of Jaffna**

Mahathevan, T. and Krishnapillai, N.

60 ripened mangoes were obtained from different markets in Jaffna to assess the quality of fruit; Total soluble solids (TSS), Titratable acidity (TA), pH, moisture content, ash content, colour of fruits and tasting panel results were considered to assess the fruit quality in this study.

After 90 days from full bloom stage, 60 mature green colour Karthacolomban mangoes were harvested from 10 year old mango tree at Thirunelvally, and kept for normal ripening in the Department of Botany, University of Jaffna. Yellow mixed with green (colour score 4.1) was observed after ripening in fruits picked from the tree (control). pH, TSS and TA of ripen Karthacolomban mangoes were 5.8, 21.3°Brix and 10.3mg/100ml respectively. Moisture content of fruits picked from tree was 80.8% and ash content was 6.4%.

Considering the pH, TSS and TA of Karthacolomban, there was significant difference, observed between the fruits from different markets and fruits picked from the tree (control). Among the 10 markets, highest value of TSS (21.3°Brix) in fruits from Chavakachcheri, highest value of pH (5.8) in fruits from Chankanai, Point Pedro and Kodikamam, highest value of TA (13.1mg/100ml), lowest value of pH (5.3) and TSS (14.3°Brix) in fruits from Jaffna, highest value of moisture content (81.9%) in fruits from Chankanai, and highest value of ash content (10.2%) and lowest value of TA (8.8mg/100ml) in fruits from Point Pedro were observed. Appearance of fruits in all markets was very good after ripening.

Normal ripened fruits were best in quality. On the basis of tasting panel result, fruits picked from tree (control) were excellent by 55% and fruits from Kodikamam market were excellent by 45%. Fruits from Kodikamam also had high colour scoring (3.7) next to control. Among the ten markets in Jaffna, Kodikamam market was best for getting Karthacolomban mangoes considering the colour and taste panel results.

**Preliminary studies on the selection of thermostable alkaline xylanase producing bacteria**

Kapilan, R. and Vasanthi Arasaratnam

This study was aimed at selecting a thermostable alkaline xylanase producing bacterial strain. Among the bacterial strains available in the laboratory, isolated from cow dung, hot rice water, water used in autoclave, opened xylan agar plate and beet root peel, the strains, which were expected to produce alkaline xylanase, isolated from opened xylan agar plate medium (GS<sub>7</sub>, GS<sub>15</sub>, GS<sub>17</sub>, GS<sub>20</sub> & GS\*) were selected. The activated bacterial strains (18h old, 20% v/v) were transferred into fermentation medium containing (g l<sup>-1</sup>) xylan, 20.0; peptone, 2.0; yeast extract, 2.5; CaCl<sub>2</sub>·2H<sub>2</sub>O, 0.005; MgCl<sub>2</sub>·6H<sub>2</sub>O, 0.005; FeCl<sub>3</sub>, 0.005; K<sub>2</sub>HPO<sub>4</sub>, 2.5; KH<sub>2</sub>PO<sub>4</sub>, 1.0; NaCl, 0.1 and (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, 2.0 at pH 7.0 and incubated at 40°C and 100 rpm. The strains were grown in the fermentation medium at different pH values (7.5, 8.0, 8.5, 9.0 & 10.0) at 40°C and 100 rpm. Highest growth (600nm) obtained for GS<sub>7</sub>, GS<sub>15</sub>, GS<sub>17</sub>, GS<sub>20</sub> and GS\* were 2.27 (16h), 2.375 (16h), 2.35 (17h), 1.85 (11h) and 2.14 (16h) respectively at pH 8.0 and for GS<sub>7</sub>, GS<sub>15</sub>, GS<sub>17</sub>, GS<sub>20</sub> and GS\* were 2.04 (15h), 2.26(16h), 2.02 (16h), 2.22(16h) and 2.25 (12h) respectively at pH 8.5. Alkaline xylanase activity measured at pH 8.5, produced by GS<sub>7</sub>, GS<sub>15</sub>, GS<sub>17</sub>, GS<sub>20</sub> and GS\* at pH 8.5 were 16.5, 18.9, 25.6, 18.6 and 23.5 Uml<sup>-1</sup> (30h) respectively and at pH 9 were 13.6, 9.6, 20.38, 10.4 and 14.73 Uml<sup>-1</sup> (30h) respectively. Xylanase production by GS<sub>17</sub> and GS\* was less affected than GS<sub>7</sub>, GS<sub>15</sub> and GS<sub>20</sub> when the pH of the medium was changed from 8.5 to 9.0. Further, xylanase production by GS<sub>17</sub> and GS\* was better than by GS<sub>7</sub>, GS<sub>15</sub> and GS<sub>20</sub> when the pH of the medium was maintained at 8.0, 8.5 and 9.0, during fermentation. Therefore GS<sub>17</sub> and GS\* were selected as the best alkaline xylanase producers among the strains. Then the bacterial strains were activated at pH 9 and inoculated into the fermentation medium (20%, v/v) at pH 9 and incubated at different temperatures (35, 40, 45, 50, 55 & 60°C) and 100 rpm. Though both GS<sub>17</sub> and GS\* produced xylanase at higher temperatures, the xylanase production by GS<sub>17</sub> after 39 hours of fermentation was 1.217 times more at 40°C, 1.311 times more at 45°C, 1.165 times more at 50°C and 3.204 times more at 55°C, than GS\*. GS\* did not produce xylanase at 60°C while GS<sub>17</sub> produced 4.25 Uml<sup>-1</sup> (30h) of xylanase activity. GS<sub>17</sub> was selected as the best thermostable alkaline xylanase producer for further studies because it gave higher xylanase enzyme activity in alkaline pH and at high temperatures. Further studies are underway to improve the strain and to optimize the fermentation medium and culture conditions to increase the xylanase production.

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*Department of Biochemistry, Faculty of Medicine, University of Jaffna, Sri Lanka*



**Production of  $\alpha$ -amylase by *Bacillus licheniformis* ATCC 6346 in fermenter  
under controlled conditions**

Vengadaramana, A., Balakumar, S. and Vasanthy Arasaratnam

Application of enzymes in industrial processes requires their production at large scale in bioreactors. Product yield depends on cell density and also on cell specific productivity. Already the production of  $\alpha$ -amylase by *Bacillus licheniformis* ATCC 6346 has been optimised in shake flasks and this is scaled up to large laboratory fermenter level. Production of  $\alpha$ -amylase by *Bacillus licheniformis* ATCC 6346 was studied in 3L laboratory scale fermenter which contained 2L fermentation medium. Single colony of *Bacillus licheniformis* ATCC 6346 from nutrient agar slants (grown at 37°C for 24h) was transferred to activation medium incubated at 42°C in a rotary shaker (100rpm) for 12 hours and used as inoculum. The nutrient agar medium contained (g l<sup>-1</sup>) nutrient agar 25.0 and starch 3.0 and the activation medium contained (g l<sup>-1</sup>) meat extract, 10.0; peptone, 10.0; NaCl, 5.0 and soluble starch 3.0 at pH 7.0. The fermentation medium was inoculated with 20% (v/v) inoculum and incubated at 42°C and 100rpm. The fermentation medium contained (g l<sup>-1</sup>) soluble starch, 4.0; (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, 5.0; peptone, 6.0; FeCl<sub>3</sub>, 0.01; MgCl<sub>2</sub>.6H<sub>2</sub>O, 0.01; CaCl<sub>2</sub>.2H<sub>2</sub>O, 0.01; KH<sub>2</sub>PO<sub>4</sub>, 4.0 and K<sub>2</sub>HPO<sub>4</sub>, 7.5. In shake flasks 48.82 Uml<sup>-1</sup>  $\alpha$ -amylase activity was obtained at 36 hours, at 100rpm and at 42°C but in 3L fermenter no amylase activity was obtained at 36 hours, at 100rpm, 42°C and at 0.6 vvm aeration. When the fermentation was continued the enzyme production was started (1.50 Uml<sup>-1</sup>) at 48 hours and reached the maximum (13.59 Uml<sup>-1</sup>) at 104 hours. When the agitation rate of the medium in the fermenter was varied from 100 to 200rpm, the activity of amylase and growth of organism (OD<sub>600nm</sub>) at 100, 150 and 200 rpm obtained were 5.15, 12.32 & 36.76 Uml<sup>-1</sup> and 2.02, 2.14 & 3.28 respectively at 72 hours, at 0.6 vvm aeration and at 42°C. After the inoculation, the dissolved oxygen percentage immediately reduced to zero and started to increase after 57 hours at 200rpm and this could be the reason for the delayed enzyme production. Therefore the aeration was increased from 0.6 to 1.2 vvm. At 1.2 vvm aeration and at 200rpm maximum  $\alpha$ -amylase activity (35.05 Uml<sup>-1</sup>) was obtained at 52 hours. At 1.2 vvm aeration, the mixing of the medium in the fermenter was varied, the activity of  $\alpha$ -amylase and growth of the organism (OD<sub>600nm</sub>) at 200, 300 and 400 rpm were 4.61, 51.17 & 8.76 Uml<sup>-1</sup> and 3.17, 3.78 & 4.96 respectively at 28 hours and 42°C. When the temperature of the medium in fermenter was varied from 37 to 46°C, the activity of amylase, growth of organism (OD<sub>600nm</sub>) and dry mass of cells at 37,

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42 and 46°C were 50.422, 51.17 & 34.71 Uml<sup>-1</sup>, 4.17, 3.78 & 3.63 and 2.36, 2.02 & 1.18 mgml<sup>-1</sup> respectively at 28h, 300rpm and at 1.2vvm aeration. For further scaling-up studies 42°C, 1.2 vvm and 300 rpm were selected. Under these conditions 51.17 Uml<sup>-1</sup> of  $\alpha$ -amylase was produced at 28 hours. In shake flask, maximum  $\alpha$ -amylase activity (48 Uml<sup>-1</sup>) was obtained at 36 hours, at 42°C and 100rpm but in fermenter, maximum  $\alpha$ -amylase activity (51.17 Uml<sup>-1</sup>) was obtained at 28 hours, 42°C, at 1.2 vvm and 300rpm therefore fermentation in 3L fermenter improved the  $\alpha$ -amylase production by 1.06 fold and reduced the time by 8 hours.



**Evaluation of the Performance of Okra (*Abelmoschus esculentus*. L) Germplasms on  
Calci red yellow lactosol Under the Recommended Cultural Practices.**

<sup>1</sup>Arooran, K. and <sup>2</sup>Arulnandhy, V.

Eight okra (*Abelmoschus esculentus* L.Moench) genotypes, consisting of five newly bred lines, standard check variety Haritha and control varieties Jaffna local and Paal vendi, were grown in the soil classified as calci red yellow lactosol as monoculture during yala season, 2005 in Jaffna region (Agro ecological region DL<sub>3</sub>) to evaluate their performance and suitability for cultivation. All the eight okra varieties/lines were arranged in a Randomized complete block design (RCBD) with three replicates. Data on days to flower initiation and 50%flowering, plant height at the first and last pick, yield, fruit characters, incidence of pod borer (*Earias vitella*), incidence of Yellow Vein Mosaic Virus(YVMV), palatability and shelf-life of fruits were collected. The data were subjected to standard ANOVA with Duncan Multiple Range Test and also correlation analysis was performed for the yield, fruit characters and insect pest incidence.

Among eight okra genotypes tested two elite lines P<sub>23</sub> and TV<sub>8</sub> showed significantly better performance than the rest. The lines P<sub>23</sub> and TV<sub>8</sub> showed 93.07% and 80.89% of yield increase respectively over a local genotype Paal vendi, which was a control included in this experiment, meanwhile P<sub>23</sub> and TV<sub>8</sub> showed 14.43% and 7.21% of yield increase over the standard check variety Haritha. In P<sub>23</sub> there had been an increase of 73.33% and 32.94% in number of fruits /plant over Paal vendi and Haritha, respectively but TV<sub>8</sub> gave 26.66% and 11.76% increase in number of fruits per plant over Paal vendi and Haritha, respectively.

Incidence of Pod borer in P<sub>23</sub> and TV<sub>8</sub> was 12.6% and 15.4% respectively, found to be comparatively low among the varieties tested whereas Incidence of YVMV wasn't noticed at all in both lines P<sub>23</sub> and TV<sub>8</sub>. Palatability and consumer performances were found to be comparatively high for the lines P<sub>23</sub> and TV<sub>8</sub>. The growth and development of P<sub>23</sub> and TV<sub>8</sub> were vigorous and good and each variety can be identified by their unique characteristics. By considering all the important economic characters, the okra lines P<sub>23</sub> and TV<sub>8</sub> appear to be the potential genotypes (varieties) for Jaffna region. However, further testing is needed to ascertain their validity.

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<sup>1</sup>Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna

<sup>2</sup>Department of Agronomy, Faculty of Agriculture, Eastern University of Sri Lanka

**Comparison of kinetic properties of crude and purified  $\alpha$ -amylase from *Bacillus licheniformis* ATCC 6346 with commercial amylase from *Bacillus licheniformis***

Vengadaramana, A., Balakumar, S. and Vasanthi Arasaratnam

Thermostable  $\alpha$ -amylases are generally used for industrial applications. Kinetic properties of crude and purified extra-cellular thermo-stable  $\alpha$ -amylase from *Bacillus licheniformis* ATCC 6346 were compared with commercial (Termamyl<sup>R</sup>, NOVO industries from Denmark)  $\alpha$ -amylase from *Bacillus licheniformis*. The influence of incubation time on the production of reducing sugar from starch (20gl<sup>-1</sup>) was studied for 60min at pH 7.0 and 85°C. Commercial and crude  $\alpha$ -amylases showed zero order kinetics for 10min while purified  $\alpha$ -amylase showed zero order kinetics for 8min. The activities of crude, purified and commercial  $\alpha$ -amylases were measured at different temperatures ranging from 40 to 95°C and the optimum temperature for the activities of crude and purified enzymes was 85°C while that for the commercial enzyme was 90°C. The optimum pH was 7.0 for the crude, purified and commercial enzymes at 85°C with starch (20gl<sup>-1</sup>). Michaelis constants for crude, purified and commercial enzymes to soluble starch were 0.47, 1.42 and 0.71 gdl<sup>-1</sup> respectively at pH 7.0 and at 85°C. When the crude enzyme was pre-incubated at 85°C and at pH 7.0, it lost 40% of its initial activity at 10min while the purified enzyme lost 75% of its initial activity at 10min and the commercial enzyme did not lose activity at 10min. When the crude and purified  $\alpha$ -amylases were pre-incubated with 1 mM Ca<sup>2+</sup>, 100% of initial enzyme activities were retained at 60min at 85°C and pH 7.0. Thus Ca<sup>2+</sup> stabilizes the  $\alpha$ -amylase from *Bacillus licheniformis* ATCC 6346. Substrate specificity for crude and purified enzymes were carried out. Crude and purified enzymes showed 19, 77.7 & 20.3 and 107,60, & 20% of relative activities respectively with amylose, amylopectin, and maltose when compared to soluble starch at 85°C and pH 7.0. Both crude and purified enzymes showed no activity with cellulose, sucrose and pullulan. Therefore substrate specificity indicated, that both purified and crude  $\alpha$ -amylases were able to hydrolyse mainly starch, amylose and amylopectin.

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Department of Biochemistry, Faculty of Medicine, University of Jaffna, Sri Lanka



### Isolation of $\alpha$ -amylase producing bacteria by Gel Micro Droplet method

Vasanthi Arasaratnam, Thayaanathan, K. and Balakumar, S.

When conventional microbial cultivation conditions are used to study populations present in environmental samples, almost 99% of the microbial diversity is unable to grow and form visible colonies on agar-plates. These unrecovered microorganisms represent the source for novel enzymes or other metabolites, which could be of biotechnological interest. The aim of this study was to isolate an  $\alpha$ -amylase producing bacterium. Gel Micro Droplets (GMDs) were formed by quickly spraying the polymer solution (diluted cell suspension containing sample, 5ml mixed with 50ml of sterile, pre-reduced 3%(w/v) sodium alginate containing 0.45% soluble starch) through a needle with 0.2mm diameter into 0.5M  $\text{CaCl}_2$  solution to form micro dropletets or micro beads to contain approximately one cell per bead. Isolated bacteria were cultured in enrichment medium containing ( $\text{gl}^{-1}$ ) starch 5.0; yeast extract 1.0; and NaCl 1.0 and transferred to nutrient agar media containing 0.3% starch. Ninety samples were isolated from horse dung (60 samples) and lake soil samples (30 samples) using the GMDs method. Isolated 60 strains were transferred from slants to activation medium containing ( $\text{gl}^{-1}$ ) meat extract 10.0; peptone 10.0; NaCl 3.0 and soluble starch 3.0 at pH 7.0. Among these strains, 22 strains showed growth (OD) more than 1.00 at 610 nm. Of the 22 strains 7 were from horse dung and 15 were from lake soil samples. These 22 strains were activated in activation medium at 37°C and at 120 rpm for 16h and transferred (20% v/v) to fermentation medium containing ( $\text{gl}^{-1}$ ) soluble starch 3.0;  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$  0.005;  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$  0.005;  $\text{FeCl}_3$  0.005;  $\text{K}_2\text{HPO}_4$  2.5;  $\text{KH}_2\text{PO}_4$  1.0; peptone 2.0; NaCl 1.0; and  $(\text{NH}_4)_2\text{SO}_4$  2.0 at pH 7.0 and incubated at 37°C. All the seven strains from horse dung utilized starch but did not produce  $\alpha$ -amylase. Among the fifteen bacterial strains selected from lake soil samples, all the strains utilized starch, two strains did not produce  $\alpha$ -amylase while nine strains produced  $\alpha$ -amylase activity between 0-0.5  $\text{Uml}^{-1}$ , one strain produced  $\alpha$ -amylase activity between 0.51-1.0  $\text{Uml}^{-1}$ , two strains produced  $\alpha$ -amylase activity between 1.0 and 1.5  $\text{Uml}^{-1}$ , and one strain produced  $\alpha$ -amylase activity between 3.5 and 4.0  $\text{Uml}^{-1}$  at 24h. Among the strains isolated from lake soil, strain SL19 showed highest  $\alpha$ -amylase activity (5.88  $\text{Uml}^{-1}$ ) at 48h in fermentation medium and hence selected for further studies. The strain SL19 gave highest  $\alpha$ -amylase activity in the activation medium (6.8  $\text{Uml}^{-1}$ ) than in the fermentation medium (4.84  $\text{Uml}^{-1}$ ) at 36h. The  $\alpha$ -amylase produced by strain SL19 was active at pH 7.0 and from 55 to 95°C, showing the highest activity at 70°C. SL19 produced  $\alpha$ -amylase was active at 70°C and from pH 3.0 to 9.0 showing highest activity at pH 7.0 and 95% of highest activity at pH 9.0. The enzyme showed 100% stability for 1hour at 70°C and pH 7.0. Further studies are in progress to characterize the strain.

### Newtonian behaviour analysis of soy-bean oil in degumming

<sup>1</sup>Prabhakaran, M. and Rakshit, S. K.

Degumming of crude soybean oil achieved by using microbial enzyme through power mixing. Power consumption per unit volume calculated according to Reynolds number, which can be determined by using viscosity and density of crude, water degummed and enzymatic degummed oil. Liquid extract from fruit and vegetables products are usually classified as pseudo plastic. These fluids are characterized by an apparent viscosity ( $\mu_a$ ) that decreases as the shear rate increases. It is a general observation that the behavior of solution of long chain molecules and suspension fluid can be fairly well represented by the equation ( $\mu = m \dot{\gamma}^{-n}$ ). The parameter  $m$  and  $n$  can be calculated from data obtained from suitable Brook's field viscometer. The value of  $n$  indicates the extent of departure from Newtonian behavior whereas  $m$  is more nearly a measure of viscosity or consistency. The Newtonian behavioral analysis curve developed from the shear stress on the stationary cylinder is observed as a function of shear rate by varying Solution of long chain molecules and suspension do not in general follow this simple law. If measurement are made at different velocity gradients (Shear rates), the ratio  $\sigma / \dot{\gamma}$  (Shear rate) will not be constant.

Viscosity measurement is calculated under the power rule of Newtonian fluid, which by the rotational Brook-field viscometer at various rotational speed (rpm). Equation was derived from the working principle of brook field viscometer at various rotational speed (rpm) verses viscosity (centi Poise) at 40 ° C. Newtonian nature of Soybean oil reveled in the graph of shear stress and shear rate linear relationship and flow behaviour index ( $n$ ) found to be 1.0 . The apparent viscosity of crude Soy bean oil at various stages were presented in the graph of log rps vs log viscosity, is found to be  $0.04 \pm 0.005$  Pa.s.

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<sup>1</sup>Department of Agricultural Engineering, Faculty of Agriculture, University of Jaffna.



### Physico - chemical changes during extraction and clarification of guava juice

<sup>1</sup>Mahendran, T. and <sup>2</sup>Grandison, S.

Enzyme treatment of guava puree was optimized for yield and clarity by determining the most effective concentration with varying incubation time and temperature. The optimum time for the pectinase treatment was determined in an experiment in which samples of the puree were drawn at 30 min during the course of the treatment, immediately afterwards accomplishing the enzyme inactivation by heating the puree to 90°C for 5 min. The application of commercial enzyme Pectinex was optimal at the concentration of 500ppm for 120 min at 50°C. As the enzyme concentration and incubation time increased, a gradual increase in total soluble solids and titratable acidity observed along with the decrease in pH and viscosity compared with control. At 120 min of enzyme treatment, there was an increase in the ascorbic acid content of the juice without an appreciable increase in the yield of juice.

The pressed juice was cloudy but after addition of fining agent and filtration, a clear juice with light yellow colour was obtained. During the extraction and clarification of guava juice, the important physical and chemical changes were monitored. Six extractions of the juice on a pilot plant scale gave the following average results for cloudy juice: juice yield 84.7%, soluble solids content 13.7%, titratable acidity 0.62%, pH 3.98 and ascorbic acid content of 91mg/100g. There was a significant decrease in viscosity of 65.2% in the pulp treated with enzyme compared to the natural pulp. The increase in reducing sugars of 204.7% in the enzyme-treated pulp is associated with the hydrolysis of pectic enzyme on pectins and as well as the hydrolysis of non-reducing sugars. The decrease in (74.5%) total phenolic content after the fining suggests that most of the tannins were precipitated and the phenolic compounds remain with the filtered out particles. There were no significant differences observed in pH and titratable acidity of the treated and untreated guava pulp and juice and that could be related to the characteristics of the juice.

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<sup>1</sup>*Department of Agronomy, Eastern University, Chenkalady (E.P).*

<sup>2</sup>*School of food BioSciences, University of Reading, Reading RG6 2AP, UK.*

**Effect of pressure, trajectory angle and riser height on uniformity  
co-efficient of sprinkler irrigation**

Punitharajah, M. and Mikunthan, T.

Uniformity of water distribution is a very important component in the sprinkler irrigation for effective efficient irrigation. System parameters such as pressure, trajectory angle and riser heights are influencing the uniformity of the water application system. Hence a field study was conducted with the objective of evaluation of the sprinkler system by changing the parameters of pressure, trajectory angle and riser heights and to find out the best combination of these parameters by comparing with the internationally accepted standard.

Already installed side winder 200 low flow type (SW 200 LF) full circle impact sprinklers with barn door type nozzles were selected. In preliminary test level equal discharge rate sprinkler nozzles were selected with out significant difference in discharge. Randomly selected five pressure heads of 0.4, 0.6, 0.8, 1.0 and 1.2 bar were used with five different trajectory angle  $-8^\circ$ ,  $0^\circ$ ,  $8^\circ$ ,  $16^\circ$  and  $24^\circ$  at three different riser heights 85, 60 and 30 cm with four replicates. Twenty catch cans were placed around each sprinkler location to collect water.. Christiansen's uniformity co-efficient model was used to calculate the uniformity of water distribution and it was compared with internationally accepted level of 85%.

The statistically analyzed results showed that there are main factor and interaction factors effect significantly. However the effect of pressure and trajectory angle on the uniformity co-efficient is higher than that of riser height. The trajectory angle of  $-8^\circ$  was rejected in the initial level of the evaluation since 50% of catch cans were not receiving the water. The trajectory angle of  $0^\circ$  was not given good performance for all combinations of pressure and riser height There were no any acceptable combinations for the pressure of 0.4 and 0.6 bar, except for  $16^\circ$  for 0.6 bar with 85 cm riser height.. There was a tendency to increase in uniformity co-efficient values as trajectory angle increases at each pressure head of different riser height. The trajectory angle of  $8^\circ$ ,  $16^\circ$  and  $24^\circ$  suited for 1.0 and 1.2 bar for all riser heights. Hence according to the requirement of crop height, riser height could be selected with suitable pressure and trajectory angle.

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*Dept. of Agric Engineering, Faculty of Agriculture, University of Jaffna*



### Health care demand behaviour of household in Valikamam area of Jaffna district

Thayalan, Y. and , Sooriyakumar, K.

This study is to identify the socio economic factors of household that influence the people to seek medical help and examine magnitude of these factors' influence in seeking medical help in Valikamam area of Jaffna district.

Stratified random sampling method was used to select the sample for this study from Valikamam area. Valikamam area was stratified into seven AGA divisions such as Jaffna, Nallur, Valikamam south-west, Valikamam-west, Valikamam-south, Valikamam-east and Valikamam-north. Household were selected randomly from each AGA divisions, and covered approximately 660 individuals living in 151 households.

Binominal probit model was developed for this study. The result of this model reveals that higher age tends to be associated with an increase in the probability of seeking medical care. This means that when adult workers fall in ill and did not attend to work there is high opportunity cost to household and when old people fall in ill there is high risk for their life. The probability of seeking medical care decreases when the family size increases. The probability of falling ill and seeking medical care of wealthy family members is lower than the probability of poor family. This is due to calorie and nutritional level in their food consumption and sanitary condition of their house. People below the poverty line are not consuming the recommended calorie and nutrient per day. There is an interaction effect of income and family size on seeking medical help. Family members were able to afford to seek medical care when financial and human resources of the family increases. There are interaction effects of income, education level of the household head and mother on seeking medical help. When two households have same income but differ in the education level of head and mother the family with higher education level of head and mother has higher probability to seek medical help when family members get sick. The probability of seeking medical help for male member is higher than the female member in a family. Department of health should make arrangements to reduce the difficulties in seeking medical help by people especially poor people, by increasing number of doctors in district hospital and rural health care center, thereby they can reduce the waiting time to get medical help and opportunity cost of poor people in getting medical help.

### **Determinants of fuel choice for cooking in Valikamam area of Jaffna district**

Selvaratnam, J. and Sooriyakumar, K.

This study is to identify the determinants of fuel choice for cooking in the households of the Valikamam area of Jaffna District. The Valikamam area of the Jaffna District was purposively selected for this study because this area consists of municipality and urban and village areas. There are significant variations in fuel use, based on the geographical situation and socio economic factors among households in Valikamam area. A simple random sampling method was used to select 150 households for interviewing. A multinomial logit model was estimated that encompasses three discrete-choice decisions of households; fire wood use only, fire wood with kerosene use, fire wood with kerosene and LPG use. Multinomial logit model shows that rural people who live far from town use mostly firewood than other modern fuels like gas or kerosene because of the availability of biomass in rural areas and cheaper but urban people prefer to use firewood with kerosene and or LPG because of convenience. The interaction effect of household size and income shows that when two households are of the same size but they differ in the income level the house hold with higher income will prefer other fuel choices than fire wood only choice. The interaction effect of education level and income shows that when education increases with income the probability to choose "firewood and kerosene use" and "firewood, kerosene and LPG increase. When people have high education they will have been employed. They have to seek convenient fuel choices that save time and provide clean energy with least cost. The interaction effect of female share and household size shows when two households with same household size but number of females differ the household with higher number of females will prefer "fire wood use only" because they have enough labour force for cooking and they can reduce the cost for cooking. The effect of household size shows that when household size increases the probability for household size of "firewood use only" increases. With increasing family size people prefer to cook with fire wood because it is cost effective for large scale cooking.



**Consumers' willingness to pay for low pesticide fresh vegetable products in the Jaffna municipality area**

Anushiya, T. and Sooriyakumar, K.

In many of the developing countries, health risks associated with pesticide residue have been a matter of concern for many years. The excess and careless use of agrochemicals in Sri Lanka have directly led to cancer and also to an increase in number of deaths by pesticide poisoning. There is also danger posed to the environment by indiscriminate use of pesticides. Health risk associated with pesticide residue is being discussed in several forums. Jaffna district is one of the high potential areas for agriculture production but presently pesticides are intensively used in agriculture in this district.

This study examines the relationship between willingness to pay (WTP) for low pesticide residue fresh vegetable products by consumers in Jaffna municipality area and the various socioeconomic variables that affect WTP. One hundred and fifty households were selected randomly from the Jaffna municipality area to collect data. A pre tested questionnaire was used to interview the selected households and collect data during the period from July to November, 2004.

A Tobit model was developed to analyze willingness to pay for low pesticide residue fresh products. Tobit analysis is the more theoretically appropriate method for WTP data sets. In this model, respondent's education (EDU), income (INCOME), vegetarianism (VEG), number of times respondent's eat outside the home (EAT OUT), number of family members who have studied up to A/L and number of graduates in the family are used as explanatory variables. The dependent variable is the WTP for low pesticide residue fresh products.

The analytical results show that the respondent's education, family income, number of family members studied up to A/L, number of graduates in the family and number of times people eat outside the home positively influence WTP for low pesticide products and also when family members are vegetarian it positively influence the WTP. But in this result the only estimate for respondent's education is significant at 5% level.

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*Department of Agricultural Economics, Faculty of Agriculture, University of Jaffna*

## **The location of coronary arterial ostia in the normal hearts of Sri Lankans**

Sivananthini Udhayakumar

Proficiency in the location of the aerial ostia is significant for easy coronary catheterization. A study was conducted in 110 fresh autopsied hearts harvested from diseased Sri Lankan adults to investigate the range of normality in coronary ostia in relation to the aortic sinuses.

Number of ostia, their vertical position in relation to the supravulvular ridge and the horizontal position, in relation to the level of commissure on either side were documented.

The aortic valves in 109 hearts were normal having three cusps, while one was bicuspid. In addition to the two main coronary astia, 46 hearts (42%) had a small accessory opening for the right conus artery, to the left of the main right ostium at the same level. The left coronary ostium was inferior to the supravulvular ridge in 76 (69.1%), at the level of ridge in 29 (26.4%) and superior to the ridge in 5 (4.5%). The right coronary ostium was inferior to the supervalvular ridge in 103 (93.6%), at he level ridge in 4 (3.6%) and superior to the ridge in 3 (2.7%). The mean distance from the mid point of left coronary ostium to the level of the commissure to the right was 9.9 (2.3) mm and to the left was 9.5 (2.3) mm. The mean distance from the right coronary ostium to the commissure level on the right was 9.3 (2.4) mm and to the left was 12.6 (1.8) mm.

This study shows that the majorities of the right coronary orifices are found immediately below the supravulviolar ridge and are towards the right commissure. This favors the artery to take a more direct course. In order of frequency, majority of the left coronary orifices are situated immediately below or at the level of the ridge and are more central in location. Nearly half of the hearts have an accessory orifice in the right aortic sinus, which gives an alternate route for right coronary flow to the conus.

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*Department of Anatomy, Faculty of Medicine, University of Jaffna.*



**Prevalence and insecticide resistance of sibling species B in the *Anopheles subpictus* complex in a malaria endemic and tsunami affected area in Jaffna Peninsula**

Kajatheepan, A. and Surendran, S.N.

*Anopheles subpictus*, a secondary vector of malaria, is reported to exist as species complex comprising four sibling species viz., A, B, C, and D. Sibling species show distinct variation mainly with respect to seasonality and susceptibility to parasites and insecticides. Owing to two decades of civil disturbances entomological data on vectors and their susceptibility to parasites and insecticides are not available. A study was initiated to establish the prevalence and insecticide resistance of members of *An. subpictus* in tsunami affected Vadamarachchi east, a malaria endemic area, in Jaffna Peninsula. During the study period only sibling species B was identified based on egg morphology. Progeny of species B was found to be complete resistant to 4% DDT and highly susceptible to 5% malathion.

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*Department of Zoology, Faculty of Science, University of Jaffna, Jaffna*

**Active Case Study at Arivial Nagar: A Malaria Endemic Locality in the District of Kilinochi**

<sup>1</sup>Kannathasan, S, <sup>2</sup> Surendran, S.N. and <sup>3</sup>Srikrisnaraj, K.A.

Kilinochi district was rated as one of five malarious districts in Sri Lanka. However the incidence of malaria has occurred in the district over the past three years. An active case dection study was done in the Arivialnagar locality of Kilinochchi district where an outbreak of malaria occurred in 2003. This study was carried out in mid March 2005. A random sample of 325 residents in the locality (1/3 of total population) was screened for malaria parasites by examining both thick and thin blood films. A questionnaire based survey was also conducted among the occupants of two hundred houses (2/3 of total houses) in the locality to identify the previous history of malaria and the practices of personal protection methods against mosquito bites. None of the screened slides showed positive for either *Plasmodium vivax* or *P. falciparam*. The questionnaire survey indicated that 52% (male 60%, female 40%; with the age distribution of 0-10 yrs.40%, 31-40 yrs. 30%, 41-50 yrs. 20% 51-60% 10%) of the responds had previous experience of malaria. The study also revealed that the residents were aware of mosquito bites and all responds practice some way of protective way of measures (80% used mosquito nets, 10% mosquito coils, 8% smokes, 2% home made nets, etc.). This study further revealed that the study population had a complete health education programs conducted by the Department of Health. This study suggests that combination of effective personal protection measures used by this population combined (chemical and biological) vector control methods by the Anti Malarial Campaign, prompt and effective treatment by the District Hospital Kilinochchi might have contributed for the recent decline of malaria incidence. However, a more detailed study on entomolical parameters (Longevity, vector density, biting pattern etc.) that determine the dynamics of malaria transmission in this population is proposed.

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<sup>1</sup>Dept of Pathology, Faculty of Medicine, University of Jaffna

<sup>2</sup>Dept of Zoology, Faculty of Science, University of Jaffna

<sup>3</sup>Dept of Biological Sciences, Faculty of Applied Science, Vavuniya Campus



**Larvicidal effect of crude extract from *Holothuria atra* against *Aedes aegypti***

<sup>1</sup>Srikaran, R., <sup>1</sup>Sivarajah, R., <sup>2</sup>Krishnarajah, S.R., <sup>3</sup>Krishnarajah P.

<sup>3</sup>Kajatheepan, A. and <sup>3</sup>Surendran S.N.

*Aedes aegypti* is the known vector of dengue. One of the options to curtail the transmission of dengue is targeting the vector which could be achieved by larval control measures. Due to the development of resistance to synthetic chemicals alternative tools and molecules are in search. *Holothuria atra* is a holothurian commonly found along the shallow waters of Sri Lankan coast with no consumer demand. Extract of *H. atra* is reported to have high concentration of saponins that have anti-tumoral, antifungal and antimicrobial activities. A pilot study was initiated to validate the toxicity of *H. atra* against dipteran larvae. Methanol extract of *H. atra* was evaluated as larvicide against III instars of *Aedes aegypti* under laboratory conditions. Replicates of larvae were exposed to serial concentrations of the extract and the mortality was recorded after 24 h. The crude extract was found to have larvicidal activity against *Ae. aegypti* with LC<sub>50</sub> 90 mg/L and LC<sub>90</sub> 165 mg/L respectively. The toxic effect on larvae of other mosquito species, which are vectors of human disease, are being investigated.

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<sup>1</sup>Department of Chemistry, University of Jaffna,

<sup>2</sup>Department of Zoology, The Open University of Sri Lanka, Nugegoda

<sup>3</sup>Department of Zoology, University of Jaffna, Jaffna

### **Preliminary Report of Identification of Scrub typhus in Jaffna**

<sup>1</sup>Murugananthan, K., <sup>2</sup>Gnaneshamoorthy, J. and <sup>3</sup>Thevanesam, V.

Typhus fevers are major causes of febrile illness throughout the world including the Asia-Pacific region. Typhus like fevers is being increasingly reported from different parts of Sri Lanka. During the last two years a high number of admissions due to such fevers are becoming of major public health concern in Teaching hospital, Jaffna. This study was performed in ward 7, Teaching hospital, Jaffna. All patients presenting to the ward 7 of the hospital with fever eschar, with or without rash were included in this study.

46 patients were admitted to the study from December 2004 to November 2005. A pretested questionnaire was used to obtain demographic and clinical data. 3ml of blood was taken in a sterile dry screw capped bottle from nine of the 46 patients as soon as possible after admission and prior to starting antibiotic treatment. Serum was separated and samples were placed in a transport box with ice-packs and transported the same day to the laboratory, Department of Microbiology, Faculty of Medicine, University of Peradeniya through a personal carrier. The nine samples were tested by scrub typhus ELISA (IgM & IgG). Also two of the scrub typhus sera were tested by genus specific PCR for spotted fever group rickettsiae.

A seasonal variation was noted with increased admissions from December to March. The majority of patients (76.1%) were 15-30 years. 88% of the patients were male. The duration of fever on presentation to the hospital ranged from 2-13 days with a mean of 6.31 SD. 2.6. Fever at onset of the illness and eschar was present in all patients. None of the patients had a macular-papular rash. Scrub typhus IgM was positive in all nine patients & IgG was positive in seven patients. PCR for spotted fever was negative in the two patients tested.

Typhus like fevers presenting at Teaching Hospital, Jaffna are due to scrub typhus. Further studies to elucidate epidemiology and risk factors will be helpful to plan preventive measures.

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<sup>1</sup>*Faculty of Medicine, University of Jaffna*

<sup>2</sup>*Teaching Hospital, Jaffna*

<sup>3</sup>*Faculty of Medicine, University of Peradeniya*



**Satisfactional factors in inducing people :an empirical study of  
Sri Lankan organizations**

Velnampy, T.

Specific employee attitudes relating to job satisfaction are most important in inducing people and achieving high level of performance. Hence Organizations should identify the dimensions of satisfaction. The present study is conducted to identify the significant satisfactional factors and the relationship between satisfaction and inducement based on the perception of employees. This paper deals with a comparative study between 25 public and 25 private sector Organizations located in Colombo city with an ultimate sample of 300 respondents. The study evolves a strong correlation between satisfaction and inducement. Among eight satisfactional factors, financial remuneration, fringe benefits, promotion and good supervision have been found as most significant factors. Any how financial remuneration is the key element in satisfaction. Multiple regression analysis shows that three groups of dimension such as financial remuneration, fringe benefits and intrinsic factors are significantly contributing to inspire the people in both public and private sector organizations.

$R^2$  value indicates that the satisfaction is contributing to induce the people by 78% and the remaining 22% is achieved by other factors which are not analysed in the paper. Because they are out side the scope of the study. Regarding the impact of different groups of satisfactional factors, the impact of intrinsic factors on inducement is greater than the other groups of factors such as financial remuneration and fringe benefits. Finally certain suggestions are given to the organizations to keep their employees satisfied which will leads to the inducement.







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