PROCEEDINGS

of the

Thirty-Ninth Annual Session

December 1983

Part I

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இலங்கை விஞ்ஞான முன்னேற்றச் சங்கம்

SRI LANKA ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Colombo, 1983

List of Papers not presented at the 1982 Annual Session

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Proceedings

of the

Thirty-Ninth Annual Session

SRI LANKA ASSOCIATION

for the

ADVANCEMENT OF SCIENCE

DECEMBER 1983

PART I

"Vidya Mandiraya", Vidya Mawatha, Colombo 7
SRI LANKA

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SECTION A: MEDICAL, DENTAL AND VETERINARY SCIENCES

A-01

AN EVALUATION OF JONES CRITERIA FOR DIAGNOSIS OF RHEUMATIC FEVER IN SRI LANKA

Shanthi Mendis
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The clinical manifestation of Rheumatic Fever (RF) in Western countries differ from those in Sri Lanka. Therefore the modified Jones criteria[1] may need modification to satisfy local requirements. This communication is based on 265 patients, 83 males and 182 females between 13 - 55 years, followed up at the Teaching Hospital, Peradeniya.

84 patients were diagnosed after they developed chronic rheumatic heart disease. They had taken treatment from ayurvedic or local dispensaries for acute attacks. 92 patients fulfilled the necessary diagnostic criteria. Evidence of preceding streptococcal infection was present in 60 patients. Subcutaneous nodules were present in 2. Erythema marginatum was absent. Out of 124 patients who had chronic rheumatic heart disease, 25 did not give a history of RF. The other 99 patients gave a history of RF. 79 (80%) of them had recurrences and 30 patients did not have a history of typical migratory polyarthritis. In them the knee joint was the most frequently affected 85%, followed by ankle 70%.

Out of 12 patients with chorea, Jones criteria were satisfied by 4 only. Out of the other 8, 4 developed polyarthritis or carditis subsequently.

As this study reveals, proving streptococcal infection presents problems. Rare features such as subcutaneous nodules and Erythema marginatum are of little practical importance. It is suggested that Syndenham's chorea be taken as an almost diagnostic feature. Same diagnostic significance should be attached to insidious carditis, only represented by mitral stenosis or multiple valve lesions. Monoarthritis and atypical polyarthritis involving knee and ankle in females, with a history of relapses, merits special recognition.

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1. American Heart Association, (1965). *Circulation*, **32**, 664.

A-02

SERUM URIC ACID IN HYPERTENSIVE PREGNANCIES

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Impaired fetal growth, leading to intra-uterine fetal death and to the birth of small for dates babies is a major problem in Sri Lanka. A large proportion of these are considered to be due to hypertension. Regular estimation of oestrogen and HPL levels are the accepted biochemical indices in the management of these pregnancies.

However, the high costs of these tests and the need for highly trained technicians to carry out such investigations have impaired the establishment of regular service in Sri Lanka. Even in more advanced countries, these limiting factors have led to the search for other more simple, reproducible and less costly investigations.

The estimation of serum uric acid seems to fit the above requirements satisfactorily.[2,3] To establish how well this test could be utilized for monitoring the fetal well-being in Sri Lanka, a preliminary study, of serum uric acid levels in non-hypertensive (115 cases) and hypertensive (50 cases) pregnant women was carried out. The uric acid in serum was estimated by the method of Caraway.[1]

SECTION A

The mean serum uric acid (SUA) level in non-hypertensive mid-pregnancy (21 - 30 weeks) was 196.3 μ moles/l, and in late pregnancy (31 - 40 weeks) was 245.5 μ moles/l. In contrast, for the hypertensive group, the mean SUA levels in mid-pregnancy (21 - 30 weeks) was 270.2 μ moles/l, and in late pregnancy (31 - 40 weeks) was 316.2 μ moles/l. These preliminary results indicate that there is a significant difference in the SUA levels between non-hypertensive and hypertensive pregnancies.

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2. Redman, C. W. G., *et al.*, (1976), *Lancet*, 1370-1373.
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A - 03

EFFECT OF KARAWILA (*MOMORDICA CHARANTIA*) ON THE GLUCOSE TOLERANCE IN MATURITY ONSET DIABETES

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The hypoglycaemic action of the fresh juice of the dried extract of the fruit of *Momordica charantia* (Karawila) has been reported both in laboratory animals and during clinical trials with diabetic patients. Phytochemical studies suggest the presence of several oral hypoglycaemic agents and an insulin-like polypeptide in the fruit. Recent *in vitro* studies with isolated islets from obese-hypoglycaemic mice also provide strong evidence for the presence in the fruit of a principle which stimulated insulin secretion from beta cells[1].

This study was undertaken to evaluate the ability of the drug to improve the glucose tolerance in diabetic patients. The patients were all of the maturity onset type. Glucose tolerance test was performed on these patients. On a subsequent day a repeat Glucose tolerance was done with the extract given 30 min. before the glucose load.

In response to the external glucose load, the average peak percentage increase of blood glucose level observed was 89.5 $\pm$ 6.6 at 1.5 hours. In contrast the corresponding value when glucose was administered after extract, was only 60.8 $\pm$ 10.9.

At 2 h, the value was 81.2 $\pm$ 5.5 without the extract while the corresponding value with extract treatment was 44.0 $\pm$ 3.7.

The present data while confirming our previous results both *in vivo*[2] and *in vitro*[1] may suggest that the hypoglycaemic effect is due either to stimulation of insulin secretion or stimulation of peripheral utilization of glucose or both.

This work was supported by NARESA Research Grants, RG 77/31, 83/29 and in part by Research Grant 531 from International Foundation for Science, Sweden.

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2. Welihinda, J., Karunanayake, E. H. *and* Balasubramaniam, K. (1982), *Proc. Inst. Chem. (Ceylon)*, (1), 16-18.

A - 04

EFFECT OF TEA ON THE ABSORPTION AND EXCRETION OF CAFFEINE

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Recent studies[1] indicate a possible teratogenic effect of caffeine in test animals. Caffeine is a major constituent of tea, which also contains a high concentration of polyphenols, to which caffeine binds very strongly. Studies were therefore undertaken to evaluate the effect of polyphenols on the bioavailability of caffeine.

Following oral administration (100 mg/kg body wt) of (1-methyl-^{14}C) caffeine to male Sprague-Dawly rats (n = 6) approximately 69% of the administered radioactivity appeared in urine and fecies during 48 h, while in the female (n = 6) the recovery of administered radioactivity was approx. 79%. In contrast, when (1-methyl-^{14}C) caffeine was administered with tea the total urinary and fecal recovery in males (n = 6) was approx. 73% and in females (n = 6) was 85%. Our results also indicate that there is a small, yet a significant sex difference in the excretion of caffeine whether administered singly or with tea.

The time-course of radioactivity associated with blood and stomach also showed differences with the type of caffeine preparation. Following the administration of (1-methyl-^{14}C) caffeine, the level of radioactivity associated with the stomach declined rapidly during the first 6 hours. In contrast, this decline was faster when caffeine was administered with tea. The peak radioactivity in blood was observed 2 hours after administration of both preparations of caffeine. However, this peak radioactivity in blood declined rapidly following the administration of pure ^{14}C-caffeine, whereas the blood level of radioactivity following the administration of ^{14}C-caffeine with tea remained steady for approx. 24 hours. These data indicate, (a) an enhancement of caffeine absorption from the gastrointestinal tract by tea, and (b) though the absorption into general circulation is enhanced, the uptake into tissues seems to be retarded by the presence of tea or its constituents.

This work was supported by a grant from Tea Research Institute.

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2. *Federal Register*, (1980), **45**, (205), 69817.

A - 05

EFFECT OF TEA ON THE TISSUE-DISTRIBUTION OF CAFFEINE

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Investigations were carried out to evaluate the effect of tea on the tissue-distribution of caffeine and its interactions with cellular macromolecules.

Following oral administration of (1-methyl-^{14}C) caffeine or (1-methyl-^{14}C) caffeine with tea to rats (n = 3), tissues (liver, kidney, spleen, testes and heart) were harvested, at 1, 2, 3, 4, 5, 6, 12 and 24 hours. Samples of tissues after processing were assayed for radioactivity. In all tissues, the highest radioactivity was observed 3 h after administration of caffeine. However, in the heart, the peak radioactivity was observed 6 h after oral administration.

In contrast, when caffeine was administered with tea, the highest level of radioactivity was observed in the testes. In all tissues, except the testes, the administration of caffeine with tea significantly lowered the tissue content of radioactivity. There was also evidence of a biphasic pattern of distribution of radioactivity in kidney, heart, spleen and testes, with a second peak of tissue-radioactivity appearing 6 h after the administration of caffeine with tea. At the cellular level, a significant amount of ^{14}C-label was associated with proteins and nucleic acids. The ratio of association between proteins and nucleic acids was approximately 4 : 1. These studies also revealed a very high association of radioactivity with the nucleic acids of ovarian tissues. This association of administered radioactivity with proteins and nucleic acids may play a role on the reported[1] teratogenic effects of caffeine.

The results of the effect of tea on the tissue distribution of caffeine again suggest a possible reduction in the bioavailability of caffeine by the component(s) present in tea.

This work was supported by a grant from the the Tea Research Institute.

Reference

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A 06

PLASMODIUM VIVAX: ISOLATION OF MATURE ASEXUAL STAGES AND GAMETOCYTES FROM INFECTED HUMAN BLOOD BY COLLOIDAL SILICA (PERCOLL) GRADIENT CENTRIFUGATION

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Immunological and biochemical research on human malaria require substantial numbers of parasites or parasitised erythrocytes free of contamination with other host components such as uninfected erythrocytes. The unavailability to date, of a satisfactory technique for the isolation and purification of *Plasmodium vivax* infected human erythrocytes has hindered the progress of research on this important human malaria parasite. In this study we present for the first time a method for the isolation of mature asexual stages and gametocytes from infected human blood by using colloidal silica (Percoll) gradient centrifugation.

Densities of human red cells infected with various blood stages of *P. vivax* were ascertained for the first time by isopycnic centrifugation in Percoll (Polyvinylpyrrolidone coated colloidal silica) gradients. Using this data, a simple one step gradient of 47% Percoll was devised to isolate red cells infected with asexual stages and gametocytes of *P. vivax* from uninfected erythrocytes. By this method a very high degree of purity (95%–100%) as well as a high yield (90%–100%) of infected erythrocytes were obtained. Parasites isolated by this method were morphologically unaltered, and they retained their viability as shown by the fact that exflagellation could be successfully induced in male gametocytes after purification. The antigenicity of asexual parasites isolated by this method was tested by Indirect Immunofluorescence and was found to be unaltered.

This investigation received support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical diseases.

THE BIOLOGY AND DESCRIPTION OF THE LARVA AND PUPA OF *ANOPHELES (CELLIA) ELEGANS* JAMES (1903)

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The distribution of *Anopheles (Cellia) elegans*, a natural vector of simian malarias, is limited to south-west India and Sri Lanka. To date, only the egg and adult stages of this species have been described. In the literature the pupa is referred to scantily, and its larva is said to be unknown. In this study, descriptions of the pupa and larva of *An. elegans* are presented for the first time, and the bionomics and medical significance of this species are updated.

The larva of *An. elegans* is distinct from those of other species in the Leucosphyrus Group to which it belongs in the length and placement of the 4th pair of clypeal hairs.

In Udawattakelle (situated in the Kandy district at an elevation of 1700 feet above sea level) from where young aquatic stages of this species were collected, the breeding places of *An. elegans* were small collections of heavily shaded unpolluted muddy water on a gravel road. The breeding season is from April to September, coinciding with rains.

We have colonised *An. elegans* in the laboratory and with it as the vector completed the entire cycle of transmission in the laboratory of *P. inui*, a simian malaria parasite indigenous to Sri Lanka. The role of *An. elegans* as an efficient vector of *P. inui* has been established.

This investigation received support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical diseases.

A - 08

ESTABLISHMENT OF AN EXPERIMENTAL MODEL OF A NATURALLY OCCURRING SIMIAN MALARIA INFECTION IN SRI LANKA : *PLASMODIUM INUI* IN THE TOQUE MONKEY (*MACACA SINICA*) USING *ANOPHELES ELEGANS* AS THE VECTOR

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Progress of research on immunological and chemotherapeutic aspects of human malaria has created an increasing demand for newer and better experimental non-human primates malaria systems. In this study we have established in the laboratory, a naturally occurring simian malaria system indigenous to Sri Lanks, *P. inui shortii* using natural host and vector, and characterised the model for studies on experimental immunization against malaria.

The natural course of infections in blood was studied in 25 animals. Within 3 weeks of patency, infections rose to peak parasitaemias of upto 4% and declined rapidly to be maintained as chronic infections (below 0.5% parasitaemias) for more than 30 weeks. Later, infections became subpatent, but sterile immunity was not acquired during the observation period of 30 weeks.

In infected monkeys splenectomy caused an increase of parasitaemias up to 35 and thereafter infections became chronic. Up to 20 months after splenectomy there was no evidence of sterile immunity.

Data on the sporogonic cycle of *P. inui* in *A. elegans*, and its transmissibility are presented here for the first time. *An. elegans* was found to be an efficient vector of *P. inui*.

This investigation received support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical diseases.

A - 09

A STUDY OF THE ROLE OF DIFFERENT INDIGENOUS ANOPHELINE SPECIES IN THE TRANSMISSION OF HUMAN MALARIA IN SRI LANKA

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Among 23 species of anophelines recorded in Sri Lanka, only *Anopheles culicifacies* has so far been established as a vector of human malaria. The role of other anopheline species had not been sufficiently investigated. This study attempts to determine the vectorial status and competence of these species.

Preliminary observations have shown that 10 out of 11 species examined were able to support the sporogonic development of *Plasmodium vivax* up to sporozoite stage when infected from human parasite carriers. In addition, up to now, natural salivary gland infections with *Plasmodium* (sporozoites) were found in wild populations of 03 among the 10 anopheline species. These natural infections were detected in areas of active transmission of human malaria. The identity of these natural infections needs to be further clarified due to the prevalence of simian malarias in the country. However, in view of the fact that sporogonic development has been successfully completed in these species, it is possible that these species may already be or have the potential to transmit human malaria in the country. Study of the bionomics of these species have been done with a view to elucidating other factors which influence transmission potential of these species.

This investigation received support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical diseases.

A - 10

EFFECT OF THORACIC HOMOGENATES OF REFRACTORY *AEDES ALBOPICTUS* ON THE DEVELOPMENT OF *BRUGIA PAHANGI* IN SUSCEPTIBLE *AEDES TOGOI*

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The procedure or principles that induce changes in the expression of filarial susceptibility or refractoriness in mosquitoes should, it is believed, contribute to the better understanding of the exact mechanisms through which genetic or any other factors affect the developing filaria parasites. This study aimed to alter the development of *Brugia pahangi* in susceptible *Aedes togoi* and in refractory *Aedes albopictus* introducing their thoracic homogenates alternatively, by using intrathoracic inoculation technique. After 2 days of inoculation the mosquitoes were infected with *B. pahangi* by feeding directly on an infected cat.

In *Aedea albopictus* which initially was totally refractory to *B. pahangi*, the alteration of non-development by facilitating an inducement using thoracic homogenates of susceptible *Aedes togoi* was a failure.

In *Aedes togoi* which was highly susceptible, significant difference in development of *B. pahangi* could be observed after the inoculation of thoracic homogenates of *Aedes albopictus*. In the above experiment the mortality of developing larvae which was 0% – 4.4% in normal mosquitoes was increased to 17.67% – 42.86%.

This investigation received support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical diseases.

Reference

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A - 11

STUDIES ON *CARDIOFILARIA NILESI* IN THE CHICKEN : A LABORATORY MODEL FOR FILARIASIS

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Cardiofilaria nilesi, a filarial parasite of birds in Sri Lanka is transmitted by the mosquito *Mansonia crassipes*. This parasite in the chicken is a good laboratory model for immunological and pathological studies on filariasis, a disease widely prevalent in Sri Lanka.

In this study, the parasite in the chicken was studied in the laboratory and the infection transmitted by *M. crassipes*.

Results indicate that *M. crassipes* is an excellent vector, but its use in the laboratory is limited as it cannot be successfully colonized.

This study was an attempt to find an alternate vector for the parasite.

Aedes togoi is a good vector of many other filarial infections and has transmitted *C. nilesi* in the laboratory.

We attempted to transmit *C. nilesi* using a strain of *A. togoi* originating from Taiwan. Results indicate that the microfilariae were destroyed very early in the stomach itself, and the parasite failed to develop in the mosquito. We conclude that the failure to transmit was because the strain of *A. togoi* used was refractory to *C. nilesi*.

This study received financial assistance from NARESA.

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A - 12

LEPROMIN SENSITISATION OF SRI LANKANS

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The lepromin test is used clinically to differentiate between the polar types of leprosy. However, few studies exist of lepromin sensitisation of general populations, and none from Sri Lanka. We investigated two Sri Lankan populations, at Pussellawa (n=258) and Nuwara Eliya (n=167), using Lepromin A with 3×10^7 bacilli per ml.

Each subject was tested with the low dose Tuberculin test and Lepromin A, both being administered intradermally on the volar aspect of the left forearm. The Tuberculin test was read at 72 hours, and the Lepromin test, Fernandez reaction at 48 hours, and Mitsuda reaction at 72 hours.

All three types of reactions showed bimodal distributions, with separation of reactors and nonreactors. Overall the patterns with each type of reactivity was similar in the two areas, with the exception, of the Fernandez reaction, where there was a significantly lesser number of nonreactors at Nuwara Eliya than at Pussellawa. With all three reactions the B.C.G. vaccinated showed lesser numbers of nonreactors than those not vaccinated. In both groups the modes of reactors were, for the Fernandez reactions, 5-6 mm., and for Mitsuda reactions 7-10 mm.

This work was supported by a grant from WHO, Geneva.

A - 13

IMMUNOLOGICAL EFFECTS OF LEPROMIN TESTING

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The Mitsuda reaction has been suggested to be, possibly, a "vaccination" response.[1] Repeated Lepromin testing of "negative" individuals was shown to lead to an increasing incidence of "positivity" in the latter.[2]

We report a study in two Sri Lankan populations, where we carried out repeated Lepromin testing using Lepromin A with 3×10^7 bacilli/ml. At Nuwara Eliya, subjects showing Mitsuda reactions of 6 mm or less, were retested once and at Pussellawa, retested twice. With all tests, both Fernandez and Mitsuda reactions were read.

With the first retest, in both areas, there appeared to be "tolerisation" with many of the larger reactions becoming zero reactions. However at Pussellawa, with the third test, there was evidence that "tolerisation" was waning off with smaller reactions reappearing. Further, the morphological type of the reaction, in some seemed to have altered with soft, plaque-like reactions appearing, instead of well-defined nodules, typical of Mitsuda reactions.

This work was supported by a grant from WHO, Geneva.

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A - 14

THE ANTIBIOTIC SENSITIVITY OF PRESUMPTIVE GROUP 'A' β HAEMOLYTIC STREPTOCOCCI ISOLATED FROM THROATS OF SCHOOL CHILDREN IN KANDY

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and
S. Mendis
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Although Group 'A', β haemolytic Streptococcal infections are commonly met with in clinical practice, there has been no investigation of the antibiotic sensitivity of these organisms reported from Sri Lanka. We

report here the drug sensitivity patterns of presumptive (on the basis of the Bacitracin sensitivity test), Group A Streptococci isolated during a study of the incidence pharyngeal carriers of Streptococci among school children in Kandy.

The sensitivity tests were carried out using Stokes' method on Mueller-Hinton agar with 10% sheep blood. The results of our tests were as follows :

Drug	*Percentage Strains*		
	Fully Sensitive	*Intermediate Sensitivity*	*Resistant*
Penicillin	100	—	—
Erythromycin	100	—	—
Streptomycin	80	18	02
Tetracycline	09	08	83
Sulphonamide	5	42	53

(Total number of strains studied — 128)

Only 6% of strains were sensitive to all five antibiotics tested, while 51% were sensitive to four, 42% to three and 1% to two.

A - 15

CHRONIC PYOGENIC OSTEOMYELITIS OF THE MANDIBLE —A STUDY OF 34 CASES

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Pyogenic osteomyelitis of the mandible usually starts as an acute infection and later becomes chronic. However it has been noticed that in anaemic subjects it could start as a chronic infection of low virulence, specially when oral sepsis is present.

34 such cases were treated at the Oral Surgery Unit, Dental School and General Hospital, Kandy during the period August 1972 to August 1982. The hospital records, and radiographs of these patients were perused to ascertain, age, sex, site of infection, X-ray appearance, oral hygiene status, level of haemoglobin and social status.

All the patients were from the estate worker population who drew a monthly income of less than Rs. 450. Their mean haemoglobin level was 7.39%. Females were the majority (74 .6%), 60.3% were in the age group 40-49. Radiographs revealed bone destruction, no sequestration and no new bone formation, in all patients.

Correction of the anaemia, curratage and suitable antibiotics proved to be a satisfactory line of treatment in 87.3% of patients. 12.7% of patients also needed irrigation of the infected area.

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SECTION A

A -16

LATE COMPLICATIONS IN MAXILLO-FACIAL INJURIES

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Maxillo-facial injuries irrespective of method and adequacy of treatment could leave behind troublesome complications that may require subsequent intervention. As a previous study has shown that these injuries are on the rise in this country, late complications of these injuries would deserve an investigation.

Subjects of this study were 304 patients treated for maxillo-facial fractures during the period January 1977 to December 1980. Necessary data was collected by a perusal of the hospital records and examination of the patients in our follow up clinics.

At the time of discharge from hospital, 206 (67.4%) of these patients had some complaint or other, but six months later only 37 (12.1%) of them had clinically discernible complications that required therapy.

50.8% of patients who had difficulty in opening the mouth, had fractures in the condylar region. 75.1% of patients who had occlusal derangement, had multiple fractures of the mandible. Infection of the fracture site was the cause of non union in 86.7% of cases.

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A -17

OSTEO-RADIO-NECROSIS OF THE JAWS — A STUDY OF THIRTEEN CASES

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Osteo-radio-necrosis could be expected to be a special problem in the jaws because of the presence of teeth. However with the use of modern methods of radiotherapy the phenomenon is seldom seen even in the jaws.

As 13 cases of osteo-radio-necrosis were discovered at General Hospital, Kandy during a period of five years, an attempt was made to find a possible precipitating factor.

A control group of 15 subjects, treated for oral malignancy with a similar dose of radiotherapy, and of similar age and social status, and who were free of general illnesses were selected. The following possible causative factors came under investigation: (*a*) Oral hygiene status (*b*) Anaemia (*c*) Extraction or trauma.

The mean total dose of radiation was 6000 rads, in both groups. No extractions were done after therapy and all teeth in the affected side had been removed prior to therapy. The mean haemoglobin level of the group with necrosis (7.6.g%) was significantly lower ($p < 0.05$) than that of the control group (8.8. g%). There was no significant difference ($p < 0.05$) in the oral hygiene status of the two groups.

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A - 18

A STUDY OF SALIVARY GLAND BIOPSIES IN SRI LANKA

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Consecutive biopsies involving salivary tissue received during 1978-1981 were analysed. This constituted less than 5% of biopsies. 87 Biopsies were received, of these 84 were intraoral biopsies. 18 lesions (21%) were of neoplastic origin, 59 lesions (68%) were cystic and 10 lesions (11%) were of inflammatory origin.

Tumours.—Intraoraltumours accounted for 14 (82%) and extraoral 3 (18%) of all salivary tumours. The commonest tumour was the Plemorphic Adenoma (P.A.) 13 lesions (72%). There was one Monomorphic Adenoma (Adenolymphoma) and 4 (22%) Mucoepidermoid Tumours (M.T.).

More than 60% of intraoral P.A. arose in the posterior region of the hard palate. For P.A. the M : F=1.4 : 1, age range 20-60 years, mean age 34.5 years and the age group most frequently affected was the second and third decades. The mean duration before seeking treatment was 2.9 years. Of the 4 M.T. three lesions presented intraorally at the maxillary incisor canine and premolar region with involvement of the upper lip and premaxilla. All lesions were in females. Age range 23-48, mean age 37 years.

Cysts.—Of the cystic lesions 32 (54%) was of the mucous retention type while the rest 27 (46%) mucous extravasation type. 37 (62.7%) of all cysts occurred in the lower lip. 10 (17%) of cysts occurred in the buccal mucous membrane and commisural areas, 8 (13%) of cysts occurred in the floor of the mouth. The younger age group 11 of 30 had 50% cysts, the age 41-70 had 20%. (Age range 5 to 68 years). There was a slight female preponderance M : F=1 : 1.3. The racial distribution was Sinhalese—47, Tamils—4, Moors—8.

Sialoadenitis.—This age consisted of 4 intraoral lesions and 6 extraoral lesions (M : F=1 : 2.5). Three intraoral lesions arose in the upper lip. Age range 35-88 years, mean age 58. All sub-mandibular lesions were with salivary calculi. Three sublingual lesions were due to nonspecific inflammation.

The age for the P.A. (second and third decades) is younger than the western[1] studies (fifth and sixth decades). The M.T. occurred in the maxillary anterior region in this study. The mandibular molar and premolar area is the commonest site affected in other studies.[2] The histopathological profile will be discussed along the W.H.O. classification.[3]

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A - 19

THE WIDTH OF THE ATTACHED GINGIVA(AG) IN A GROUP OF SRI LANKANS

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Studies in U.S.A. and Finland showed that the width of the AG varied between individual teeth and between the maxilla and the mandible, with the mean width ranging from 1.4 — 5.2 mm.[1,2] No studies are available for an Asian population whose dietary and oral hygiene habits differ. This study was designed to determine (A) the width of AG on the buccal and labial aspects of deciduous and permanent teeth, and (B) the

variation of this width between maxillary and mandibular arches and also with age. Using a periodontal probe the width of AG in 97 subjects (50 males and 47 females, age 3-40 years) was measured and the results subjected to a statistical analysis. The results showed that:—

(*a*) In the permanent teeth the width is greatest in relation to the maxillary incisors $\bar{x}$ — 4.41 mm. (range 2.0-7.0 mm) and narrowest in relation to the mandibular premolars $\bar{x}$ — 1.96 mm. (range 0.5-4.0 mm). In deciduous teeth the width is greatest in relation to maxillary incisors $\bar{x}$ — 2.84 mm (range 1-4.5 mm) and narrowest in relation to mandibular canines $\bar{x}$ — 1.41 mm (range 1.0-2.0 mm).

(*b*) The width of AG in relation to the maxillary permanent incisors, canines, and premolars is greater than the width in relation to the respective mandibular permanent teeth ($p<0.01$) but there is no significant difference between the maxillary and mandibular first molars.

(*c*) There is a significant difference between the width of AG in relation to deciduous maxillary and mandibular incisors and canines ($p < 0.05$) but no significant difference between the deciduous maxillary and mandibular molars.

(*d*) The width of AG increases with age, and in Sri Lankans is less than that of comparable Western populations.

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A - 20

TUMOURS OF NEUROGENIC ORIGIN AS THEY PRESENT IN DENTAL PRACTICE

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Tumours of neurogenic origin in the mouth are rare and have not been documented for Sri Lanka. Sixteen tumours associated with nerve and nerve related tissue were received at the Dental School from May 1978 to May 1983: Neurofibroma-4, Neurofibromatosis-1, Neurilemmoma-6, Traumatic (amputation) Neuroma-2 and the uncommon Malanotic Neuroectodermal Tumour of Infancy-3. There were no malignant nerve sheath tumours, ganglioneuromas and neuroblastomas. These tumours appeared from 2 months to 65 years and had a variable clinical presentation mimicking the commoner intraoral lesions. There were six tumours in males and ten in females (M : F = 1 : 1.5). Of these, five tumours appeared in the premaxilla and maxilla, four in the tongue, three in the mandible, two in the lip and one each in the cheek mucosa and the soft palate. The neurilemmoma was commoner in the younger age groups—all lesions being below 40 years. The neurofibroma occurred commonly in the age groups above 40 years. One neurilemmoma recurred one year postoperatively. The neurilimmoma was differentiated from the neurofibroma in this study, by the presence of palisading of nuclei and the presence of Antoni type A and Antoni type B cells, the latter being more reticular.

Of the three rare melanotic neuroectodermal tumours, two were in patients below six months and the other in a three year old patient. Two tumours involved the premaxilla and the deciduous dentition and one tumour involved the mandibular deciduous incisor region. All lesions were radioluscent. Two of these recurred within three months of the first operation with wider involvement of the surrounding tissues. Histopathologically

the pigment cells were arranged in solid groups and were found to be diffusely scattered throughout the connective tissue. These cells were flattened with large nuclei and the cytoplasm contained melanin in the form of minute rod shaped particles. It is now believed that this tumour, also called "melanotic progonoma" "retinal anlage tumour" and "melanotic ameloblastoma" among others is likely at least in the jaws of infants to arise from a neural crest ectodermal origin rather than from the misplaced retinal elements in the course of development. This turmour cannot be considered as a variant of the odontogenic tumour ameloblastoma.

A - 21

AN ELECTROPHYSIOLOGICAL STUDY OF CARPAL TUNNEL SYNDROME

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This paper is based on the electrophysiological findings in 36 patients with carpal tunnel syndrome. The age range of the patients was 31-54 years. All except two patients were females. In 19 patients there was electrophysiological evidence of bilateral involvement; right hand was affected in 91.7% of the patients and the left hand in 61.1%.

Sensory conduction velocity of the median nerve from digit II to wrist (SCV), amplitude of the sensory action potential (SAP) and the terminal latency of the median nerve from wrist to abductor pollicis brevis (TL) were the parameters used in diagnosis. Abnormalities in the absolute values as well as relative abnormalities as shown by a significant asymmetry were considered. In the 55 instances of median nerve compression at the carpal tunnel, the frequency of abnormalities in the absolute values was as follows:

Slowing of SCV in 83.3%; Prolongation of TL in 80.1%; Reduction of SAP in 77.1%

In addition, slowing of motor conduction velocity in the proximal segment of the median nerve was observed in 32.7%.

The results show that measurement of sensory conduction increase the sensitivity of electrophysiological diagnosis of carpal tunnel syndrome.

This work was supported by a research grant from the University of Peradeniya.

A - 22

NEUROTOXICITY OF ORGANOPHOSPHATE PESTICIDES: SOME UNUSUAL MANIFESTATIONS

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Acute neurotoxicity of organophosphate (OP) pesticides varies from symptoms of cholinergic overactivity to coma. Some of these compounds also cause delayed neurotoxic effects which manifest as polyneuropathy.[1] This paper documents some hitherto unrecognized neurological deficits, namely, cranial nerve palsies and unilateral sensory deficits occurring after exposure to OP insecticides marketed in Sri Lanka:

1. Unilateral lateral rectus palsy causing diplopia in two patients (males, 23 and 25 years). One patient also had marked weakness of limbs due to polyneuropathy, and the other patient had numbness and impairment of sensations in the limbs on one side.
2. Restriction of all ocular movements in two patients (males, 25 and 38 years). One patient also had ptosis, facial weakness and palatal palsy bilaterally. Both patients had evidence of polyneuropathy in addition.

3. Nasal regurgitation due to palatal palsy, bilateral in one patient (male, 55 years) and unilateral in the other (male 16 years). There was no clinical or electrophysiological evidence of polyneuropathy

The underlying mechanism of these neurological phenomena is not clear. Yet, it is worth remembering these manifestations as possible neurotoxic effects of OP pesticides, especially in view of the high incidence of insecticide poisoning in our country.

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CARDIORESPIRATORY MANIFESTATIONS OF CHRONIC HYPERVENTILATION SYNDROME

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Patients (n=20) with chronic hyperventilation syndrome (F : M ratio of 2.33 : 1 and mean age of 33 years) showed as their characteristic cardiorespiratory feature a respiratory distress punctuated by intermittent "sighs". This distress was relieved by sighing (95%), burping (60%) and yawning (45%). Eight (40%) patients noticed an increase in their respiratory movements.

Palpitations were experienced by eighteen (90%) patients—the majority (65%) obtaining relief with a hot drink.

Chest pain occurred in eighteen (90%) patients. The site of the pain was retrosternal (44%), left sided (39%), diffuse (11%) or right sided (6%). The pain was often tightening in nature (56%) but was occasionally pricking (22%) or non-specific (22%). Radiation of the pain to the back or neck was seen in only 28%.

The heart rate and blood pressure were normal, with a mean of 81/min and 120/75 mm Hg respectively The mean respiratory rate was 32/min (range, 16-44).

The electrocardiogram was normal in all patients. The main non-specific changes seen were T inversion (39%) and flat T (33%) in lead III, an upright T in V_1 (56%) and extension of T inversion to leads V_3 or V_4 (11%) and V_2 (6%). The QRS and T axes were 38.1° ± 26.9° and 31.1° ± 23.7° (mean ± S.D.) respectively from the horizontal. The QRS—T angle was usually narrow and was either positively (mean of 22.8°) or negatively (mean of — 16.6°) directed.

CLINICAL DIAGNOSTIC CRITERIA FOR HEPATIC AMOEBIASIS

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The diagnosis of hepatic ameobiasis is based in clinical practice on the use of varying and non uniform clinical criteria. We present an objective set of diagnostic criteria based on a retrospective analysis of patients admitted to our Unit.

		Points
(I)	**Hepatic Criteria**	
(i)	Right hypochondrial pain	1
(ii)	Enlarged tender liver	3
	or	
	tender epigastric lump	5
(iii)	Right intercostal space—	
	tender and full	5
	definite tenderness	4
	ill defined tenderness	1

			Points
(I)	**Hepatic Criteria** (*cont.*)		
(iv)	Elevation of right dome of diaphragam (over 2.5 cm)	..	3
(v)	Aspiration of Amoebic pus	..	10
(vi)	SGPT— Normal	..	1
	Mild elevation	..	½
	Over 60 I.U.	..	(−) 1
(vii)	Definite clinical jaundice	..	(−) 1
(II)	**Extra Hepatic Criteria**		
(A) (i)	Fever— Less than 100°F	..	1
	Over 100°F	..	2
(ii)	Neutrophil count— 7000-10,000/cu mm	..	1
	Over 10,000/cu mm	..	2
(B) (i)	Definite alcoholic history	..	1
(ii)	Blood and mucus diarrhoea within 6 months	..	1
(iii)	Right basal lung signs	..	1
(iv)	Right shoulder tip pain	..	1
(v)	ESR— Over 100 mm/hr	..	2
	50-100 mm/hr	..	1

A diagnosis of Hepattic Amoebiasis could be made with

a. 10 points from (I).
or b. 10 points overall with at least
5 points from (I)
and 2 points from II A or 1 point each from II A and II B.

A-25

ANAEROBIC STARVATION OF *STAPHYLOCOCCUS EPIDERMIDIS*

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Starvation is one of the principal stresses which micro-organisms may undergo in their natural environment. Furthermore, a study of this nature will be useful in the elucidation of many complex processes taking place in multicellular organisms during starvation.

Staphylococcus epidermidis described earlier was starved in sterile phosphate buffer at 37°C (bacterial density 2 mg dry wt ml^{-1}). The carbohydrate content of the organism declined from 5.0% to 3.2% over a period of 14 hours of starvation, but an equivalent amount of it appeared in the suspending buffer. Over the same period, the protein content decreased from 49% to 40% and the net loss in protein was only 2%. So it is unlikely that the organism utilizes the degraded protein for its endogenous metabolism. The amino acid pool was rapidly depleted; a net decrease in total free amino acid with the release of ammonia occurred. The RNA content declined from 13% to 3.8% after 10 hours. Nearly 37% of the nucleotide formed during RNA degradation could not be accounted for and therefore it was concluded that they provided endogenous substrate.

Both the viability and energy charge declined rapidly from the onset of and during starvation. The viability declined to 5% after 10 hours. Therefore it could be concluded that *S. epidermidis* dies when the energy available for maintenance is no longer sufficient to support essential cellular functions.

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A - 26

ENZYMES IN FILARIAL WORM *SETARIA DIGITATA*

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Inhibition of parasite specific enzymes by chemotherapeutic agents could be an effective way of controlling filarial infection. The parasite specific enzymes of filarial worms has not been well charted and in an attempt to identify such enzymes, the presence of key enzyme of metabolic pathways and their kinetic properties in crude extracts are being investigated.

The presence of lactate dehydrogenase (LDH) and alkaline phosphatase (AP) in *Setaria digitata*, an adult filarial worm present in the peritoneal cavity of cattle, was detected in crude extracts prepared by homogenising in a hand homogeniser.

The optimum pH for LDH activity was 7.5 in phosphate buffer (0.1 M) and it declined gradually on either side of the pH optimum. The Lineweaver-Burk plots for the substrate pyruvate and cofactor NADH were linear and gave Michaelis constants (K_m) of 1.25 mM for pyruvate and 0.116 mM for NADH. The specific activity of the enzyme was 0.019 μmoles min^{-1} mg^{-1}.

The AP assay was carried out in veronal buffer at pH 9.0. The K_m value for the substrate p-nitrophenol phosphate was 40 mM when enzyme extraction was carried out in 0.1 M phosphate buffer at pH 6.8. However, when extraction was carried out in the presence of added 1% Triton, whereby releasing the membrane bound enzyme, the K_m value was found to be 5.2 mM. Therefore it appears that AP exists in more than one form. The specific activity of the enzyme remained same in extracts prepared with and without added Triton.

A - 27

AN OUTBREAK OF SWINE FEVER IN SRI LANKA

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Swine fever (hog cholera) has not been reported from Sri Lanka, although it is prevalent in our neighbouring countries. Swine fever was reported for the first time in Sri Lanka in April 1983. An epidemiological study revealed that the disease has got introduced to Sri Lanka through garbage containing infected pig meat products discarded from Katunayake International Airport. The spread of the disease within the country, was mainly by feeding pigs with hotel swill contaminated with infected pork scraps. The disease spread to all the major pig rearing districts killing about 30-40% of the pig population in the affected areas. The estimated pig population in Sri Lanka is about one lakh.

In this epidemic, the principal symptoms shown by the affected animals were lethargy, inappetence pyrexia 105-108°F, nasal and occular discharges, constipation followed by profuse diarrhoea. At terminal stages there was posterior paralysis, hyperemia of the skin, especially over the lower abdominal region, the snout, the ears and the medial aspects of the thighs. In infected herds the pregnant sows rarely showed symptoms, but produced still born or malformed fetuses which were carried through the full gestation period.

At postmortem examination maxillary, pharyngeal, and mesentric lymph nodes were seen to be highly haemorrhagic. Petechial and echimotic haemorrhages were present in the glottis, kidneys and sometimes in the inner lining of the gall bladder and urinary bladder. Haemorrhagic infarcts of the lungs involving one or more lobules were observed. There were marginal infarcts on the spleen. Multiple ulcers of the size of shirt

buttons—"button ulcers" in the large intestine mostly in the area of the ileocaecal valve were common in chronic cases. Presumptive diagnosis was made from the morbidity and mortality pattern, symptoms and lesions. The diagnosis was confirmed by the Central Veterinary Institute, Netherlands.

A - 28

ACTINOBACILLOSIS IN CATTLE IN SRI LANKA

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Actinobacillosis in cattle due to *Actinobacillosis lignierersi* has not been reported from Sri Lanka previously. This paper presents the results of a detailed clinical and bacteriological study of two outbreaks of Actinobacillosis in two large cattle farms in the dry zone of Sri Lanka (Oyamaduwa Farm at Anuradhapura and Livestock Farm at Nikaweratiya). The herd at Oyamaduwa farm consisted of about 850 cattle of Sindhi, Sahiwal and Sinhala breeds. Nikaweratiya farm had about 1,000 heads of Khillari cattle. Both farms had cattle of all age groups (suckling calves to pregnant cows).

On clinical examination about 25% of the cattle at Oyamaduwa farm and a similar percentage at Nikaweratiya farm were found to be affected. The principal lesions were abscesses on lymph nodes. Mostly the sub maxillary, sub mandibular, cervical, prescapular and prefemoral lymph nodes were affected. At the initial stages, the lymph nodes were hypertrophied and could be observed as raised, circumscribed nodules having the size of a nutmeg. Those eventually enlarged to the size of a tennis ball and developed into abscesses. The abscesses extruded a copious amount of thick creamy, non foetid, finely granular pus when incised. No lesions were observed on the tongue or on any other organs except that three animals which died at Nikaweratiya farm had multiple open and encapsulated abscesses on the lungs and liver. The general body condition of the animals at Oyamaduwa farm was average to poor and the animals at Nikaweratiya farm were in poor condition.

Actinobacillosis lignierersi organism was isolated from the pus by culturing on blood agar. Sugar reactions of several isolates from both farms showed that all isolates were identical. Treatment with sodium iodide to one group and with a combination of Penicillin and Streptomycin to another group showed that the latter treatment was more effective and economical.

A - 29

PNEUMONIC PASTEURELLOSIS IN SWINE IN SRI LANKA

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Pneumonic pasteurellosis in swine due to *Pasteurella multocida* has not been reported in Sri Lanka previously. This report describes the clinical and bacteriological observations of an outbreak of Pneumonic pasteurellosis in a herd of swine.

This herd consisted of about 800 pigs and were reared in enclosed pens. About 75% of the animals were noticed sick. The most prominent symptom was, elevation of body temperature to 104-106°F. Majority of the affected animals had a dry husky and unproductive cough at the beginning. As the disease advanced a slight watery nasal discharge was evident. The affected animals were lethargic and did not feed. About 67 animals died within 10 days of noticing the symptoms. Sick animals responded to treatment with Tribrissen injection. Altogether about 100 animals were lost.

Pasteurella multocida organism was isolated in pure culture from the heart blood and lungs of a number of dead animals. This organism although gave identical biochemical reactions to *Pasteurella multocida* type B causing haemorrhagic septicaemia in cattle, was not typable with any of the types A B D and E antisera. At

postmortem examination, consolidation of the lungs, especially the epical lobes, and pluracy were noticed. There were petechial haemorrhages in the heart and kidneys. Haemorrhagic gastritis and enteritis too were noticed in some cases.

A - 80

FURTHER STUDIES ON THE SUITABILITY OF FORMIC ACID AS A POST MILKING TEAT DIP IN MASTITIS CONTROL

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In a previous study it was demonstrated that the resident bacterial population on the teat surfaces were killed when dipped in 1.6% formic acid solution, without causing harm to the teats, and that 1.6% formic acid killed 10^8 *S. aureus* and *Str. agalactiae* organisms when suspended for 10 minutes.

Str. dysgalactiae and *Str. uberis* too are known to cause mastitis. Thus a good teat dip should be able to kill these organisms as well. In many instances milk samples from mastitic cows have yielded 10^8 organisms per ml on cultures. Thus a good teat dip should be able to kill this concentration of bacteria in a given time. In addition, a teat dip should remain stable and effective in the desired dilution for a reasonable period of time.

In this study the ability of formic acid to kill 10^8 organisms of *S. aureus*, *Str. agalactiae*, *Str. dysgalactiae* and *Str. uberis* when suspended in a 1.6% solution stored under room temperature (30-35°C) was tested fortnightly. The results showed that the efficacy of diluted formic acid remained unaltered up to the conclusion of the experiment in six months. Thus, formic acid 1.6% could be successfully used as a post milking teat dip in mastitis control.

SECTION B: AGRICULTURAL SCIENCES AND FORESTRY

B - 01

STUDY OF THE TIME FACTOR INVOLVED TO EQUILIBRATE THE MOISTURE CONTENT IN PADDY

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and **D. B. T. Wijeratne**
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Moisture content of paddy is an index to determine the stage of harvesting, quality for safe storage and feasibility of milling with maximum head rice recovery. The moisture content of newly harvested paddy ranges from 18-22% and is too wet for milling or storage. To result in maximum head rice recovery during milling, it is recommended that paddy should be shade dried.

The time taken to attain equilibrium moisture level was studied for different varieties of paddy at different initial moisture contents. Four varieties of paddy were selected and each of their initial moisture contents were increased to four desired levels. Samples were stored under room conditions and their moisture contents were determined every third day.

The moisture levels were observed to be decreasing with time in a specific type of curve. The pattern analysis from plotted diagrams and statistical analysis indicated that the curves follow the polynomial pattern of '$y = \beta + \alpha x + \gamma x^2$', with higher correlation coefficients. The magnitude of the results were graphically expressed by plotting curves for different initial moisture contents of the same variety. The moisture content at equilibrium point was estimated according to the equation and was found to be in the range of 12.0 to 12.7% (at 25°-28°C room tepmerature and 42-56% relative humidity). The average time taken to attain equilibrium state was 21 days for all four varieties and was independent of the initial moisture contents.

B - 02

OPTIMIZATION OF PROCESSING PARAMETERS FOR THE PARBOILING OF PADDY

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Grain quality is a combination of inter-related factors that include consumer taste, preferences, appearance, nutritional value, grain purity, processing and storage quality. Processing quality is dependent on processing methods as well as quality of the seeds that go in for processing[1]. Quality and colour of parboiled rice are dependent on the extent of parboiling. The heat treatment given in the process of parboiling affects the quality of the product and it also shows varietal differences[2]. The possible grain characteristics responsible for this behaviour are the size-shape and gelatinization temperature.

Seven varieties of paddy were selected representing all recommended Sri Lankan rice varieties with respect to the size-shape and gelatinization temperature. The laboratory processing parameters for optimum parboiling were studied for the above mentioned samples. The samples were tested at three different soaking temperatures and at two steaming periods. The degree of parboiling was determined on the basis of Ranghino test, milling quality, water uptake ratio and alkali degradation score.

Results indicated that optimum parboiling is dependent only on the gelatinization temperature of the varieties, but not on the size-shape. To obtain an optimum parboiled product it could be recommended that the low gelatinization temperature varieties be soaked at 70°C for six hours and steamed for twelve minutes, while the intermediate gelatinization temperature varieties be soaked at 65°C and steamed for fifteen minutes.

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B - 03

DEVELOPMENT OF A CONCENTRATED MALT EXTRACT USING LOCALLY AVAILABLE GRAINS AND STARCHES

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Malt extract is a sweet and viscous product containing considerable amounts of dextrin and maltose, prepared by digesting starch with enzymes of germinating grains. It is used to partly replace sugar in malted milk and confectionery. In developed countries, the main enzyme source for the production of malt extract is germinating barley and the substrate is wheat starch.

Locally available raw materials like germinating kurakkan (*Eleusine coracana*) seeds and manioc starch were investigated as substituents to reduce cost of production of malt extract. The product is designed to replace a certain amount of cane sugar used in the food industry.

Laboratory investigations revealed that: (*a*) The fourth day of germination paralleled with maximum diastatic activity; (*b*) A ratio of 1 : 8 of enzyme source : substrate could be recommended to result in a malt extract of 65-70° Brix, and (*c*) Mashing of enzyme source with substrate for one hour in each of the following temperature ranges (40-45, 50-55 and 60-65°C) maintained at neutral pH, are optimum conditions for maximum yield of a good quality malt extract.

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B - 04

CHEMICAL CONTROL OF THE CHILLI LEAF CURL COMPLEX

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The leaf curl of chilli (*Capsicum*) is prevalent in the traditional chilli growing areas of the North and East[1] and in the North Central Province. The casual factors are thrips, mites and virus[2]. The virus is transmitted by the insect vector *Bemesia.*

Commonly used chemicals were screened to compare their efficacy in controlling the casual agents of the chilli leaf curl. The treatments were: control, Methamidophos + Sulphur, Monocrotophos + Sulphur, Profenofos + Sulphur, Pirimiphos methyl and Profenofos, applied at 14 day intervals for a period of 90 days.

The populations of mites, thrips and whitefly nymphs and the number of upward and downward curled leaves were assessed fortnightly, a day prior to the treatment.

Profenofos + Sulphur and Profenofos gave better results than other treatments; there was no significant difference (p=0.05) between treatments Profenofos + Sulphur and Profenofos alone. Profenofos had good acaricidal action in addition to its insecticidal properties. Hence Profenofos used alone (without admixture with Sulphur) gives adequate control of chilli leaf curl.

This has two implications: (*a*) At the national level—Approximately 100 metric tons of Sulphur (WP) was imported in 1982, the bulk of it was used for the control of chilli leaf curl. Substantial savings in the import of Sulphur could be achieved by the use of Profenofos for chilli leaf curl control. (*b*) At the user level—By avoiding the use of Sulphur the frequent clogging of applicator nozzles, arising mainly as a result of inadequate 'creaming' of Sulphur can be eliminated. This would result in more uniform and economic application of pesticides.

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B - 05

THE UPTAKE OF SOME SYSTEMIC FUNGICIDES BY THE TEA PLANT AND THEIR EFFECTIVENESS AGAINST *MACROPHOMA THEICOLA* AND *PHOMOPSIS THEAE*

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Benomyl has been shown to be taken up by the tea plant from the soil and its activity within the plant has been found to be long lasting[1]. This was demonstrated by bioassays using *Phomopsis theae*, the fungus causing collar and branch canker in young tea. Similar studies were carried out with *Phomopsis theae* and *Macrophoma theicola*, the fungus causing stem and branch canker in the low-country. The fungicides tested were benomyl pyracarbolid, thiabendazole and triadimefon. The effectiveness of these fungicides on spore germination and mycelial growth of these two fungi was also tested *in vitro*.

All these fungicides were taken up by the tea plant, when applied to the soil, to varying degrees. Their activity within the plant, as determined by bioassays, lasted for different periods of time. In the *in vitro* tests, except for pyracarbolid, the other fungicides inhibited spore germination and mycelial growth.

The effectiveness of some of these fungicides, their systemic activity and their apparent lack of phototoxicity indicate the possibility of their use as routine fungicides for the control of these diseases in the field.

Reference

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B - 06

AN APPRAISAL OF TEA DETERIORATION DURING STORAGE

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Sri Lanka teas are subject to a 4-6 month period of storage during their transit to oversea destinations. During this period, the teas often lose much of their astringency and character and consequently suffer a reduction in valuation—which is clearly undesirable for our economy.

The above post-manufacture storage deterioration has, therefore, been studied by a number of workers. These studies are critically examined in this paper with a view to integrate the data, identify the possible causes, and suggest remedial measures to arrest quality deterioration during storage of black tea.

The major factor responsible for the loss in quality and valuation has been ascribed to the decrease in theaflavin content, and the principal agent catalysing these changes has been identified as moisture.

The moisture absorption patterns during the post-drying operations in the factory are re-examined; and the use of humidity-controlled chambers for these operations is suggested.

B - 07

STUDIES ON THE STORAGE CHARACTERISTICS OF TOP-FLAVOURY TEAS

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and **K. Sivapalan**
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Flavoury teas obtained during the flavour seasons in the high-grown tea districts are known to lose their flavour characteristics quite rapidly on storage, irrespective of the storage conditions.

This aspect was investigated to obtain information on the behaviour of flavoury teas during storage.

A top-flavour invoice of tea obtained from an upcountry estate during the peak Uva flavour season was divided into ½ kg lots, and stored under different conditions, namely: (1) Aluminium foil packets (Control); (2) Aluminium foil packets, with Silica gel; (3) Single lined polythene packets; (4) Double lined polythene packets–evacuated and filled with nitrogen.

Assessments for theaflavin content, moisture, flavour profile and tasters' valuation were carried out fortnightly for four months.

The results which were statistically analyzed indicated that there was (1) a considerable drop in valuation with storage; (2) no loss of theaflavins, and (3) a gradual decrease in the major flavour components.

It appears that the loss in valuation could be attributed to the loss in flavour components which could not be arrested even under ideal conditions of storage.

B - 08

TEA CONSTITUENTS AND MARKET VALUATION OF SRI LANKA TEAS

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Recently UNCTAD/GATT discussed the concept of minimum export standards for tradeable teas. Since earlier work on Malawi teas (CTC manufactured, 'plain teas') showed that a good correlation was obtainable between the theaflavin (TF) fraction of black tea and market valuation, there was a proposal that TF content be included as a minimum export standard, for all teas.

The theaflavin fraction of black tea is believed to make important contributions to the colour and 'mouthfeel' properties of its infusion. But TF as a criterion of quality/valuation may not be strictly correct for orthodox-manufactured Sri Lanka teas, because in these 'superior' teas, TF is one of the many constituents contributing to valuation. An investigation was therefore undertaken to evaluate TF as an index of market price. The relationship of other constituents was also examined.

In attempting to relate TF content to market price, consideration has to be given to the fact that because of market trends, the value in monetary terms given to TF (or any other biochemical component) varies from sale to sale. This was overcome by taking a large range of teas (25 samples) of one grade sold at the Colombo auctions in one day by one broker. The teas were assayed for their theaflavin content, total colour and soluble solid content. The results were collected over 16 sales, and the data used to examine in Sri Lanka teas, the influence of the different constituents on market valuation. No significant correlations were obtained.

B-09

THE EFFECT OF CONTROLLING SEED-BORNE PATHOGENS ON SEED GERMINATION IN SOYBEANS

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Twelve soybean (*Glycine max* (L) Merrill) genotypes, consisting of advanced breeding lines and cultivars, were tested to study the effect of controlling seed-borne pathogens on seed germination at optimal (30°C) and above optimal (38°C) temperatures. Benomyl (Benlate 50 WP), a fungicide, and amended and acidified potato-dextrose agar (PDA) were used to control seed-borne fungi and bacteria while plain PDA served as control.

The germination percentage increased and percent infection by bacteria decreased significantly when seeds were germinated on acidified PDA at 38°C. Meanwhile, Benlate controlled the fungal infection and improved the germination significantly at 30°C. The percentages of germination and fungal infection declined and percent infection by bacteria increased when the incubation temperature was raised from 30 to 38°C. However, two geno-types germinated as well at 38 as at 30°C with over 80%, despite differing incidences of seed-borne bacteria and fungi. Coefficients of correlation between germination percentage and percent of seed infection by seedborne pathogens were negative and significant.

It appears from this investigation that controlling of seed-borne fungi at low temperature and seed-borne bacteria at high temperature would improve seed germination in soybeans.

B-10

INFLUENCE OF WEATHER FACTORS ON THE INCIDENCE OF LATE BLIGHT OF POTATO

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The incidence of late blight in potato (*Phytophthora infestans* (Mont) de Bary) is strongly influenced by weather factors.

The course of the disease was monitored during the seasons *Maha* 1981/82, *Yala* 1982 and *Maha* 1982/83 at Sita Eliya with plantings of the susceptible variety Vekaro exposed to infection under natural conditions. Disease incidence was assessed using Key 3.1.2 of British Mycological Society.

Disease progress curves were mathemetically transformed using logistic transformation and fitted by simple linear regression lines. The slope of the regression line gave the 'r' value, Vanderplank's average apparent infection rate. 'r' value varied each season. The weather factors rainfall, relative humidity and sunshine hours were found to have a marked influence on the 'r' value and determined the variable severity of the attack of the epidemic during the three cultivation seasons.

SECTION B

B - 11

EVALUATION OF YIELD AND TUBER QUALITY OF SWEET POTATO VARIETIES INTER-CULTIVATED IN COCONUT PLANTATIONS

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Next to manioc, sweet potato is the most popular indigenous root/tuber crop. It is cultivated as a mono crop, under coconut and in home gardens. Cultivation of sweet potato under coconut is gaining importance because of the potential area available in the Intermediate and Wet zones.

Several varieties were evaluated under coconut at the Regional Agricultural Research Centre, Makandura, situated in the Low Country Intermediate Zone.

Varieties Wariyapola and Bentota A gave the highest yelds in trials under rainfed conditions in *Maha* 1980-81, *Yala* 1982 and *Maha* 1982-83. The net area yields obtained from these two varieties during these three seasons ranged from 4,191 to 10,864 kg per ha. These yields compare favourably with yields obtained with mono crops.

However, in taste panel ratings, their overall rank for fibrosity, flavour and taste, were intermediate The varieties A_1, B_1 and Cinchi ranked highest in such ratings while Georgia Red, Norin, A_{23} and Divulapitiya were the least acceptable.

B - 12

POTENTIALITY FOR INTER-CULTIVATING GRAIN LEGUMES IN COCONUT PLANTATIONS

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Several varieties of soybean, groundnut, cowpea and green gram were evaluated under rainfed conditions in coconut plantations at the Regional Agricultural Research Centre, Makandura, which is situated in the Low Country Intermediate Zone.

Soybean net area yields ranged from 1,116 to 1,792 kg per ha in *Yala* 1981, 731 to 1,120 kg per ha in *Yala* 1982 and 538 to 1,165 kg per ha in *Maha* 1982-83.

Groundnut net area yields ranged from 1,880 to 2,135 kg per ha in *Maha* 1980-81, 1,233 to 1,680 kg per ha in *Yala* 1981, 825 to 1,331 kg per ha in *Maha* 1981-82, 407 to 1,168 kg per ha in *Yala* 1982 and 757 to 1,211 kg per ha in *Maha* 1982-83.

Cowpea net area yields ranged from 121 to 631 kg per ha in *Maha* 1981-82, 179 to 776 kg per ha in *Yala* 1982 and 698 to 1,045 kg per ha in *Maha* 1982-83.

Green gram net area yields ranged from 28 to 186 kg per ha in *Maha* 1981-82, 115 to 375 kg per ha in *Yala* 1982 and 14 to 134 kg per ha in *Maha* 1982-83.

Generally, a variety x season interaction was evident in each crop.

While the yields obtained with soybean and groundnut compare favourably with that obtained under rainfed conditions in Dry Zone mono crop trials, the yields obtained with cowpea and green gram, particularly green gram, were low.

B-13

CHARACTERIZATION OF GROWTH IN EXOTIC, CROSSBRED AND INDIGENOUS PIGS

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This study was initiated to analyze the body characteristics of Exotic (E), Exotic × Indigenous (EI) and Indigenous (I) type of pigs. The data was collected from 64 E, 27 EI and 21 I type of animals maintained at the Swine Production Unit of the University of Peradeniya.

Breed groups were compared on the basis of body weight (BW), age and chest girth (CG). The E type had larger body measurements when compared with crossbred and indigenous groups. The increase in the measurement of each body character was more uniform when the trends were studied on an age rather than on a weight or chest girth basis. Within each age class, the EI type was heavier and larger than the I type for each body characteristic and the percentage increase in body weight for the EI type was 86.7%, 35.2%, 3.03% and 18.1% for 2 months, 2-6 months, 7-12 months and 1 year age classes, respectively.

Body weight was highly correlated with chest girth, body length, height at shoulders and hip width the correlations being always greater than 0.73 for the three breed groups. The high and positive correlation between body measurements may suggest a regularity, proportionality and uniformity in the growth process. It is therefore very probable that BW could be predicted accurately by fitting equations which use body measurements such as CG, as independent variables.

B-14

CHARACTERIZATION AND EVALUATION OF INDIGENOUS BREEDS OF LIVESTOCK—II. PIGS

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(*Dept. of Animal Science, University of Peradeniya*)

Although the indigenous breed of pig constitutes about 80 per cent of the pig population in the country, it has only been subjected to very limited scientific evaluation. The data used in this study was obtained from a nucleus herd of indigenous pigs maintained at the Swine Production Unit of the University of Peradeniya.

The indigenous pig is small in size. The height at shoulders for adult males and females are 60.2 $\pm$ 0.9 and 49.3 $\pm$ 1.9 cm respectively. The adult body weights of males and females were 45.9 and 36.6 kg respectively. The pig is characterized by short legs that result in the abdomen being almost dragged on the ground in pregnant females and a pronounced snout. The predominant colours are black or darker shades of grey. Light tan coloured pigs with horizontal stripes are also occasionally seen, thus linking the origin of the indigenous breed to Asiatic wild pig (*Sus scrofa vittatus*) which still abounds the jungles of Sri Lanka.

The litter sizes at birth and weaning were 6.35 and 4.17, respectively. The mean body weights at birth, weaning and six months were 0.59, 5.14 and 14.71 kg for males and 0.53, 5.01 and 13.16 kg for females, respectively. Castration resulted in a faster growth rate of indigenous males. Considerable improvement in reproductive and growth traits can be expected by crossbreeding the indigenous pigs with exotic breeds such as Large White.

SECTION B

B - 15

CHARACTERIZATION AND EVALUATION OF INDIGENOUS BREEDS OF LIVESTOCK—I. SHEEP

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Almost 90 per cent of the estimated sheep population in Sri Lanka belongs to the indigenous type However, no real attempts have hitherto been made to identify these sheep as a part of our animal genetic resources. The data used in this study was collected from a survey conducted among 39 flocks in Northern Sri Lanka during 1979-80.

The indigenous sheep is without exception hairy and small in size. Height at withers for adult males and females were 52.4 $\pm$ 3.3 and 49.2 $\pm$ 2.4 cm respectively. The adult body weights of males and females were 24.45 and 18.73 kg respectively. The breed is believed to be a retrograde South Indian breed. The sheep are of mixed colour. The mean weight at birth was 1.80 kg. The daily weight gains up to 12 months of age were 47.9 g for males and 37.6 g for females.

Peak lambing occurred between November and January. This is a deliberate rather than natural phenomenon, as ewes are bred in July-August so that the lambing season coincides with increased forage availability following North East monsoonal rains. The mean lambing percentage was 75.7. Lamb mortality up to six months of age was high ranging from 14 to 36%, the major cause being pneumonia resulting from exposure to dampness. The results suggest that the potential of indigenous sheep as a meat producer in Sri Lanka may have been underestimated.

B - 16

EFFECTS OF FEEDING COLOCASIA CORM MEAL ON THE GROWTH OF PIGS

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Colocasia (*Colocasia esculanta* (L) Schott), an aroid, exists in a wild state throughout the low-lying areas of Sri Lanka. The meal prepared from the corms of colocasia contained (dry matter basis) 2.15, 1.23, 8.35, 9.68 and 78.6 per cent crude protein, ether extract, crude fibre, ash and carbohydrates, respectively. The object of this study was to ascertain whether colocasia corm meal (CCM) could be used to replace maize in diets for growing pigs. Because of the presence of anti-nutritional factor(s) in raw CCM[1], boiling as a means of eliminating these factor(s) was also investigated.

Inclusion of raw CCM depressed growth and feed efficiency of pigs and this was attributed to the presence of anti-growth factor(s). Boiling the corms for 30 min., however, appears to eliminate or reduce the anti-growth factor(s). The results suggest that boiled CCM could be used up to 10% level in diet for growing pigs. Our data also indicate that the level of inclusion may be increased to 20% by prolonging the boiling time.

Reference

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B-17

ENERGY EVALUATION OF SELECTED POULTRY FEED INGREDIENTS

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Knowledge of the available energy content of feed ingredients is essential if economical poultry diets are to be formulated. Information on the metabolizable energy (ME) content of locally available feedstuffs is scanty. This paper summarizes the results of a series of chick bioassays[1] conducted to determine the ME values of selected poultry feedstuffs.

The nitrogen-corrected ME values (in kcal/kg) of the feedstuffs were as follows: Maize (3414), Paddy (2201), Damaged rice (2951), Rice bran No. 1 (3413), Rice bran No. 2 (2223), Wheat bran (1830), Wheat flour (2224), Sorghum (3447), Sugar mud (2114), Coconut poonac (1784), Gingelly poonac (2743), Rubber seed poonac (2683), Kapok seed cake (2093), Black gram (3030); Milk powder (2488), Fish meal (2862), Dried fish (2489) and Meat meal (1916).

Reference

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B-18

EVALUATION OF ANALYTICAL METHODS AND USE OF ION CHROMATOGRAPHY FOR SULPHUR IN COCONUT SOIL AND PLANT MATERIAL

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Analytical procedures for sulphur in soils and plant materials are compared for average percentage recovery rates. Studies of variability between techniques show that the variability between samples is lower for turbidimetry as compared to gravimetry. However, conventional procedures for estimation of sulphur lacked precision due to interference from inorganic ions in the oxidised material. The use of high performance liquid chromatography in the determination of total sulphur in rain water samples and plant material is described. Determination of several anions SO_4^{2-}, Cl^-, NO_3^- together is shown to be a distinct advantage.

References

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B-19

AGRONOMIC SIGNIFICANCE OF RECYCLING RICE STRAW

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The straw generated from a crop of rice can contain about one fourth the quantity of nitrogen and about twice the quantity of potassium fertilizer required by it. Additionally straw is rich in carbon and silicon. Yet straw is hardly put to agronomic use mainly due to lack of simple and inexpensive methods of recycling.

SECTION B

Straw with its high C/N ratio can be converted into compost without addition of any low C/N ratio materials by merely heaping it in a part of the paddy field. The time taken for composting will depend largely on the extent to which the heap gets moistened. In soils which are moderately well drained or well drained, straw can be recycled by direct incorporation after the first ploughing. Straw can also be spread on the surface of the land and rice seedlings transplanted. Another method is to add straw in between rows of transplanted rice. Each method has its advantages and limitations. In addition to supplying nutrients, surface added straw serves to effectively control weeds in a rice crop.

Field experiments have shown that the amounts of nitrogen and potassium fertilizer necessary for a rice crop can be reduced by use of straw. In fact higher grain yields are often obtained when straw is recycled.

B - 20

RESISTANCE TO BACTERIAL WILT (*PSEUDOMONAS SOLANACEARUM*) OF POTATO CLONES DEVELOPED AT THE INTERNATIONAL POTATO CENTER

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Resistance to bacterial wilt caused by *Pseudomonas solanacearum* is a character desired of varieties to be grown in Sri Lanka especially in the Uva region and the lowlands. Efforts are being made by the International Potato Center, Peru (CIP) to develop potato varieties resistant to bacterial wilt using *Solanum sparsipilum*, *Solanum chacoense* and *Solanum phureja* as sources of resistance.

In a collaborative programme with CIP, several selections developed for resistance to bacterial wilt derived from *Solanum phureja*, as well as other CIP clones developed for resistance to late blight and adaptability to tropical lowland conditions, were screened against bacterial wilt in heavily infested field plots at Rahangala in the warm up-country dry zone and Getambe in the warm mid-country wet zone.

Of the many samples tested, the CIP lines 379 418, 379 420 and 379 421 which are also heat tolerant, have shown good resistance to the disease at Rahangala while 800 224 and 377 863.1 have performed well against bacterial wilt at both Rahangala and Getambe. The line 377 838.2 has also shown promise.

B - 21

THE SPREAD OF BACTERIAL WILT (*PSEUDOMONAS SOLANACEARUM*) OF POTATO THROUGH THE USE OF DISEASED SEED

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Bacterial wilt of potatoes in cooler climates and higher elevations is caused by *Pseudomonas solanacearum* biovar 2 of Hayward[2] or race 3 of Buddenhagen[1]. At higher temperatures and lower elevations, it is caused by Hayward's biovar 3 or Buddenhagen's race 1. In Sri Lanka, only biovar 2 occurs in the cool up-country wet zone of the Nuwara Eliya District while biovar 3 is found at lower elevations[3].

In an investigation of a recent outbreak of bacterial wilt in the Jaffna District in fields around Urelu, Kopay, Urumpirai, Uduvil and Chankanai, isolates of the pathogen were obtained from diseased plants and their biovars determined. Sixteen of twenty-two isolates examined were of biovar 2, the typical cool temperature type, and the remaining six biovar 3.

The commerce of seed potatoes is a lucrative business. Farmers in the Jaffna and Badulla Districts, who are unable to obtain their requirements of certified seed potatoes from official sources, purchase potatoes for use as seed from private dealers who trade uncertified seed potatoes obtained from growers in the Nuwara Eliya and Badulla Districts.

It is evident that this outbreak of bacterial wilt in the Jaffna District has been caused by the use of uncertified seed, infected with *Pseudomonas solanacearum*, purchased from private dealers, a recognised means of spread of the disease to areas where it was not previously known.

This outbreak of bacterial wilt is both a warning and a challenge. Farmers must not use uncertified seed potatoes, the health status of which is uncertain. Also, the need for farmers to obtain uncertified seed potatoes must be prevented by an effective programme of seed potato production recognising disease aspects which is long overdue.

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B - 22

STUDIES ON LEAF CURL OF TOMATO (*LYCOPERSICON ESCULENTUM*)

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The condition of tomato referred to as leaf curl is prevalent in the tomato growing areas of the Kandy District, being more severe during the Yala season than in Maha. Its characteristic symptoms are a curling of leaflets, puckering, reduction of leaf size and vein clearing. Affected plants are stunted, especially if the condition sets in during the early stages of growth when yields are markedly reduced.

Two components of the condition have been distinguished, one viral associated with the whitefly *Bemisia tabaci*, and the other "physiological" associated with environmental factors. The former is more damaging; plants usually recover from the effects of the latter with a change of conditions.

In transmission studies, the viral component could not be transmitted by sap but it was successfully transmitted by grafting and by whiteflies. Whiteflies were able to acquire the virus from a diseased source in 30 min and transmit the virus after an incubation period of 4 h. The minimum inoculation feeding period was 1 h. A single whitefly was able to transmit the virus. Whiteflies, after acquiring the virus, remained infective for life. Nymphs were also able to transmit the virus though less efficiently than adults. Female whiteflies appeared to be more efficient transmitters than males.

A number of plant species were investigated as potential hosts of the virus. Six of those infected, *Nicotiana tabacum*, *Nicotiana glutinosa*, *Vernonia cinerea*, *Acanthospermum hispidum* and *Sida acuta* reacted with leaf curling symptoms. *Acalypha indica* developed a yellow mosaic. The common weed *Acanthospermum hispidum* was most easily infected. Two other common weeds, *Ageratum conyzoides* and *Urena lobata* were not infected.

SECTION B

B - 23

SEED-BORNE FUNGI OF CULTIVATED CROPS IN SRI LANKA

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In a systematic survey of seed infections in crops cultivated in Sri Lanka, nearly 300 seed samples of cereals, pulses and vegetable crops from various agro-ecological regions of the country were examined for the presence of seed-borne organisms. The blotter method for determining seed-borne fungi was extensively used.

Rice samples constituted the bulk of the cereals tested. There were marked differences in the degree of infection with *Drechslera oryzae* and *Trichoconis padwickii* in seed samples from different locations and also in seed samples of different varieties from the same location. *Pyricularia oryzae* was not encountered.

The crops tested in pulses were black gram, cowpea, green gram and soybean. *Ascochyta* sp., *Botryodiplodia* sp., *Cercospora* sp., *Corynespora cassiicola, Fusarium oxysporum, Fusarium solani, Macrophomina phaseolina, Myrothecium roridum* and *Phomopsis* sp. were noteworthy recordings.

The fungi of pathogenic significance detected in samples of vegetables and other crops were *Ascochyta* sp., *Botryodiplodia theobromae, Cercospora* sp., *Didymella bryoniae, Fusarium oxysporum, Fusarium solani, Macrophomina phaseolina, Myrothecium roridum, Myrothecium verrucaria, Phoma* spp. and *Rhizoctonia solani.*

Besides the above fungi, several genera of saprophytic fungi were also observed in most of the seed samples, *Chaetomium* spp., *Penicillium* spp. and *Trichoderma* spp., which are known to be biocontrol agents, were detected in several samples.

B - 24

THE VARIATION OF FUNGAL INFECTIONS IN SOYBEAN SEEDS WITH TIME OF HARVEST

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Gannoruwa, Peradeniya)

The nature of fungal infections was determined for seed samples of soybean harvested at maturity, and at two and four weeks after maturity.

Visual examination of dry samples revealed discoloured and deformed seeds. Black, brownish red and purple seed coat discolorations were observed. Seeds with purple blotch showed cracking.

In blotter and agar tests, the following fungi were recorded: *Alternaria* sp., *Alternaria tenuis, Aspergillus* spp., *Botryodiplodia* sp., *Cercospora kikuchii, Chaetomium* spp., *Choanophora* sp., *Cladosporium* sp., *Curvularia* spp., *Drechslera oryzae, Drechslera tetramera, Fusarium equiseti, Fusarium moniliforme, Fusarium oxysporum, Fusarium semitectum, Fusarium solani, Fusarium* spp., *Macrophomina phaseolina, Myrothecium roridum, Nigrospora* sp., *Rhizopus* spp., *Stemphylium* sp. and *Trichoderma* spp.

In sand tests, emergence was generally low. Seed rot and seedling rot were commonly observed. Incubation of seedlings with lesions confirmed the presence of the following fungi: *Cercospora kikuchii, Curvularia* spp., *Fusarium* spp., *Phoma* spp. and *Phomopsis* sp.

The percentage incidence of fungi recorded was highest in seed samples harvested four weeks after maturity, moderate in samples harvested two weeks after maturity and lowest in samples harvested at maturity. The increase was sharp in four cultivars for *Phomopsis* sp. and in one sample for *Fusarium* spp. The increase was remarkable in other cultivars for these fungi and *Cercospora kikuchii.* The frequence of occurrence of abnormal seedlings followed the same pattern. Reverse results were obtained for normal seedlings.

Physiological changes in the seed during maturity and weather conditions prevailing at the time of harvest appear to be factors influencing the frequency of incidence of the fungi recorded.

B-25

FOLIAR INFECTIONS OF THE SACRED BO TREE AT ANURADHAPURA

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The Sacred Bo Tree at Anuradhapura (*Ficus religiosa*) now has a rather thin canopy and a study was made of foliar fungi which might impair its condition following the observation of necrotic brown lesions on some leaves.

Normally, the foliage of trees such as *Ficus* spp. is infected by several fungi generally not regarded as pathogenically important. Black crustations occur on the surfaces of leaves on the Sacred Bo Tree. They are produce by the fungus *Phyllachora ficum* which is not considered damaging. However, irregularly shaped brown lesions spreading inwards from the margin in some leaves caused concern. A diffused interveinal yellowing of the lamina was also observed.

Several isolations were made from affected leaves and the fungi indentified included the following: *Nigrospora sphaerica, Nigrospora* state of *Khuskia oryzae, Pestalotiopsis versicolor, Alternaria alternata, Phyllosticta religiosa, Fusarium semitectum, Curvularia lunata* state of *Cochliobolus lunatus* and *Colletotrichum* state of *Glomerella cingulata.*

While *Nigrospora* was the most common fungus produced in culture, *Phyllosticta* which causes a blight of leaves and *Colletotrichum*, a weak parasite, could be regarded as damaging to a tree in a state of low vitality. In plate assays, these fungi were found to be sensitive to fungicides such as Benlate (benomyl) and Delsene X (carbendazim + coordinated zinc ion and Maneb).

As the Sacred Bo Tree is in a state of low vitality, protective fungicidal spraying against the weakly pathogenic fungi was carried out in a programme to which the Deputy Director, Agriculture (Gardens), Mr. D. T. Ekanayake, gave leadership. The intensive attention that was given protected the Sacred Bo Tree during a period when it was subjected to considerable environmental stresses which increased its vulnerability to weak pathogens.

B-27

MILD STRAIN PROTECTION IN COMBATING THE PASSION MOTTLE VIRUS DISEASE

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Passion mottle is a serious virus disease of passion fruit (*Passiflora edulis*) limiting production. The virus is not seed transmitted but healthy seedlings get infected quickly when set in the field because the common weeds, *Passiflora foetida* and *Cassia occidentalis*, are carriers of the virus. This virus is also easily transmitted mechanically and is spread in the field through human and animal agencies.

In an attempt to live with the disease, many isolates of the virus from passion fruit and weed hosts, collected from various localities, were studied to identify possible mild strains. Seedlings sap inoculated with these isolates which showed only mild symptoms or were almost symptomless were set in a field at Horatapola, near Wadumunnegedera, a site where the disease occurred in a severe form. A "clone" from this planting designated 1.3, which showed very good vigour and virtually no virus symptoms, was selected and propagated. Grafts raised with scions from this clone were grown under field conditions in coconut plantations at Walpita

and Madampe. At Walpita, where field conditions were generally favourable and weed hosts almost absent, vines made vigorous growth and produced abundant foliage with no apparent symptoms of virus infection. Few fruits, however, were set. At Madampe, where site factors were adverse, with severe moisture stress periodically and weed hosts abundant, vines showed stress symptoms of the adverse growing conditions and also mild symptoms of virus infection. Few fruits were set.

The field tests so far indicate that the mild strain protected clone will perform well if grown under conditions of good management with adequate irrigation and weed hosts of the virus kept in check. Hand pollination is essential to secure satisfactory fruit set.

B - 27

CONTROL OF DAMPING-OFF IN NURSERIES CAUSED BY *PYTHIUM BUTLERI*

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Pythium butleri Subramaniam causes damping-off in nurseries especially in the warm regions of the country. The fungus is readily isolated in plain water agar with Benlate (benomyl) added to the medium at 50 mg/l (PWA-benlate medium).

Pythium species cannot tolerate soil temperatures above 45°C. Soil temperatures in nursery beds were raised above this temperature using solar radiation by covering the beds with a double layer of clear polythene for two or more successive days when there was bright sunshine. Soil temperatures at 2 in. and 4 in. depths exceeded 45°C for more than one hour, the desired minimum, each day under these conditions. This treatment was very effective in controlling damping-off while germination was also quickened and the seedling produced vigorous.

Formalin treatment at 100 ml/m^2 was also found to be effective in controlling damping-off. Morut (quintozene + fenaminosulf) did not give satisfactory results.

B - 28

FUNGAL PATHOGENS OF BUSH BEAN (*PHASEOLUS VULGARIS*)

B. Sivakadadcham, S. N. de S. Seneviratne
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Reduced plant stands and seedling deaths, often resulting in serious crop losses, have attracted increasing attention both in the up-country intermediate and mid-country wet zones. The diseases induced are caused by soil-borne fungal pathogens, some of which have also been detected seed-borne.

Foot rot is a serious condition which becomes noticeable during the second and third weeks after sowing. Affected seedlings wilt, a dry rot is observed in the tap root, smaller roots are killed, and the stem becomes hollow or pithy. *Rhizoctonia solani* was consistently isolated from plants with these symptoms and is regarded as the main causal agent. Other fungi associated with the condition were *Pythium butleri, Sclerotium rolfsii, Fusarium oxysporum, Fusarium solani* and *Fusarium equiseti*. One or more of these fungi were isolated together with *Rhizoctonia solani* from foot rot lesions, the *Fusarium* species being more abundant than *Rhizoctonia solani* in older lesions. However, they were found to be non-pathogenic or only weakly pathogenic in bush beans. *Pythium butleri* caused an easily detectable soft rot. *Sclerotium rolfsii* induced typical collar rot symptoms, sclerotia and mycelial mats being usually present in diseased plants.

Pathogenicity studies indicated *Rhizoctonia solani* as the primary pathogen involved in the foot rot condition although the other organisms also probably contributed to the overall expression of foot rot symptoms.

In seed infections studies, *Colletotrichum dematium, Colletotrichum* sp., *Fusarium equiseti, Fusarium oxysporum, Fusarium semitectum, Fusarium solani, Macrophomina phaseolina* and *Rhizoctonia solani* have been detected as being seed-borne.

B - 29

NEW HOSTS OF *SCLEROTIUM ROLFSII* IN SRI LANKA

B. Sivakadadcham, S. N. de S. Seneviratne, Premala Jeyanandarajah *and* **Srimathie Udugama**
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Sclerotium rolfsii is one of the most destructive soil-inhabiting fungal pathogen attacking a wide range of hosts in the warmer regions of the world. It generally invades host tissues at the soil level causing collar rot.

Weber[2] listed 189 host species of *Sclerotium rolfsii* from several plant families and Bertus[1] recorded some 25 hosts attacked in Sri Lanka by this pathogen, including several common vegetables and weeds. More hosts, detected at Gannoruwa, can now be added to these lists.

Mango (*Mangifera indica*) and papaw (*Carica papaya*) seedlings were naturally infected under field conditions, typical collar rot symptoms being induced in them. Unthrifty banana (*Musa paradisiaca*) was found to be infected with dense mycelial mats and sclerotia developed on the inner surface of leaf sheaths. Potted plants of *Peperomia* sp. were attacked at soil level.

Of special interest are records of this pathogen on some lower plants. The water fern *Azolla* sp. was attacked under paddy field conditions. Two species of bryophytes, the liverwort *Riccia* sp. and the moss *Zygodon* sp. growing in soil infected with an isolate of *Sclerotium rolfsii* from chilli were parasitised and killed by the pathogen. This appears to be the first report of *Sclerotium rolfsii* in bryophytes.

These observations, while demonstrating the sub-aerial activity of *Sclerotium rolfsii*, also indicate its versatality as a pathogen.

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B - 30

SOURCES OF RESISTANCE TO BACTERIAL WILT (*PSEUDOMONAS SOLANACEARUM*) IN "BATU" VARIETIES OF *SOLANUM*

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Apart from the cultivated variety of brinjal, *Solanum melongena*, there are other "batu" varieties growing in a semi-wild state, some of which are edible and others used for medicinal purposes. Two cultivars of *Solanum melongena* (wambatu), two of *Solanum xanthocarpum* (elabatu), *Solanum torvum* (gonabatu, thibbatu) and two other *Solanum* species referred to a thiththathibbatu and naibatu were screened against bacterial wilt in a heavily infested field at Getambe.

Thiththathibbatu and *Solanum torvum* were found to be highly resistant to wilt. Both these varieties offer possibilities as resistant rootstocks on which susceptible brinjal varieties of desired fruit quality may be grafted.

SECTION B

B - 31

EFFECT OF ADDITION OF PHOSPHORUS ON THE GROWTH OF AZOLLA

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The growth of Azolla and its nitrogen fixing ability are largely dependent on the quantity of phosphorus in the growing medium. A field experiment was conducted at Gannoruwa, to determine the effect of addition of different levels of concentrated superphosphate on the growth of two strains of *Azolla pinnata*.

Two hundred grams of fresh weight of Azolla were introduced to a bunded 2m × 2m plot where 15 cm standing water was maintained throughout. Phosphorus rates ranging from 0 to 16.66 kg P_2O_5/ha/week were added at the commencement of the experiment and at weekly intervals thereafter. The experiment was carried out for 6 weeks and at the end of every 2 weeks Azolla was harvested. Thus, 3 harvests were taken.

The effect of addition of phosphorus on fresh weight of Azolla showed a quadratic relationship, with the highest yields obtained for the addition of about 12.50 kg P_2O_5/ha/week, for both strains and at all 3 growth periods. The nigrogen content of Azolla showed a linear relationship to added phosphorus. Only about 20% of the phosphorus added was taken up by the Azolla. The fate of the balance phosphorus needs to be ascertained with a view to its use by an accompanying or following rice crop.

B - 32

PROSPECTS AND PROBLEMS OF AZOLLA CULTIVATION IN SRI LANKA

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Azolla is a small water fern belonging to the family Salviniaceae. The potential significance of Azolla as a source of nitrogen in agriculture is due to its symbiotic association with the nitrogen fixing blue-green algae, *Anabaena azollae* that is found within its leaves. Azolla has been known and used as a green manure for rice in Vietnam for centuries.

Of the 6 species of Azolla in existence today, *Azolla pinnata* is found occurring naturally in many parts o Sri Lanka. Although some rice fields in the country had this for well over half a century, there is no evidence of attempts to exploit its agronomic potential by farmers.

Under favourable conditions Azolla can be made to provide more than half the quantity of nitrogen required by a rice crop. Additionally it provides organic matter to the soil.

Water is the fundamental requirement for the existence of Azolla. A major constraint to the extension of its use in rice culture in Sri Lanka would be the non-availability of sufficient water during certain periods of the year in some parts of the country.

Some insect pests and snails are found to be very disastrous to the growth and propagation of Azolla.

As a supplier of nitrogen and carbon using atmospheric sources and solar energy, Azolla is a bio-fertilizer with great potential.

B- 33

IMPROVEMENT OF CHILLIE VARIETIES FOR THE EASTERN REGION OF SRI LANKA

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In the Eastern Region, chillie cultivation is predominantly undertaken in the regosols and non calcic brown soils. To improve production, a breeding programme was undertaken to combine the desirable characteristics of the varieties MI-1 and PC-1.

The segregating populations of the cross PC 1 x MI-1 were found to be more promising, and they were screened under farmers field conditions to identify genotypes with high adaptability. Pedigree method of breeding was followed.

The contrasting characteristics of the parents with differences in plant height, fruit bearing position, fruit dimensions, the colour of immature and mature fruits, and their resistance to diseases and environmental stresses, have generated the release of a vast array of genotypic combinations. Most of the morphological characters of MI-1 showed dominance over that of PC-1.

On an average 9% natural cross pollination was observed in the parental varieties. The segregating genotypes were grouped into various character combination classes numbering 108 and the promising types were studied. Segregants with erect fruit position showed greater resistance to leaf curl diseases than those with drooping fruits. Some of these showed perennial habit of growth.

Some of the selections KA 2, KA 2-9, KA 2-27, KA 6-5, KA-11, KA 28, appear promising in the Eastern Region. The selection KA 6-5 has a high rate of growth in the early stages even with limited soil moisture availability and it continuously produces pods with adequate soil moisture levels.

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ADAPTABILITY OF KA CHILLIE VARIETIES

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Chillies form an important cash crop in the Dry Zone of Sri Lanka. Variations in the environmental conditions and crop management practices determine the production potential of a chillie crop.

Promising KA chillie varieties when tested for ripe fruit yield under different environmental and management conditions showed that the varieties KA-2 and KA-2-9 are adaptable under well managed conditions. Under moderate management levels the variety KA 6-5 appears promising. The variety KA 11 tends to give stable high yields. The lines KA 4, KA 6-5, KA 2-9, KA 2 were found to be suitable for green chillie production.

In a range of environmental continuum of a region, the potential yield of the varieties differ markedly. Best advantage will be obtained when varieties suitable to specific conditions are cultivated.

B - 35

ENVIRONMENTAL ADAPTATION OF GROUNDNUT CULTIVARS

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Twelve groundnut cultivars were tested for their yield and other agronomic characters at 6 locations of the dry and intermediate zones in *Maha* 1981/82 and *Yala* 1982 seasons. At each location the treatments were arranged in a randomized complete block design with 3 replications. The recommended cultivar No. 45 served

as the check. South China and No. 45 recorded the highest mean yields. Varietal differences for the number of pods, seed size, shelling percentage and the number of seeds per pod were observed.

The regression analysis[1] of the yield data showed that the cultivars South China X-14-4-b-19-b, V-53 tatu and No. 45 have general adaptability. These cultivars recorded above average pod yields in all the environments. Six of the remaining cultivars recorded regression coefficients close to unity and had regression lines below the average line showing poor adaptation to all the environments.

A 92 and Red Spanish were classified as having above average stability. However, Red Spanish produced below average yields in all the environments whereas A 92 produced above average yields in poor environments.

Reference

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B - 38

THE RELATIONSHIP BETWEEN ATMOSPHERIC DEPOSITION OF SULPHUR AND INTENSITY OF RAINFALL

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The amount of sulphur brought down by rain over a period of one year at ten locations in Sri Lanka varied from 4.9 to 23.9 kg S/ha. In general locations with higher rainfall had higher sulphur deposition. The quantity of sulphur (S) brought down in kg/ha was related to the annual rainfall in mm (RF) by the equation:

$$S = 1.0625 + 0.0072RF$$

with a r^2 value of 0.79.

Other conditions being same, rain falling in one hour may wash down less S than rain of the same magnitude falling over a ten hour period in the form of a light drizzle. Further, a rainfall of a certain intensity falling after a long drought period can be expected to have more S in it than a similar rain falling the next day. These considerations point out the limitations of making judgements on atmospheric S content by studying a particular rainfall. On the other hand, when the following model,

$$\sum_{i=1}^{j} S \Big/ \sum_{i=1}^{n} S = f\left[\sum_{i=1}^{j} RF \Big/ \sum_{i=1}^{n} RF\right]$$

where $j = j^{th}$ observation and n = number of observations, was fitted, the r^2 value increased to 0.93. Regression coefficients were found to be significantly different from zero, indicating that cumulative sulphur is proportional to cumulative rainfall and that there might be a continuous flow of sulphur to the atmosphere.

EFFECT OF SUBLETHAL DOSES OF SOME PYRETHROID INSECTICIDES ON THE REPRODUCTIVE RATE OF BROWN PLANTHOPPER, *NILAPARVATA LUGENS*

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Three synthetic pyrethroids—decamethrin, cypermethrin and alfoxylate—and a carbamate were tested on the rice brown planthopper, *Nilaparvata lugens* Stal. (Homop.: Delphacidae) in a laboratory experiment. Evaluations were carried out at two sub-lethal doses and one lethal dose for each of the four insecticides. Insecticides were applied to rice seedlings in a Potter's spray tower.

Pyrethroid treatment resulted in significantly higher levels of *N. lugens* numbers, although the degree of resurgence did not vary among the different levels tested. These pyrethroids caused nymphal mortality at 3 days after treatment, but not at seven days after treatment. Pyrethroids at sublethal doses used had no effect on nymphal mortality. The results indicated a possible mode of resurgence *via* increased egg-hatchability.

B - 38

SOME ASPECTS OF THE BIOLOGY AND ECOLOGY OF THE RICE FIELD MOLE RAT, *BANDICOTA BENGALENSIS*, IN SRI LANKA

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Field investigations on the biology and ecology of the rice field mole rat *Bandicota bengalensis* Gray (Rodentia : Muridae), was carried out for two cultivation reasons. These rats colonised the rice field bunds by making extensive burrows within. Observations were made on the rat population by regular fumigation of their burrows using phosphine gas followed by the examination of the killed animals.

The results clearly indicated a very close synchrony between the development of the rat colony and the stages of the rice crop. Primodia initiation stage of the rice crop appeared to stimulate the reproductive physiology of the female rats that led to an increase in the numbers of gravid females. This was followed by increased nesting, littering and juvenile production. Thus it was possible to re-classify the stages of the rice crop in terms of the reproductive status of the female rodent population. However, numbers of adult male rats fluctuated very widely and showed no definite relationship with the stage of the rice crop.

These observations were useful in designing a practical control strategy against this pest.

B - 39

EFFECT OF TWO BOTANICALS ON THE FECUNDITY AND MORTALITY OF COWPEA WEEVILS REARED IN THE LABORATORY

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The effect of two botanicals i.e. powdered leaves of *Azadirachta indica* L. and *Vitex negundo* L., on the fecundity and mortality of the cowpea weevil, *Callosobruchus maculatus* F., was tested in the laboratory.

These botanicals significantly lowered the fecundity of the cowpea weevil, compared to that in the treated control. However, compared to the recommended insecticides, the effect of these botanicals on the mortality

of the weevils was not significant. These botanicals did not affect the seed viability whereas the recommended insecticides significantly lowered the rate of germination of the seeds.

The results indicate that these botanicals in their present formulation are not promising as control agents of the cowpea weevil adults although their effect on the fecundity of these weevils is worth further investigation.

B - 40

EXTENT OF AFLATOXIN CONTAMINATION IN COCONUT KERNEL PRODUCTS PROCESSED IN COMMERCIAL MILLS

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Coconut kernel products, copra, copra meal and coconut oil collected from 45 oil mills in Sri Lanka were analysed for the presence of aflatoxins B_1 and G_1 over a period of one year.

Of 339 samples, approximately 50 per cent contained medium-high levels (0.05-1.0 mg/kg) of aflatoxin B_1. None of the samples had levels above 1 mg/kg. Among 99 selected copra kernels with heavy fungal growth, the levels ranged from 0.05-4 mg/kg in 50 per cent of the kernels. Two kernels contained higher levels of 10 and 20 mg/kg; 29 per cent of the kernels contained less than 0.05 mg/kg while no aflatoxin was detected in 18 per cent. The aflatoxin levels detected in cured copra and its processed products were less than those reported in other oil seeds. This is probably associated with the inhibitory effect of smoke on fungal colonization in copra.

There were 25 oil mills in continuous production during the survey period. The mills were classified as "regularly high", "occasionally high", "regularly medium low", and "low or nil". These patterns were associated with the rainfall, extent of curing of copra, conditions and duration of storage, mixing of copra of different quality, economic reasons and lack of quality control measures.

This work was supported by a research grant from NARESA and a studentship from the Coconut Board, Colombo.

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AFLATOXIN CONTAMINATION AND FREE FATTY ACID CONTENT OF COCONUT OIL FROM SMALL-SCALE MILLS

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The copra used for oil extraction in the small scale power driven mills is either dried intermittently in the sun and in the shelves above the hearth in domestic kitchens or are rejects from large scale processing mills, both categories showing heavy fungal contamination. This could result in consumption of high amounts of aflatoxins by certain groups of people continuously, in contrast to the use of coconut oil from large mills where contaminated oil gets diluted and distributed in larger areas of the country. The aim of this study was to find the extent of aflatoxin contamination in oil processed in the small mills and any possible correlation of toxin levels with the free fatty acid (FFA) content.

The mean aflatoxin B_1 level observed for 115 samples of coconut oil was 0.15 mg/kg as against 0.05 mg/kg observed in large-scale processing mills. Among them there were 10 samples showing levels between 0.5-3.0 mg/kg. The FFA content in oil gave a modal value of 0.5-1 % in a range from 0.33-19.25 %. The mean FFA content was 3.56 % indicating the oil to be of very poor quality. No correlation was observed between the free fatty acid content and the aflatoxin B_1 levels ($r = +0.0648$).

This work was supported by a research grant from NARESA.

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A PILOT PLANT FOR THE DETOXIFICATION OF AFLATOXINS IN COCONUT OIL

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Among the methods described in the literature for the detoxification of aflatoxins in agricultural commodities, chemical refining is the only method practised commercially today, for oils. The possibility of detoxifying aflatoxins by exposing to sunlight under laboratory conditions was first shown in 1977.

A pilot plant was designed for solar detoxification of oil. This consists of eight aluminium trays placed in an overlapping cascade arrangement supported on a wooden frame. The apparatus is set at a fixed inclination. A residence time of 9 minutes and an oil film thickness of 1.0 ± 0.2 mm was maintained at a throughout of 5 litres of oil per hour.

In this plant, exposure of coconut oil on a bright sunny day for 6 minutes was sufficient to detoxify 0.1 mg/kg aflatoxins to levels below 0.02 mg/kg. Industrial exploitation of the apparatus is suggested.

This work was supported by a research grant from NARESA. We thank Mr. S. Ranjithan for the assistance in designing the pilot plant.

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B - 43

PROXIMATE ANALYSIS AND MINERAL COMPOSITION OF FIVE SRI LANKAN CULTIVARS OF WINGED BEANS, *PSOPHOCARPUS TETRAGONOLOBUS* (L.) DC.

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The proximate composition was determined for the following five cultivars, Sri Lankan Selection 7 (SLS 7), SLS 18, SLS 40, University of Papua New Guinea Selection 102 (UPS 102) and Thailand 25.01. The ground samples of mature dried seeds were used in the study. The results showed that the protein content (mean $\pm$ standard deviation) of the five varieties was 33.29 ± 1.24 per cent, the fat content 18.30 ± 0.87 per cent and the soluble carbohydrate 10.92 ± 2.46 per cent. The values obtained in this study fall in line with the values reported by earlier workers for the seeds of Winged Beans.[1]

The mineral composition was determined by using an Atomic absorption spectrophotometer. Variations in calcium, iron and phosphorus contents among the five cultivars were hardly observed. However, magnesium, sodium and potassium contents indicated some variability and the amounts were 182.40 ± 71.55 mg/100g, 108.00 ± 35.94 mg/100g and 597.60 ± 54.87 mg/100g respectively. Compared to the values reported by earlier workers,[1] sodium content was considerably high since the samples were from saline areas.

Reference

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SECTION B

B - 44

PRELIMINARY STUDIES ON LEAF PROTEIN CONCENTRATE

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Protiens were extracted from Winged beans, *Psophocarpus tetragonolobus* (L.) DC leaves. Sri Lankan Selection (SLS 40) was used since it has profuse leafy growth. The decolourisation of leaves was attempted by solvent extraction and among different solvents ethanol gave the best results.

The off-white coloured leaf protein concentrate (LPC), obtained after centrifugation was pressed well to reduce the amount of water. The press-cake with the moisture content of 55% was preserved at room temperature, using 10% salt as a preservative..

The LPC consisted on a dry weight basis 59.73% crude protein, 6.13% crude fibre, 5.40% ash and 1.71% crude fat.

The trypsin inhibitor activity in the LPC was 7.95×10^3 trypsin units inhibited/g, but it was found that it could be destroyed by heat treatment for twenty minutes. The *in vitro* digestibility of protein concentrate amounted to 87.36%.

The high protein content and the high *in vitro* digestibility suggest the use of LPC in animal feed as well as incorporating into food formulations.

B - 45

AN EPIDEMIOLOGICAL APPROACH TO THE CONTROL OF *OIDIUM HEVEAE* IN RUBBER

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Powdery mildew of rubber caused by *Oidium heveae* affects immature leaves formed during refoliation after the annual wintering, resulting in premature defoliation referred to as secondary leaf fall (SLF).

The pattern of wintering and the incidence of SLF due to *Oidium* were recorded on clones PB 86, RRIC 7, RRIC 45 and RRIC 52 at Dartonfield Estate over a 4 year period. In addition, the host phenology, the pattern of spore distribution and spore viability were also studied during the same period.

The results show that the wintering of all clones usually commences in early December, and reaches a peak between the 3rd-4th week of January. However, the exact time differs from year to year and on the clone, depending on the weather conditions during the interim period. Generally, in RRIC 45 the peak wintering period is seen in 1st-2nd week of February. The commencement of SLF takes place in the 2nd week of February and is continued into early April and late May, with the peak infection brtween 3rd-4th week of February. In RRIC 45 peak SLF occurs in the 2nd week of March. In some years a small peak of SLF occurs in 2nd-4th week of April. *Oidium* spores were trapped on rod traps using a sellotape as the trapping surface. These were found in abundance in the 2nd week of February and the maximum spore catch was seen in late February. The maximum viability also coincided with the period of maximum spore release. A second catch was observed over the entire month of April. The critical period to protect against an oubreak of the disease, therefore, is just prior to the 2nd week of February.

In-depth studies on the epidemiological relationship between the disease and the host and its environment has helped to determine the optimum time to control the disease thereby reducing the cost of sulphur dusting.

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DISTRIBUTION AND SPREAD OF *RIGIDOPORUS LIGNOSUS* ON *HEVEA BRASILIENSIS*

N. I. S. Liyanage *and* **O. S. Peries**
(Rubber Research Institute, Agalawatte)

Rigidoporus lignosus affects *Hevea brasiliensis* Muell. Arg., causing a root disease commonly known as white root disease.

The infection was mostly observed on the lateral roots, in the first 30 cm of soil. The rate of spread of the fungus varied from 1.9 to 8.7 m per year with an average of 4 m per year. The spread of the disease was low in dry, compared to wet areas. In wet areas the cumulative loss of trees within 12 months ranged from 0.5-2.4% under natural conditions. The disease is known to spread through root contact. The size of the inoculum is important in the initiation and spread of the disease. Small roots of diameter 1.2 cm caused infection in young plants, if present in the planting hole. The removal of food base prior to planting is important and it is likely that small pieces of infected roots could be left in the field unnoticed. Emphasis has to be placed on the removal of these in order to reduce foci of infection so that the required stand per acre could be maintained.

B - 47

EFFECT OF LEVEL OF NITROGEN AND FREQUENCY OF DEFOLIATION ON HERBAGE DRY MATTER YIELDS OF TWO PASTURE GRASSES GROWN UNDER COCONUT

M. N. M. Ibrahim *and* **L. K. V. Liyanage**
(Coconut Research Institute, Lunuwila)

Two independent experiments were carried out to determine the influence of frequency of defoliation on herbage dry matter production of two *Brachiaria* species grown under coconut. *B. dictyoneura* being a promising grass for the wet zone, was tested at Dodanduwa-Galle under four levels of nitrogen application (0, 25, 50, 100 kg N/ha) and two frequencies of cutting (30 and 45 days). In the second experiment conducted at Lunuwila (intermediate zone) with *B. ruziziensis* and the same levels of nitrogen application as in experiment I, three cutting intervals (3, 4 and 6 weeks), were used. Both experiments lasted for four years. *B. dictyoneura* trial was defoliated continuously whereas with *B. ruziziensis* trial the cycles were confined to the monsoons.

Over the four year period studied, increasing the nitrogen levels and cutting frequency progressively increased herbage dry matter production of *B. dictyoneura*. But when the individual defoliation cycles over the experimental period were analysed separately, 30 day cutting interval produced higher dry matter yields for the cycles which coincided with the monsoons. The 30 day cycle produced more digestible organic matter per year.

Although *B. ruziziensis* responded well to increasing nitrogen application, there was no significant and persistent trend in dry matter production due to frequencies of defoliation. On the contrary, when the same trial was duplicated in the glass house, progressively increased yields were obtained with the increase in cutting interval. It was concluded that during the monsoons a three week defoliation cycle seems to be appropriate with *B. ruziziensis*.

B - 48

EVALUATION OF PASTURE GRASSES UNDER COCONUT FOR THE DIFFERENT AGROCLIMATIC ZONES OF SRI LANKA

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(Coconut Research Institute, Lunuwila)

Recommendation of *Brachiaria miliiformis* as a suitable pasture grass to be grown under coconut was based on a trial conducted in the intermediate zone. Due to the increased interest among the coconut growing

farmers in rearing ruminant livestock, it was necessary to evaluate pasture and fodder grasses that could be in the different agroclimatic zones as that found in the coconut triangle.

Five pasture (*Brachiaria miliiformis; Brachiaria brizantha; Brachiaria ruziziensis; Brachiaria dictyoneura; Digitaria decumbens*) and four fodder (*Panicum maximum*—green Panic; *Panicum maximum*—Guinea B; *Setaria sephecelata;* Pussa Giant Napier) grasses were evaluated at two levels of (25 and 50 kg N/ha) at Dodanduwa-Galle (wet zone), Madampe–Chilaw (intermediate dry zone) and Walpita–Divulapitiya (wet/intermediate zone). The trial lasted for three years and the grasses were harvested on at least 5 to 6 occasions every year. Herbage quality and seasonality of production were studied. on the trial conducted at Madampe and Walpita.

In all the three zones studied, *B. dictyonoura* significantly out yielded all the other pasture and fodder grasses tested. The herbage dry matter yield production at Dodanduwa, Madampe and Walpita were 12.5, 10.9 and 8.6 MT per year, respectively. At Dodanduwa and Madampe, *B. brizantha* produced 10.5 and 9.0 MT of dry matter per year, respectively and ranked second. At Walpita, Guinea B ranked second and produced 7.2 MT of dry herbage per year. Except at Walpita where there was no significant responses to added nitrogen, at the other two locations all varieties produced significant responses.

Herbage quality as measured by the nitrogen content and *in vitro* organic matter digestibility fluctuated with the time of the year. As compared to the other grasses tested, the digestibility of *B. dictyoneura* showed very little changes irrespective of the time of harvest. At Madampe, *B. dictyoneura* produced 5.5 MT of digestible organic matter per year as compared to 3.8 MT to that produced by *B. brizantha.* It is concluded that in terms of herbage dry matter production and quality of herbage produced, *B. dictyoneura* is a better pasture than the presently recommended *B. miliiformis.*

S - 49

ADAPTATION TO ENVIRONMENT IN POWDERY MILDEW FUNGI

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Powdery mildew (PM) fungi are widely distributed throughout the world from the very arid areas to the very cold temperate regions. They are generally active during the dry periods of the year, whenever atmospheric humidity is high, and cause economic losses to crop plants as varied as wheat, rape, strawberry, mango and rubber (*Hevea*).

This paper discusses the biology of powdery mildews in general and examines in detail the environmental factors favouring two named PM pathogens, one affecting strawberry (*Sphaerotheca macularis*) in the temperate regions and the other *Hevea* (*Oidium heveae*) in the tropics. Temperature is obviously one of the key factors for adaptation; but there are other interesting factors such as overwintering, alternate hosts, reaction to free water and production of fruit bodies, which have not been considered in this context in the past. These are taken as examples to assess the mode of adaptation of different species of powdery mildews to life in their present environments.

SECTION C: ENGINEERING, ARCHITECTURE AND SURVEYING

C-01

MANUFACTURING OF TOOL STEELS AND THEIR PROPERTIES

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and **J. M. Ranasinghe Banda**
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The tool steels have been grouped into six types i.e. hot work, cold work, high speed, special purpose, water hardening and shock resisting. This paper deals with manufacturing process of tool steels and variation of properties with their composition and heat-treatment. It describes the specific applicability of the heat-treatment process to the various types of steel.

The properities considered were Hardness (red hardness), Tensile strength, Hardenability, Toughness and Wear resistance. Melting was carried out using a high frequency induction furnace. The charge materials used are high purity steel scrap, Ferro manganese, Ferro silicon, Ferro vanadium, Ferro chromium, Ferro molybdenum and Ferro tungsten. By adding these ferro alloys, it is possible to manufacture the following alloyed tool steels.

(i) Tungsten-base and Chromium-base hot work die steels.

(ii) Manganese oil hardening die steel.

(iii) Tungsten finishing steel.

(iv) Tungsten chisel steel.

(v) Chromium vanadium, and Carbon vanadium general purpose steels.

Tool specimens were fabricated by forging. Uses for a range of compositions for tool steels are suggested.

C-02

FRACTURE OF GREY CAST IRON

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Flexural testing and microstructural studies were carried out on ferritic grey cast iron after suitable heat-treatment. Examination of the microstructure of both the surface and the interior, before and after stressing, revealed that the formation of voids and volume changes accompany tensile loading. It was also observed that cracking does not originate at the tip of graphite flake but within the flake. The flake fractures along the longitudinal axis and then joins with another fractured flake, ahead of the main crack path. It is possible that graphite which has a hexagonal structure increases its volume under tension and helps to separate its weekly bonded basal planes. Microstructural examination of some specimens which were flexurally loaded to about 75% the mean fracture load showed evidence of cracking of graphite flakes, although there was no continuous cracking of the specimen. This result partly explains the bending of the stress-strain curve before yielding begins.

It is very likely that fracture in grey cast iron occurs first in the graphite clusters. Scanning electron micrographs showed large areas of graphite on the fracture surface. Ferrite in the matrix appears to resist the propagation of the main crack but as more graphite flakes fail—the ferrite being unable to carry the extra load—the ferrite matrix fails by forming voids.

This work was supported by a research award of the University of Cambridge, England.

C - 03

THE DEVELOPMENT OF THE STRAIN FIELD BENEATH A FOUNDATION IN SANDS

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The theories of elasticity and plasticity which were developed for metals, are used extensively for the solution of problems in soils, the former under working load conditions and the latter under failure conditions. This is despite the fact that soils do not possess linear stress-strain relationships; soils begin to yield even at low stress levels; and soils exhibit large dilatation or volume changes while shearing.

This paper sets out the experimental results of strain fields obtained in plane strain tests in foundations on sand. An X-ray technique was used to measure the displacements of leadshot buried in the sand, and the strain field was calculated from the measured displacement field.

It is shown that at very small foundation loads, the principal axes of strain orient themselves to coincide with the principal axes of stress. Subsequently, there is very little rotation of the principal axes of strain, indicating that the principal axes of strain rate and of strain coincide. The strain contours obtained are compared with the stress contours predicted using the theory of elasticity, and found to be very similar. Thus, it is reasonable to use pseudo elastic constants (E and V) for predicting the stress and strain fields in soils.

At failure, the theory of Plasticity identifies three shear zones—Active Rankine, Radial Shear, and Passive Rankine zones. It is shown that at loads very close to the failure load, very little strains are developed in the passive Rankine zone. However, the development of this shear region just prior to failure is not ruled out.

C - 04

TRAFFIC MANAGEMENT SCHEMES FOR DEHIWALA JUNCTION AND KOLLUPITIYA LIBERTY CIRCLE AREA

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Dehiwala Junction is the most congested point of the Colombo-Galle Road, during peak traffic flow. Kollupitiya Liberty Circle Area is another congested place which needs attention. The traffic congestion in these two places will be further aggravated in the near future with the increasing vehicular traffic.

From studies made, the factors that may be causing traffic congestion are determined, analysed and suitable solutions are recommended which will improve the traffic flow.

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C - 05

HYDRAULIC MODEL STUDIES OF THE KOTMALE BOTTOM OUTLET

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Kotmale Hydro-Power Project is a part of the Accelerated Mahaweli Diversion Programme. Hydraulic Model studies on all the structures namely, the diversion tunnels, the spillway and the bottom outlet have been carried out. Work on Kotmale Bottom Outlet is presented in this paper.

Five different design proposals were studied on three scalar models. The final design proposal is now undergoing verification tests.

SECTION D: LIFE AND EARTH SCIENCES

D - 01

FOOD AND FEEDING OF *SIGANUS JAVUS* AND *SIGANUS CANALICULATUS* FROM WATERS AROUND JAFFNA

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Siganus javus and *Siganus canaliculatus* reported to inhabit the tropical parts of Indian and Pacific oceans, are found in the coastal areas and brackish water bodies in Sri Lanka.

Stomach contents of *S. javus* ranging in standard length from 2.1 to 30.6 cm, and those of *S. canaliculatus* ranging from 3.3 to 35.1 cm, collected from 12 stations along the Northern coast, Jaffna and Thondaimannar lagoons were examined during the period February 1981 to April 1983.

Analysis of stomach contents of *S. javus* and *S. canaliculatus* indicated that both species are purely herbivorous, feeding on different genera of diatoms, blue-greens, green algae, red algae, brown algae and an angiosperm—*Thallasia*, of which the green algae predominated. In both species the major food components were species of *Cladophore, Chaetomorpha, Thallasia, Licmophora, Navicula* and *Oscillatoria.* In *S. javus, Cladophora* was the dominant food item contributing to 20.4% in composition by bulk while in *S. canaliculatus, Thallasia* predominated with 19.8%.

In both species, when the variations in food habits with size of the fish were analysed by placing fish in 3 cm length classes, no significant variation in food was found.

The analysis of stomach fullness of the specimens collected during day and night indicated an apparent preference of *S. javus* and *S. canaliculatus* for feeding during night.

This work was supported by a NARESA Research Grant, RGB/81/11.

D - 02

STUDIES ON THE PRAWN FISHERY IN JAFFNA LAGOON

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and **K. D. Arudpragasam**
(University of Colombo)

Certain aspects of the prawn fishery in the Jaffna Lagoon were studied over a period of one year from June 1982 to May 1983. Samples were collected fortnightly, from 10 landing centres extending from Ponnalai near the eastern end of the lagoon to Kerativu near the western end. Aspects studied included gear used, total catch, species compostion of catch, size of species caught and seasonal variation.

The gear used included drag nets and two types of passive gear, the Sirahu Valai and Raal Koodu. The first two were in use over the whole lagoon area while the real koodu was in use only near the western end. In addition, hand operated traps were in use occasionally at Ponnalai. On the basis of catches the drag net (4.18 kg/day) was the most productive followed by the Sirahu Valai (2.2 kg/day).

Species included in the catches were, in order of relative abundance, *Metapenaeus monoceros, Penaeus semisulcatus, P. indicus* and *P. latisuleatus. Penaeus monodon* was caught occasionally. The average sizes of prawns of the first four species was larger during the period June to December than during the period January to May. However, the total catch tended to be lowest for the year during the period July-September.

SECTION D

D - 03

SOME BIOLOGICAL ASPECTS AND THE FISHERY OF THE PONY FISHES (KARALLA) IN THE BOLGODA LAGOON, SRI LANKA

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The present study on the biology and the fishery of the pony fishes "karalla" in the Bolgoda Lagoon was started around 1982.

Four species of pony fishes were recorded from Seine and Ja-kotu namely, *Leiognathus dussumieri, L. fasciatus, L. brevirostris* and *Gazza minuta* of which *L. dussumieri* was the most abundant species forming about 90% and 65% of the catch at the head end and the mouth of the lagoon respectively. *G. minuta* was the second most abundant species forming about 1.5% and 23% of the catch at the above two ends of the lagoon. The peak pony fish production was around May/June and the total production was about 02-04 kg/ha/year, which accounted for about 10% of the total fin-fish and shell-fish production from this lagoon.

The standard length of the fish in the exploited stock varied from about 1.5—9.5 cm and the weight ranged from about 1.0-35.0 g. The examination of the age structure indicated that their life cycle was completed within one year. It was observed that the pony fishes entered the lagoon from the sea around January/February, when the salinity of the lagoon water was relatively high.

D - 04

DIVERSITY AND YIELD OF FIN-FISH AND SHELL-FISH IN THE BOLGODA LAGOON, SRI LANKA

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The dissolved nutrients in the Bolgoda Lagoon increase from about July with a peak around September and the primary productivity increase from about October with a peak around December.[1] The number of species of fish increased from 7 to 16 around December to a peak of around February/March, when the surface and bottom salinities were also relatively high. Six species of fish migrated into the lagoon during the peak species abundant period. The number of species of fish was relatively low from April to December, during which period the surface and bottom salinities were relatively low. Therefore fish found in the lagoon during this period were mostly fresh water species. There were four major species of penaeid prawns of which *P. indicus, M. ensis* and *M. dobsoni* were the most abundant species.

The fin-fish yield from the lagoon was about 70% of the total catch of fin-fish and shell-fish from Seine and Ja-kotu. Fin-fish catch varied from 18-20 kg/ha/year of which *Mugil cephalus* and *Etroplas suratensis* formed the bulk of the catch (42.2%). The standard length of the exploited *M. cephalus* varied from 8-30 cm and that of *E. suvatensis* varied from 6-18 cm. Penaeid prawns formed the bulk of the shell-fish yield and was about 30% of the total yield. Shell-fish yield ranged from 7-10 kg/ha/year.

This study was funded by NARESA (RGB/82/13) and University of Sri Jayewardenepura.

Reference

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D - 05

MONOCULTURE OF MILK FISH *CHANOS CHANOS* (FORSCAL) IN A BRACKISH WATER POND, PITIPANA

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As a part of a programme to develop culture practices in brackish waters of Sri Lanka, a monoculture trial on *Chanos chanos* was conducted at the Fisheries Station, Pitipana.

The trial was conducted from 09 February 1982 to 06 October 1982 in a 0.05 ha mud pond. The pond was prepared with prior fertilization using 200 kg of urea/ha and 50 kg of T.S.P./ha. Four hundred juveniles of 0.1 g mean weight and 2.1 cm mean total length were temporarily stocked in vellon net hapa fixed inside the pond and were released to the pond after one month. No supplementary feeding was done during the first 6 months. Fish were then fed with chick mash at approximately 5% body weight daily.

The fish grew to an average weight of 368 g and to an average size of 36.5 cm at a survival rate of 47%. The average of daily growth increment was 0.9 g during the first 6 months and the daily growth increment was enhanced to 2. 9 g with the supplementary feeding. The total yield was 1,391 kg/ha/8 months.

Gut analysis of sacrificed fish shared remnants of lab lab during the early part of the study, while the guts of the harvested fish after 8 months carried the supplementary feed.

D - 06

AN ANALYSIS OF ACID-BASE DISTURBANCES IN THE BLOOD FOLLOWING STRENUOUS ACTIVITY IN TROUT, (*SALMO GAIRDNERI*)

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Enforced activity caused a marked depression of plasma pH (7.85 ± 0.02 to 7.591 ± 0.07) in *Salmo gairdneri*. Both lactate concentration and P_{co_2} of the plasma were elevated (10.5 ± 1.3 mmol/l and 6.2 ± 0.55 mmHg) immediately following exercise, but resting P_{co_2} (3.5 ± 0.3 mmHg) was restored within 1 hour, whereas resting lactate levels (0.71 ± 0.43 mmol/l) were not restored for at least 8 hours. The plasma acid base disturbance is caused largely by elevated plasma lactate levels, but a Davenport analysis based on measurements of pH and total CO_2 revealed a marked discrepancy between the amount of metabolic acid buffered by the blood and lactate anion concentration. Analysis of Na^+, K^+ and Cl^- concentrations of plasma showed simultaneous displacement of these ions. The H^+ deficit in blood appears to be due to buffering of H^+ in the intracellular body compartment and excretion into the environmental water.

This work was supported by the Commonwealth Scholarship Commission and was carried out at the School of Biologica Sciences, University of East Anglia, England.

D - 07

STUDIES ON INTERACTION AMONGST YOUNG STAGES OF *SAROTHERODON NILOTICUS*

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In hatchery production of *S. niloticus* different size categories of fry and fingerlings usually exist together. The present study was conducted with a view to assessing the nature and extent of interaction amongst them, especially incidences of attack and/or predation.

Two sizes of fry (>10mm and 10-15 mm) were used as prey and five sizes of fry/fingerlings were used as predators. Trials were conducted in duplicate. Fish were observed continuously for 8 h and again at the end of 24 h. Observations were recorded in relation to (*a*) schooling (*b*) nipping attacks (*c*) swallowing of prey.

When prey and predators were of approximately equal size neither aggressive interactions nor separate schooling was observed. Predators of 15-20 and 20-25 mm attacked prey >10 mm nipping them off and on. Weakened prey were killed off within 6-8 hours but not swallowed. Predators of 25-30 mm and 30-35 mm attacked prey of both size groups and swallowed them. Prey were consumed within a period of 2 h. Prey were observed to move in very tight schools in this case.

It would appear that considerable loss of fry could be expected in hatchery systems in which different size groups are freely mixed.

D - 08

STUDIES ON SURVIVAL OF *SAROTHERODON NILOTICUS* AT DIFFERENT SALINITIES

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(Dept. of Zoology, University of Colombo, Colombo 3)

During cage culture trials using *S. niloticus* in a brackish water environment, high mortalities were observed when salinity rose beyond certain levels. Laboratory studies were therefore conducted to determine acceptable levels of salinities for various sizes of this species. Preliminary trials were conducted at salinities of 8.5, 17 and 26% with fresh water as control. Fish (25-30 mm length) were unaffected at 8.5% and 17% but died at 26% salinity. A second series was carried out with salinities 18, 20, 22, 24 and 26% using size groups ranging from 10-15 mm to 60-70 mm. Fish were observed continuously for 10 h and time of 50% mortality was recorded.

Below 20% only the 10-15 mm group was affected with 50% mortality recorded in 90 min. at 18% and 52 min. at 20%. Values for the 10-15 mm and 40-50 mm groups at 22% were 27 min. and 8 h respectively; at 24% values were 22 min. and 6 h 20 min. At 26% values were 22 min. and 3 h 45 min. Fish ranging from 50-70 mm were unaffected at 22% but showed 50% mortality in 8 h at 24% and 6 h at 26%. Studies on long term survival and growth are proceeding.

This study indicates that cage culture sites for *S. niloticus* should be located at points where salinities do not exceed 20% or culture should be planned avoiding periods when salinity may be expected to exceed this value.

D - 09

THE PERIODICITY OF THE PHYTOPLANKTON IN THE NEGOMBO LAGOON

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Physico-chemical factors and their effects on phytoplankton periodicity in the Negombo Lagoon were studied over a period of 6 months as from February 1982. Samples were collected once a month from 4 sites in the lagoon. Three sites were located on the west side (i.e sites 1, 2 and 3) and the other was on the eastern side (site 4) in close proximity to the Free Trade Zone at Katunayake.

Physico-chemical factors and phytoplankton periodicity varied with the prevailing weather conditions. Rainfall had a direct bearing on salinity. With rains, salinity dropped to 0.5 ‰ S, during the dry period values ranged from 21-29 ‰ S. These values compared well with previous observations.[1] Site 4 was more eutrophic when rains prevailed and could have been due to a freshwater influx *via* the Dandagamu Oya and Jaela.

The productive months were May-July 1982 when counts of 268×10^3 — $1\,120\times10^3$ cells/l substantiated with chlorophyll data were recorded.

Dinoflagellates dominated when the waters were warm, highly saline and depleted of nutrients. The diatoms seemed to favour cooler waters with high salinities and nutrient levels.

Asterionella japonica, *Coscinodiscus* sp. *Navicula* sp. *Pleurosigma* sp., and *Grammatophora* sp. dominated the flora throughout the period of sampling.

Asterionella japonica, a marine species dominated the water in close proximity to the estuary, whilst *Grammatophora* sp. favoured less saline waters and was dominant at site 4.

BOD_5, COD and DO levels indicated mild pollution when dry weather prevailed. With rains BOD_5 increased from 3 mg/l to 6.63 mg/l indicating fairly high levels of pollution at sites 2, 3 and 4, which were highly urbanized and subjected to domestic as well as industrial waste loading.

Reference

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D - 10

EXPERIMENTAL FIELD CULTIVATION OF *GRACILARIA EDULIS*

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Preliminary observations on the artificial cultivation of red algae such as *Gracilaria edulis*, *Hypnea musciformis*, *Gelidiella acerosa*, *Acanthophora delile* and *Laurencia obtusa* in the open sea at Mandaitivu revealed that *G. edulis* could be cultured more easily compared to others.

Vegetative fragments from the apex of *G. edulis* were used as propagating material, but observations indicate that fragments from other parts of the plant also could grow, although not as vigorously as the apical fragments. Planting was done from October 1982 to June 1983 and each month an experiment was set up using algae collected in that month.

Three types of substrata namely, coir ropes, coir nets and coral stones were used and it was found that the coral stones supported good growth of the alga. The alga grew to its maximum size in about 2½-3 months attaining a length of 30-35 cm and fresh and dry weights of 20-30g and 1.5 - 2.5g respectively. Planting can be started at any time of the year. However, frequent growth of species of *Chaetomorpha*, *Jania* and *Hypnea* occurred and overgrew *G. edulis* thus limiting its growth. This necessitates frequent weeding out of these algae.

Regeneration studies from harvested algae indicate that plants are able to grow at the same rate as the fresh planting material.

The agar content and gel strength of agar obtained from cultured alga were determined. The amount of agar increased with increase in growth stage of alga but there was no difference in the gel strength of agar. These data compare well with those obtained for naturally occurring *G. edulis*.

This work was supported by a research grant from NARESA, (RG/82/Mis/1).

SECTION D

D-11

EFFECT OF GAMMA-IRRADIATION ON THE MALE GERM CELLS IN THE PRE-IMAGINAL STAGES OF THE FILARIASIS MOSQUITO *CULEX QUINQUEFASCIATUS*, SAY

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(Dept. of Zoology,
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The mutational response of the male germ cells in pupae, larvae and eggs of *Culex quinquefasciatus* to gamma-irradiation was tested. The percentage dominant lethality in the males emerging from irradiated pre-imaginals was used as the measure of mutational response. The studies also involved a brood analysis for separate screening of the different germ cell stages in the testes.

Pupal irradiation experiments showed that the pupae can withstand gamma-ray doses above 8,000 R and when they were screened for mutations it was observed that the mutation frequency was highest in the first brood and takes a mid value in the second and was at the spontaneous level in the third brood. The induced dominant lethality and the gamma-ray dose was found to be linearly correlated in the first two broods.

The LD_{100} for larvae and eggs were found to be 3,000 R and 2,000 R respectively. Brood analyses of males irradiated below these levels obtained from both these stages did not show significant mutation frequencies in any of the broods.

In adult males the dominant lethality was relatively higher in the first two broods and was almost halved in the third brood[1]. All these observations can be explained by hypothesizing that the different germ cell stages in the spermatogenesis respond differently to gamma-irradiation.

This work was funded by NARESA (Grant RG/79/8).

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D-12

LACK OF AN EFFECT OF FORMALDEHYDE AND NITROGEN-MUSTARD IN INDUCING DOMINANT LETHALS IN *CULEX QUINQUEFASCIATUS*, SAY

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(Dept. of Zoology,
University of Sri Jayewardenepura, Nugegoda)

Formaldehyde and Nitrogen-Mustard are proven mutagens for many test organisms. Formaldehyde is a very peculiar mutagen in that it produces mutations only when *Drosophila* larvae are treated by supplementing formaldehyde in the larval food medium[1]. N-Mustard too has been tested on *Drosophila* and its mutagenicity parallels that of X-rays.

We attempted to test whether these mutagens can be used on *C. quinquefasciatus* as chemosterilants or as agents producing chromosomal mutations which are of importance for genetic control purposes.

As in the *Drosophila* studies, formaldehyde was added to yeast and then fed to mosquito larvae. The N-Mustard-treatment was given by injecting appropriate doses of N-Mustard into adult mosquito males by employing laboratory turned out micro-injection pipettes[2]. Adult males emerging from formaldehyde treated larvae and N-Mustard treated males were mated to virgin females whose eggs were screened for dominant lethals.

From an overall point of view, the results showed that there was no treatment effect for both formaldehyde and N-Mustard. Apart from the spotty occurrence of high mutation frequencies in some lines, most of the dominant lethal frequencies were at the control level.

This work was funded by NARESA (Grant RG/79/8).

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D - 13

ELEVEN SPONTANEOUSLY OCCURRING MUTANTS OF *DROSOPHILA ANANASSAE* IN SRI LANKA

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A study was carried out to isolate morphological mutants from wild populations of *Drosophila ananassae* in Sri Lanka.

Wild *D. ananassae* males were collected fortnightly from three places, namely Piliyandala, Gangodawila and Nawinna and were mated to virgin females from the laboratory stock. The resulting F_2 offspring were screened for morphological deviants. When such deviants were isolated they were tested genetically to study their mode of inheritance.

Eleven inheritable mutants were isolated in this study. The phenotypic characters of these eleven mutants are as follows : dark antennae, brown eye, garnet eye, short wing, short and baloon wing, curled wing, marginal cell-less wing, cut wing, miniature wing, extra single and double cross vein wing mutants.

The brown eye, extra single and double cross vein wing, were found to be due to recessive autosmal genes. Marginal cell-less wing, short wing, short and baloon wing were due to recessive sex linked genes.

Mutants similar to brown eye (Moriwaki, 1971) cut wing (Kikawa, 1933; Moriwaki, 1968) extra cross vein wing (Kikawa, 1835; Moriwaki, 1972) curled wing (Baranas Hindu University, India, 1967) mutants of *D. ananassae* have been reported previously while the other mutants are being reported for the first time.

This work was supported by NARESA (Grant RGB/80/5).

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SECTION D

D - 14

PATTERN OF INHERITANCE OF FLOWERING IN *SESAMUM INDICUM* L. USING DIALLEL ANALYSIS

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Varying concepts have been proposed to explain the pattern of inheritance of sesame and many disagreements existed regarding the control of flowering.

This investigation involved six varieties namely MI-3, JT-7, Kilinochchi local, GT, PT and AI of different origin.

The parents and the F_1 progeny of 36 diallel lines were tested under day-lengths of 10½ h, 12½ h and 14½ h.

Data for reciprocal crosses studied separately did not present any evidence of maternal effects and hence reciprocal crosses were combined to give single values for each cross.

The regression line obtained by plotting Covariances and Variances from half-diallel table indicated that there is a significant regression of Wr on Vr, with slope value of 1.29 and S.E. of 0.29 and thus gives good evidence for dominance but it is only partially able to account for relationship observed between Wr and Vr.

There is no indication of non-allelic interaction since neither "b" value nor the "orientation of the regression line" reveal any interactions, but both reveal that there is partial additive effects. Thus the behaviour of genes controlling flowering at least in the varieties studied can be explained using Additive-Dominance model.

The validity of the above model was confirmed using (Wr+Vr) and (Wr—Vr) data.

It was also observed that the varieties used were of the Short Day types with varying sensitivity to photoperiod and the variety AI was found to be the least sensitive one.

This work was supported by NARESA (Grant RGB/81/13).

D - 15

A STUDY ON THE OVIPOSITOR OF *PTINUS TECTUS* BOIELDIEU (COLEOPTERA : PTINIDAE)

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Ptinus tectus Soic. is a pest of stored products. Although much work has been done on its biology, the structure and mechanism of its ovipositor has not been studied.

This study was made by making a whole mount of the insect, microscopic sectioning and scanning of the ovipositor by stereoscan electron microscope.

The vagina tapers into the ovipositor posteriorly. When not in use the ovipositor is retracted and concealed inside the oviposition chamber, forming a double walled tube.

Internally the ovipositor has numerous infoldings and its wall contains longitudinal muscles. The ovipositor has two hemisternites dorsally, each possessing a stylet and a single lobe ventrically. The vulva lies between the two hemisternites and the ventral lobe.

The distal region of the hemisternites and the stylets possess structures presumably the sensory organs. They are in the form of pegs, papillae or setae. The distal end of the ventral lobe carries two spines pointing posteriorly.

Prominent genital muscles are attached to the ovipositor. A pair of prominent longitudinal muscles originate from the apex of the apedome, diverge posteriorly and insert themselves into either side of the base of the ovipositor.

D - 16

PRELIMINARY STUDIES ON THE RELEASE OF LABORATORY REARED *EVANIA APPENDIGASTER* FEMALES FOR THE CONTROL OF *PERIPLANETA AMERICANA*

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Evenia appendigaster (Hymenoptera : Evanidae) and *Tetrastichus hagenowi* (Hymenoptera : Eulophidae) are two oothecal parasites of *Periplaneta americana*. Each parasite exercises a natural parasitism level of about 33%. With the intention of further increasing the percentage of natural parasitism of *E. appendigaster*, the parasites were bred in the laboratory and were released into seven experimental sites. The number of females to be released was based on the number of oothecae found at each of the release sites.

The releases were made in the following ratios (oothecae : females) : 10 : 1, 1 : 1, 1 : 2, 1 : 3, 1 : 5 and 1 : 10 at the different sites, during the period January to December 1982. The maximum level of parasitism obtained using each of the release ratios are : 10 : 1 - 30.00%, 1 : 1 - 32.85%, 1 : 2 - 37.29%, 1 : 3 - 57.50%, 1 : 5 - 61.90%, 1 : 10 - 59.09%. The average level of natural parasitism at the control sites (where no parasites were released) were 24.72 + 5.21%. The release ratio 1 : 5 gave the maximum level of parasitism with the minimum number of *E appendigaster* females. Hence this release ratio was repeated at 4 sites over a period of 5 months. The highest parasitism levels at each of these sites are : I - 64.70%, II - 57.14%, III - 66.66% IV - 65.00%. Further release of both parasites are to be made to attain the maximum possible level of parasitism for the control of *P. americana*.

This work was supported by NARESA (Grant RGB/80/07).

D - 17

GEOMANETIC FIELD INTENSITY IN THE GEOLOGICAL PAST

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The analysis of the available palaeointensity data indicates that the dipole moment of the earth was fairly high and similar to the present dipole moment of 8.0×10^{22} A m^2 in the pre-Cambrian times, then dropped precipitously during the late Cambrian—Cambrian and since then has been gradually increasing to its present value. With a view to investigate the above behaviour of the geomagnetic field, a palaeointensity study for 3 crucial sections of the geological time scale was carried out using improved laboratory techniques and magnetically igneous rocks.

Young tertiary basalt samples from Australia showed a mean palaeointensity value of $(8.55 \pm 0.30) \times 10^{22}$ A m^2. A mean value of $(5.81 \pm 0.48) \times 10^{22}$ A m^2 was obtained for the Permian, using samples of the Exeter traps in England and the Esteral volcanics in France. For the pre-Cambrian, palaeointensities of

$(7.32 \pm 1.72) \times 10^{22}$ A m^2 and $(4.56 \pm 0.92) \times 10^{22}$ A m^2 were determined, using dolerite samples from southern Zimbabwe (1,700-2,000 million years old). The present study suggests, contrary to the observations of the previous workers, that the intensity of the earth's magnetic field has not changed significantly throughout geological time.

D - 18

THE OXIDATION OF MAGNETIC MINERALS

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Magnetic minerals that are largely responsible for the magnetic properties of igneous rocks are within Titanomagnetite (Magnetite-Ulvospunel) series, and these magnetic minerals usually undergo high temperature oxidation (above 600°C). The present study involves a method of identifying the oxidation state of the magnetic mineralogy of rocks by optical microscopic observations. A large number of thin polished sections, prepared from young tertiary basalt samples, were examined under a reflected light microscope at a magnification of x 1200 in oil. These observations revealed that more than 95% samples investigated could be grouped into three categories, each group representing a different oxidation state. Samples of group 1, to which more than 50% samples belonged, consisted of brownish yellow, optically homogeneous, coarse grains (the average size 30-40 μm) of titanomagnetites. The magnetic mineralogy of group 2 samples composed of bright, gray magnetic grains with varying degree of ilmenite lamellae, showed the deutric oxidation of homogeneous titanomagnetites to magnetite and ilmenite. Group 3 samples, less than 5% of the samples investigated, were characterised by the presence of pseudobrookite and hematite in the magnetic mineralogy. The group 3 characteristics, due to further oxidation of magnetite-ilmenite lamellae, represented the highest oxidation state.

D - 19

THE THREE MAJOR DEFORMATIONS OF THE ROCKS AROUND KANDY

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The area around Kandy, the pre-Cambrian of Sri Lanka has undergone three major deformations. The geological studies of the Dumbara, Teldeniya double plunging synclinoriums and Rajawella, Haragama anticlinoriums indicate the sequence of deformations to be as follows: (1) Event No. 1 (D 1): Deposition and metamorphism under environment.

(2) Event No. 2 (D 2): Folding (as corrugated cardboard) under high metamorphic conditions. This could be accompanied with D1.

Formation of prevailing foliations, lineation, bondinage structures and the most part of migmatities (syntectonic origin) in double plunging synclinoriums with plastic folding (Ramsay Class 1 C) are paraistic to the deformation D2. Thickening of bands from limbs towards noses of synclinoriums have been formed due to D2.

The D2 appears to be formed under probable E-W force acted on the metasediments towards east.

(3) Event No. 3 (D 3): Superimposition of folds:

All the existing topographic structures have been formed due to this event under less metamorphic conditions. Minor structures such as Z, M, S, folds, Kink folds, narrow ductile shears which are parasitic to the major structures are accompanied with D3.

Migmatites formed during the event D2 had been remobilized in the event D3. D3 appears to have been formed by a probable force along SW-NE acting towards NE, so that the major trend of the highland series rocks have a kink in E-W trend in the vicinity of Haputale and Nuwara Eliya. This force seems to have been acted along the axis of the maximum uplift of Sri Lanka (Vitanage (1972), Geologic-Neotectonic map of Ceylon).

As the metamorphic conditions at D3 were less than D2, the lineaments of D2 are still preserved to be seen.

The overturning of all the structures in highland series are predominantly towards east and it is suggested to be accompanied with the described two forces.

The bottom exposured law dipping parasitic syncline between Rajawella and Haragama anticlinoriums consists of garnet granulitic gneiss at the bottom. This indicates, that the overlain migmatitic hornblende biotite gneiss is eroded away, and it provides a strong evidence of the syntectonic origin of the migmatitic hornblende biotite gneiss rather than an intruded origin.

D - 20

SALINITY OCCURRENCE IN RELATION TO THE FORMATION OF HIGHS AND LOWS, ISLE OF MANNAR

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Isle of Mannar is completely formed by sedimentary deposits under marine conditions. The sandy wind deposits lie upon the sediments in some areas.

The topographic highs are always accompanied with sandy deposits which consist of fresh water rather than the lows which consist of clayey, silty saline soils.

These recently uplifted topographic laws are suggested to be former lagoons which should have existed under tidal flat environment.

D - 21

A MODEL FOR USE OF TRACERS IN SOIL

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In this model the unsaturated soil profile is divided into a number of layers connected in series and the mass balance equation expressed as[1]

Net accumulation = Input to the system — Output from the system + Generation inside volume — Consumption inside volume.

is applied successively to each layer at finite time increment. The flow through the soil profile is therefore represented by a sequence of finite inputs and the mass balance equation is solved iteratively using the computer.

The model is used to understand the observed tracer output and infiltration at a given depth of soil. The model calculations compare favourably with the experimental results and yield interpretation in terms of the hydrodynamic parameters of soil.

Reference

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D - 22

WATER QUALITY VARIATIONS IN STRUCTURALLY CONTROLLED AQUIFERS

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Water quality parameters were studied in different structurally controlled aquifers in the Kandy-Kurunegala areas. Samples were collected from tube wells of the area and analyzed for NO_3^-, SO_4^{2-} and Cl^- contents. *In situ* measurements of conductivity and alkalinity showed a two-fold increase towards the geologically weak fracture zones.

The increase of NO_3^-, SO_4^{2-} and Cl^- in the Halloluwa basin (average values: NO_3^-- 5 mg/l; SO_4^{2-}-21 mg/l; Cl^-- 20 mg/l) when compared to the water in the anticlinal regions (average values: NO_3^-- 1 mg/l; SO_4^{2-}- 4 mg/l; Cl^-8 mg/l) indicates the abundance of the ions in the synclinal regions.

The ground water in the fracture system N 30°E - N 60°E/N O° - N 30°W and in nose regions of the synclines had similar chemistry but the high SO_4^{2-} (145 mg/l) contents indicate the existence of a pathway for groundwater contamination along the westerly trending fracture system.

It was thus found that screening of the tube wells along the westerly trending fracture system was necessary to prevent contamination of the aquifer.

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D - 23

SOME OBSERVATIONS ON THE NATURAL ENVIRONMENTAL POLLUTION OF AQUIFERS IN MANNAR AND HAMBANTOTA

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The tube and dug wells investigated were located mainly in sandy, loamy overburden underlain by limestones particularly in the Mannar area. Nearly 500 samples were analyzed over a period of 3 years.

The results were as follows :

		1980	1983
Average specific conductivity	...	400 μ mhos/cm	420 μ mhos/cm
Average nitrate content	...	1.00 mg/l	1.34 mg/l
Average chloride content	...	200 mg/l	600 mg/l

Excessive lowering of the water table along the coastal region leads to saline intrusion and this effect seems to migrate gradually towards the land. The Cl^- content had increased three-fold during the last 3 years.

In the case of nitrates, the amount and distribution of rainfall, land use, disposed sewage etc. affect the leaching of nitrates below the root zone. The stability of nitrates in the unsaturated zone and in the aquifer is a significant factor that controls the pollution of ground water. In the tube wells the nitrate contents appear to be constant, caused possibly by the lack of oxidized carbon (average PV = 2 mg/l) detrimental to the existence of denitrifiers. Even though SO_4^{2-} levels are very high (300 mg/l) in tube and deep seated dug wells, the presence of low SO_4^{2-} contents in shallow dug wells (1 mg/l) indicates the existence of sulphate reducing bacteria.

Reference

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D - 24

PRELIMINARY STUDIES ON ACID RAINS IN SRI LANKA

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Industrial and automobile emissions which concentrate SO_x and NO_x compounds in the air contribute primarily to the increase of acidity in rain water. With the establishment of new industrial complexes and increasing motor traffic in congested cities in Sri Lanka, conditions suitable for acid rain precipitation may prevail.

Preliminary investigations were carried out in four localities in the Kandy area, namely Kadugannawa, Peradeniya, Kandy and Katugastota. The object of the study was to examine if there is any acidity in the rain water in Sri Lanka.

The acidity of the rain water was measured *in situ* while the NO_3^- and SO_4^{2-} determinations were carried out in the laboratory. A total of 50 samples were analyzed. The town of Kandy had the highest acidity in the rain water (pH : 3.5 - 4.8). Katugastota and Peradeniya situated north and south of Kandy respectively, both showed a pH of 4.5. Kadugannawa had the lowest acidity in the rain the pH being 5.0 - 6.0. In view of the limited industries emanating fumes in the area, the high traffic density and the automobile exhaust fumes could be the cause of acidification. However, the SO_4^{2-}/NO_3^- ratios were higher in the Katugastota region (4.0) reflecting a combination of higher SO_4^{2-} levels and lower NO_3^- levels. In the Kandy district, the Kandy-Katugastota highway had the highest pollution levels.

Reference

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SECTION D

D - 25

ORIGIN AND RECHARGE OF GROUNDWATER THROUGH ISOTOPE STUDIES IN MADULLA DIVISION, MONARAGALA DISTRICT

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Drilling of 94 deep tube-wells in the crystalline rocks of Madulla Division, Monaragala District, has gained momentum in promoting the programme of rural community water supply, especially in the dry zone of the country. The area is essentially covered by the crystalline rocks constituted of hornblende-biotite gneisses, undifferentiated metasediments and granitic gneisses. The area around Madulla is highly tectonised.

As large scale groundwater development is planned in this region in the near future, it is considered very essential to establish the origin and recharge to this source on priority. To obtain this information fast, an isotope approach was adopted, as a pilot study.

The stable isotopes viz. Oxygen-18 and Deuterium occur naturally in rain water and their variation has been used to establish the origin of ground water. From 13 tube-well water samples, one spring and a river sample, it was established that these waters were of meteoric origin. The average values of Oxygen-18 and Deuterium for ground water and spring water (in δ-notation, $\delta D = -35\%$, and $\delta^{18}O = -5.75\%$) are those expected for local precipitation of the region. Hence, it was concluded that ground water originated from precipitation in the vicinity of Monaragala.

Tritiated water injections in soil at two locations yielded a direct recharge of about 20 cm for the period from September 1982 to May 1983. Chemical analyses provided additional information as to the origin of ground water and a fast circulating system within the fractures.

D - 26

MICROBIAL DEHALOGENATION AND OXIDATION OF HALOGENATED N-ALKANES

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Microbial degradation of 40 halogenated n-alkanes was carried out using 5 different species of known hydrocarbon utilizing bacteria (*Pseudomonas aeruginosa, Pseudomonas mendocina, Bacillus subtilis, Bacillus circulans, Aeromonas* sp.). This study was aimed at obtaining information on the effects of halide group, chain length, and number of substitution, on the degradation of hydrocarbon. The selected hydrocarbon compounds had 3 - 18 carbon atoms in their chain and consisted of mono or disubstituted compounds with Br^-, Cl^- and I^- groups. Microbial degradation was assessed using the following criteria : (a) Growth tests; (b) Halide release; (c) Oxidation tests.

The comparative studies carried out using short chain and long chain hydrocarbons showed that the selected bacterial species could readily utilize long chain hydrocarbons than short chain ones. Monosubstituted compounds were utilized easily by the selected bacteria, than disubstituted compounds. As revealed by values of halide release and oxygen uptake, there was no effect of the nature of halide group on degradation.

Resting cell suspensions of the selected bacteria incubated with the halogenated compounds (which did not serve as growth substrates) showed an appreciable oxygen uptake indicating that co-metabolic degradation processes may occur when halogenated hydrocarbons are present in the natural soil.

D - 27

AN INVESTIGATION OF FAECAL POLLUTION IN WATER USED FOR DOMESTIC PURPOSES IN TWO HIGHLY CONGESTED AREAS IN AND AROUND THE MUNICIPAL LIMITS OF COLOMBO

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The Henamulla camp at Thotalanga is a highly congested tennement area in close proximity to a land reclamation site and a sewage drain which emits untreated sewage into the Kelani river.

Kakkaduwa, a densely inhabited area and berthing site for fishing boats, is in close proximity to the Kelani estuary.

Sampling sites were as follows :

Henamulla : Site A_1—Shallow unprotected well in close proximity to the sewage drain and land reclamation site; Site A_2—Deep protected well amidst shanties; Site A_3—Shallow bathing well, amidst temporary aqua privies; Site B_1—Point at which sewage effluent enters the Kelani River.

Kakkaduwa : Site B_2—50 ft away from the bank and within the estuary.

Samples were collected over a period of two months commencing in August 1982.

Sites A_1, A_3, B_1 and B_2 indicated gross pollution and values exceeded permissible levels of 20-25 mg/l BOD[1]. In most instances they ranged between 24.0 - 53.2 mg/l BOD_5.

Site B_1 recorded a 53.2 mg/l BOD_5 with a DO reading of zero, during mid-September 1982, when fish mortality was reported in the Kelani river. However recovery was inevitable since dilution, self purification and steady flow was in operation within the river.

All sites with the exception of Site A_2 indicated faecal pollution and M.P.N. counts of *E. Coli* exceeded permissible levels of 0-1/100 ml for potable water[2] Sites B_1 and B_2 were highly contaminated and recorded counts of 8 - 250/100 ml and 17 - 350/100 ml respectively.

Site A_2, although grossly polluted (i.e. BOD_5 of 12.6 - 14.2 mg/l) recorded permissible *E. Coli* counts.

As such, of the sites sampled Site A_2 appeared to be the only satisfactory source of water for domestic purposes.

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SECTION D

D - 28

AN INVESTIGATION OF THE LEVELS OF POLLUTION IN TWO MARINE HABITATS (MARCH 1981 TO MARCH 1982)

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The levels of pollution and its effect on phytoplankton growth were studied during a period of 13 months. Sites chosen were the Queen Elizabeth Quay (Site 1), Guide Pier (Site 2) both within the Port of Colombo and a natural habitat—Uswetakeiyawa (Site 3).

Samples were drawn at Sites 1 and 2 from the surface and at depths of one and two meters, whilst only surface samples were drawn at Site 3.

Site 2 was grossly polluted (i.e. BOD_5 ranged from 5.75 - 12.5 mg/l) both during rainy and dry weather conditions. This could have been due to it being a berthing area for cargo vessels. Sites 1 and 3 recorded high BOD_5 levels in dry weather conditions. Dissolved oxygen, turbidity and suspended solid observations substantiated these findings.

Pollution by oil and grease was evident at all three sites. In most instances they exceeded the permissible levels (4 ppm - Sri Lanka standards). Site 2 recorded the highest levels ranging from 43.51 -.61.72 ppm, perhaps due to it being a berthing site for ships. Site 3 could have been affected by oil, due to a backwash from the Kelani estuary and by it being extensively used by the fishing industry.

The waters were alkaline when phytoplankton were a maximum, indicating high eutrophic conditions. The productive months were March-May 1981 and October 1981-March 1982. These were similar to previous observations recorded in Sri Lankan and Indian Coastal waters. Furthermore, algal incidence during October 1981 - March 1982 appeared to be affected, since numbers recorded were low when compared with the algal incidence during the same period at Site 3. This could have been due to high levels of oil and grease being recorded.

D - 29

A PRELIMINARY STUDY ON THE RADIOACTIVITY OF PLANTS FROM A HIGH RADIATION AREA OF SRI LANKA—BERUWELA

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A radio-ecological survey has been carried out to investigate the gamma activity of plants growing in the monazite bearing high radiation region[1], Beruwela. Radioactivity for plants from locations with normal background radiation levels and ecological characteristics similar to the exposed population were carried out for comparison. Data clearly demonstrate that the levels of gamma activities in plants from the radiation area are higher than those in the control samples.

A relative comparison of alpha activities have also been carried out on some of the plants studied.

Comparing with the gamma spectrum of a pure thorium salt, it is observed that radiation energies of 0.08, 0.24, 0.33, 0.57, 0.7 and 1.6 Mev occur most extensively in the spectra of samples from the high radiation area.

Reference

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PATTERN OF WOOD FORMATION IN TEMPERATE TREES (*PINUS VIRGINIANA*)

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The 13C/12C isotope data of the cellulose component of the wood in annual rings could be utilised to supply information on the seasonal temperatures that prevail during the actual time of the formation of wood in the tree. Of the two main wood components *viz.* cellulose and lignin, only cellulose was investigated here.

In a slice cut through the trunk of a well grown *P. virginiana*, the annual rings of the middle portion of the stem were taken and spring, summer, autumn and winter wood were isolated out of each ring. These samples were then mixed together to form homogeneous mixtures and cellulose was extracted. The cellulose samples were burnt in a special combustion apparatus to collect the CO_2 gas. The isotope ratios of the gas samples were measured in a double forcussing spectrometer.

Trees are known to discriminate ^{13}C with increasing growth temperature. The present experiment supports the view that there is no coincidence between the period of production of sugars by photosynthesis and the actual period of ring growth. Early wood production, which is a rapid process, uses material stored in the tree when photosynthesis occurred late in the previous year and to a much lesser extent throughout the winter. In the case of the late wood, material used is that which is produced during the growing season of the same year. The best correlation with temperature was found to be as follows : For spring wood with the average temperature of the months October, November and December, for summer wood with January, February and March, for autumn wood with April, May and June and for winter wood with July, August and September.

Part of this work was carried out at the Institute of Biophysical Chemistry, Nuclear Research Centre, 5170 Juelich, West Germany.

D - 31

EFFECT OF AUXIN AND ETHYLENE ON THE ROOTING OF MUNG BEAN CUTTINGS

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Vegetative propagation by cuttings has become important not only in crop plants but also in foliage plants and cut flower industry. The two hormones mainly important in regulating the rooting of cuttings are auxin and ethylene.

In some other growth processes promoted by both ethylene and auxin, a striking observation has been the highly synergistic effect produced when both regulators are given together. Such an effect has been reported for root development in mung bean cuttings,[1] where root number and root elongation are both enhanced synergistically in the presence of 10 ppm IAA and 10 ppm Ethrel (ethylene releasing agent). The purpose of the present study was to re-investigate the above claim.

Experiments were carried out with 4-5 day old mung bean seedling cuttings held in treatment solutions at ambient temperature under artificial light giving a photoperiod of 16 h light and 8 h dark. Two main aspects were investigated: (*a*) Effect on rooting of Auxin and Ethylene given singly and in combinations; (*b*) Use of Co^{2+} ion to investigate if the auxin effects were due to "auxin induced ethylene".

SECTION D

Major conclusions from this study were:

(*a*) High auxin concentrations (10 ppm) strongly promote root initiation but strongly inhibit root elongation while low auxin concentrations (0.001-0.01 ppm) produce reverse effects.

(*b*) Ethrel concentrations higher than 1 ppm were highly toxic to these seedling cuttings. Lower ethrel concentrations were inhibitory to root elongation. Root initiation was slightly promoted by low ehtrel concentration (0.001-0.01 ppm) but inhibited at concentrations higher than this.

(*c*) In contradiction to Krishnamoorthy's result ethrel and auxin did not produce any synergistic effect at any concentrations both for root initiation and root elongation.

(*d*) Use of Co^{2+} ion (10^{-5}M) indicated that the auxin effects were not due to "auxin induced ethylene".

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D - 32

STUDIES ON PALMYRAH (*BORASSUS FLABELLIFER*) PALM SAP

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The average sap yield per male palm for 24 h period under the two different methods of tapping, viz., aripanai (from young inflorescences) and vallupanai (from mature inflorescences) are 5,020 ml and 3,160 ml respectively. The sap yield from the female palm for 24 h period under the thattupanai method of tapping (young inflorescence) is 5,915 ml.

However, there is variation in the yield of sap between palms and also between spathes from the same tree. The rate of flow of sap in a particular inflorescence seems to be fairly constant throughout the day. In a high yielding inflorescence, the rate of flow was estimated as 2.86 ml/min.

Sugar analysis of sap from both male and female palms under different tapping methods showed variation ranging from 10%-16.5%. The average value of sugar content for male (aripanai), male (vallupanai), female (thattupanai) and female (kaivetty) are 12.3 $\pm$ 1.045%, 13.3 $\pm$ 1.248%, 15.5 $\pm$ 0.803% and 11.54 $\pm$ 0.843% respectively. There is also variation in sugar content among the different inflorescences of the same palm. The sugar is primarily non-reducing sugar (sucrose) with trace amounts of reducing sugar.

The average alochol yield in fully fermented palmyrah toddy (i.e., after 48 h) is 5.48%. However, there is wide variation in the alcohol in toddy fermented for shorter periods (12-48 h) ranging from 2% to 6.7%.

Improvement in alcoholic fermentation was achieved by introducing pure selected yeast inoculum, into the collection pots. An increase of 1.0%-1.5% alcohol over the control wsa observed.

The gas chromatographic pattern of the alcohols distilled from different toddy samples was studied. The main component is ethanol with trace amounts of methanol and there is variation in the propanol/isopropanol content.

This work was supported by the International Foundation of Science (No. 581) and NARESA (RG/83/19).

D - 33

SOME STUDIES ON THE GROWTH CHARACTERISTICS OF TWO VARIETIES OF *CATHARANTHUS ROSEUS* L.

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Morphological and anatomical investigations showed that *Catharanthus roseus* L, is present in Sri Lanka as three varieties, distinguishable by flower colour and anthocyanin content.

The seeds of the purple and white flowered varieties had germination rate of about 70%. Stem cuttings showed rooting after 20d. On treatment with IBA it was found that the purples showed greater degree of root initiation, but the whites showed longer roots. IBA from 10 ppm to 0.01 ppm were tested, and the results showed that stem cuttings of both varieties responded best to root initiation on stimulus at 0.05 ppm IBA.

Dry matter accumulation in the whites was 10% higher than the purples even though root and stem growth was less in the whites. The time for flowering by seed-grown and plants propagated from cuttings was about 7-8 weeks. Those propagated from cuttings after treatment with IBA and those without IBA, and the plants that were seed propagated, all yielded dry weights that were not significantly different.

The crude alkaloid content of the plants propagated from seeds and cuttings with and without IBA treatment were compared and there were no significant differences. A comparative study of the crude alkaloid content of plants collected from the arid, dry, intermediate and wet zones of Sri Lanka showed that the plants from the arid zone contained about 80% more crude alkaloid. This indicated that the agroclimatic conditions have a distinct effect on plant alkaloid content.

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D - 40

INTEGUMENTARY HISTOLOGY OF LARVAL *ICHTHYOPHIS* (AMPHIBIA : GYMNOPHIONA)

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The adult Ichthyophis is a terrestrial, burrowing form whereas the larva is aquatic. Larval biology of Ichthyophis is not well documented and this report deals with a study of the larval integument or skin which serves as a boundary with the surrounding environment.

The skin from different regions of the body of larvae of various ages, including the newly emerged larva, was examined using routine histological and histochemical procedures.

The larval skin although thinner (104-260 μm in cross sections) resembles the adult skin in its basic organisation. The thin epidermis (3-4 cells thick, 28-68 μm in cross sections) is unciliated and has a row of small unicellular glands. The secretion of the glands is periodate reactive and alcianophilic which reactions are indicative of acid mucosubstances. These glands are absent in the adult epidermis. Dermal glands, both mucous (alveolar) and poison (granular), which are characteristic of the adult amphibian integument, are present in the larval integument even at hatching. Calcified dermal scales, visualised in the adult by the Alizarin Red S and von Kossa techniques, were not seen in the larval stages examined. The scales apparently appear later on in development.

The secretion of the epidermal glands is presumably important in larval life which is not totally aquatic, the larvae living both in water and buried in the soil, especially at later stages of development.

E-01

EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION OF VANADIUM(V) WITH N-PHENYLBENZOHYDROXAMIC ACID AND PHENYLFLUORONE

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N-Phenylbenzohydroxamic acid (NPBHA) and its analogues[1] are extensively used as reagents for the spectrophotometric determination of vanadium(V). However, the maximum sensitivity so far reported[2] corresponds to molar absorptivity of 7.4×10^3 dm^3 mol^{-1} cm^{-1}. The violet coloured complex formed between vanadium(V) and NPBHA was extracted from about 5M hydrochloric acid into chloroform. The chloroform extract of the vanadium(V) complex, on second extraction from a dilute hydrochloric acid medium (0.1-0.5 M) in the presence of phenylfluorone (PF) and ethanol, forms an intensely coloured complex possessing an absorption maximum at 520 nm against a reagent blank. The molar absorptivity under optimum conditions was 1.6×10^4 dm^3 mol^{-1} cm^{-1}. The system obeys Beer's law up to 2.0 ppm of vanadium(V). Considerable amounts of many cations and anions except molybdenum (VI) and tungsten (VI) can be tolerated. The method bears somewhat similar selectivity and sensitivity as the previously reported[3] method for titanium (IV).

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E-02

ANALYSIS OF MINERAL SANDS USING A PORTABLE X-RAY FLUORESCENCE ANALYSER

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The use of a portable X-ray Fluorescence Analyser for the determination of Ti, Mn, Cr and Fe in samples of Ilmenite, Monazite and Zircon is described. The analyser uses the principle of energy dispersive X-ray fluorescence. The radiation from a radioactive source (Cd^{109}) strikes the sample and excites fluorescent radiation. The spectrum of this radiation is measured by a proportional counter and processed by a micro-computer.

The instrument has to be calibrated in order to relate the measured counts to percentage composition of the elements. The calibration consists of (*a*) Instrument calibration, to set microchannel limits for counting the emitted radiation from the desired elements of the sample; for this, pure elements are used and the resulting counts are measured. (*b*) Sample calibration, to relate the percentage composition of the desired elements to the emitted radiation. This requires approximately 20 samples of known composition. These are used to set up a multiregression model from which other unknown samples of the same type can be analysed. Once a calibration is carried out for a given set of four elements, unknown samples of the same type can be analysed very quickly (e.g. measurement times of 15 sec 1 min 4 min and 16 min can be used).

Advantages of the technique are: high speed, absence of elaborate sample preparation, small sample quantity (approx. 200 g), portability and suitability for field use. The accuracy that can be attained depends on the element and the matrix in which it occurs. In the present analysis an accuracy of 10% was achieved.

SECTION E

E - 03

ANALYSIS OF SEAWEEDS FOR SOME TRACE ELEMENTS

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Marine algae have been used as food[1],[2] fertiliser[3], animal feed[3] etc. The protein content and amount of sodium, potassium, calcium, magnesium, phosphorus and iron present in 11 species of seaweeds from the Mandaitivu coastal area of Jaffna District has been reported[4]. The present study was carried out to determine whether the seaweeds contained appreciable amounts of elements, which are toxic to human and animals.

Eighteen species of seaweeds were analysed. Of these species 8 were red, 7 brown, 2 green and 1 Angiosperm. Atomic absorption spectrophotometry[5] was used for the estimation of the elements. Lead was also estimated by complexing with dithizone[6]. No detectable amount of cobalt was present in any of these species.

Element	*Species containing the highest amount*	*Species containing the lowest amount*
Copper	*Padina Pavonica* (41 ppm)	*Hypnea musciformis* (2.7 ppm)
Manganese	*Gracilaria edulis* (397 ppm)	*Stoechospermum marginatum* (21 ppm)
Nickel	*Struvea anastomosans* (37 ppm)	*Turbinaria ornata* (9.7 ppm)
Lead	*Jania natalensis* (19 ppm)	*Turbinaria ornata* (3.7 ppm)
Cadmium	*Padina Pavonica* (3.9 ppm)	*Stoechospermum marginatum* (1.26 ppm)
Zinc	*Struvea anastomosans* (20 ppm)	*Ulva reticulata* (5.86 ppm)

This work was carried out with financial support from NARESA.

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E - 04

STUDIES OF TRACE METAL STATUS ON CULTIVATION OF TEA

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Analytical studies of the trace metal status in tea[1] were carried out in order to evaluate the effect on tea cultivation with chemical treatment of the soil. The errors resulting from sample preparation for analysis, and effect of soil extractants were investigated[2]. The Caffeine and polyphenol content of different varieties, as well as the ISO parameters were also determined. The investigation also included identification of the levels of toxic metal ions, such as Pb and Cd, with a view to establishing their translocation from the soil.

Plant-soil correlation has been obtained for treated and untreated soils with Zn and Cu additives and biocides.

The results indicated levels of Cd and Pb of the order of 200 ppb and 400 ppb respectively in black tea with variations in variety and sources. Trace metal contents were in the order of Cu,20 ppm; Zn,30 ppm and Fe,140 ppm. These correlated well with their total values in soil. Levels of PO_4^{3-} were in the order of 0.3%.

References

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E - 05

VITAMIN A, β-CAROTENE, ZINC AND COPPER CONTENT OF SOME COMMON FOODS

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Very little information is available on the vitamin A and trace element content of foods consumed in Sri Lanka. In this study, analyses for vitamin A, β-carotene, zinc and copper were carried out on some common foods.

Vitamin A was determined by a fluorometric method[1] after saponification of the sample of food (as purchased,) with 60% aqueous KOH in the presence of ethanolic pyrogallol. In the determination of β-carotene, the optical density of the petroleum ether extract was measured at 450 nm.[2] Atomic absorption spectroscopy was employed in the determination of zinc and copper.[3]

The vitamin A content of meat, fish, liver, eggs and milk was determined. Fish and meat contained only traces of vitamin A, while ox liver had the highest amount of vitamin A of the foods studied (64.2-85.5 μg/g).

The β-carotene content was determined in foods of plant origin. Cereals and starchy roots contained only traces of β-carotene. Legumes contained moderate amounts of β-carotene, while dark green leafy vegetables were a rich source of β-carotene, the highest amount being present in *Alternanthera sessilis*-Mukunuwenna (99.5 μg/g fresh weight). Of the fruits studied, mango and papaw were richer in carotene than plantains, guavas and pineapples.

The zinc and copper contents of several animal and plant foods were determined. All the animal foods contained significant amounts of both zinc and copper, except cow milk which contained only traces of copper, while its zinc content was 90 μg/100 ml. Of the plant foods studied, pulses and dark green leafy vegetables were good sources of zinc and copper. As their availability may be lowered by the presence of phytates in these foods, the phytic acid-phosphorus content was also determined.

This study was supported by a grant from the University of Colombo.

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E - 06

STUDIES WITH METAL ION INTERACTION WITH PENICILLIN AND TETRACYCLINE

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Metal ion interaction with Tetracycline and Penicillin have been investigated in solution. Spectral observations identify an absorption band at 240 nm which was linearly dependent on the concentration of the transition metal ion added. Potentiometric titrations confirmed the reported order of complex formation viz: Cu > Ni > Cd > Zn. Quantitative polarographic studies showed that with the Cu^{2+}-tetracycline

system, values were obtainable for both the stoicheiometry and stability constant. Spectral studies with penicillin and Fe^{3+} showed that the observed changes at 515 nm could be used for analytical procedures for both Fe^{3+} and penicillin. The results obtained are of significance in studies of Drug action and interaction.

Reference

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E - 07

SAMPLING AND ANALYSIS OF LEAD PARTICULATES IN THE URBAN ENVIRONMENT

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Particulate samples in air were collected using organic membrane filters and glass fibre filters using high volume air samplers. Samples collected on membranes were prepared by destroying the membranes in acetone solution and then extracting the lead in 1 : 1 nitric acid. The samples on glass fibre filters were ashed with perchloric acid and nitric acid mixture. These samples were analysed spectrophotometrically and by atomic absorption spectrophotometry. Both methods compare well for the determination of time weighted average concentration of lead in the urban environment.

Results indicate a variation in lead levels from 0.3 to 2.5 μg per cubic metre of air.

Reference

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E - 08

ENVIRONMENTAL AND BIOLOGICAL EVALUATION OF LEAD

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Respirable particulates in air of a selected residential area were collected using Hexhlet samplers at 50 l/min. Spctrophotometric analysis revealed that the concentrations of lead in air were less than 0.015 mg/M^3 during normal days. However, the concentrations increased to 2.5 mg/M^3 during limited periods of time on 4 to 5 occasions a month, due to other lead-based activities such as recovery of gold from jewellers' waste. The sampling period corresponded to 6 hours.

Blood and urine lead levels of the children of the area were estimated spectrophotometrically. Majority of the children showed lead blood levels more than 60 μg/100 ml and more than 450 μg/l of lead in urine. All these children maintained symptoms of lead poisoning as a result of intermittent exposure to high levels of lead in air.

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E-09

A COMPARATIVE STUDY OF SOME ASPECTS OF THE ENVIRONMENTAL GEOCHEMISTRY OF SOME LAKES IN SRI LANKA

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Kandy lake, Polgolla reservoir, Castlereigh reservoir, Nuwara wewa (Anuradhapura) and Parakrama Samudra were investigated for their water quality and environmental influences. High average NO_3^- levels (20 mg/l) were reported from the Castlereigh reservoir whereas Nuwara wewa and Parakrama Samudra had low (0.02 mg/l) NO_3^- levels. Both lakes however had high Kjeldhal-N (5 mg/l) indicating a slow nitrification of the organic matter present in the lakes.

In the Kandy lake, both total and soluble phosphorus contents are relatively high (TP-20 mg/l; SP-10 mg/l) indicating a tendency towards eutrophication of the lake. In the Polgolla reservoir, a noteworthy feature observed was the elevated NO_2^- level (3 mg/l) an indication of active denitrification.

The conductivity of water showed a two-to three-fold increase in the wet zone lakes when compared to those in the dry zone, indicating a relative abundance of free ions in the groundwater regime, in the wet zone. All the lakes studied had comparable pH, ranging from 5 to 7.

Nearly 1,000 water samples from different locations covering the entire island were studied for their NO_3^- contents. It was found that the value of 20 mg/l represented a high concentration when compared to the background values. The low levels of NO_3^- (0.01-0.5 mg/l) were also measured by uv spectrophotometry (λ = 206 nm) and the results compared with the values obtained by specific ion electrodes. The two sets of values agreed reasonably well. The interference by Cl^- and HCO_3^- ions was reduced by the use of Ag_2SO_4 and the ionic strength adjustor (ISA).

This work was supported by a NARESA grant.

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E-10

FURTHER STUDIES ON THE CHEMISTRY OF TAP WATER IN SOME SRI LANKA CITIES

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This study was carried out in the areas around Kandy, Nuwara Eliya and Anuradhapura. The general chemistry of the tap water under investigation can be summarized as follows:

	pH	Total Hardness (mg/l $CaCO_3$)	NO_3^- (μg/l)	PO_4^{3-} (μg/l)	Pb^{2+} (μg/l)
Nuwara Eliya	5-6	10-20	0-100	0-50	10-120
Kandy	5-7	30-50	10-500	100-1,000	20-200
Anuradhapura	6-8	200-400	0-500	100-5,000	100-600

The rapid decrease of Pb concentration with increasing pH was mainly found in the soft waters (hardness 10-100 mg/l $CaCO_3$). The NO_3^- content of water does not seem to affect the Pb content in the tap water. In

Kandy and Nuwara Eliya regions there was a decrease of Pb concentration with an increase of soluble PO_4^{3-} The F^-/concentration appeared to show an effect on the Pb content of tap water. The tap water in the Anuradhapura region differs from that in the other areas reflecting the hydrogeochemistry of the groundwater and factors associated with purification and piping.

All samples were analyzed in triplicate and inter-laboratory checks made. A relative standard deviation of $\pm$ 5% was observed for the analytical data.

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E - 11

LEACHING OF PREVULCANIZED LATEX FILMS

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Generally, prevulcanized latex films when subjected to leaching in water shows better clarity due to more efficient leaching away of water soluble material which causes discolouration. These substances are mainly phenolic or amine types. One disadvantage is the poor ageing properties of leached films. This can however be improved by adding antioxidants at the latex stage prior to drying. These antioxidants should not themselves be leached away and they should not discolour the films. Phenolic antioxidants are preferred to amine types due to this reason.

Prevulcanized latex films prepared by using different vulcanizing systems and different latex types are compared and the effectiveness of irradiated prevulcanized latex films to preserve the clarity is demonstrated.

Reference

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E - 12

CONTRIBUTION OF SODIUM BISULPHITE OR META BISULPHITE TO THE RAW RUBBER INDUSTRY

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Discolouration of latex can be due to various causes. This discolouration has serious disadvantages in latex crepe manufacture, where the white colour is of paramount importance. In the manufacture of RSS too, if the discolouration takes place to a significant extent, the sheets are down graded. In order to prevent enzymatic discolouration, sodium bisulphite or meta bisulphite is used widely in the raw rubber industry. In the crepe rubber industry the amount of sodium meta bisulphite used is 500 g per 100 kg of dry rubber. In the case of sheet rubber manufacture 7 to 8 g of the chemical is added into latex containing 500 g of dry rubber in the form of a freshly prepared solution to prevent discolouration caused by enzymes during overnight coagulation. This also helps to control pin head bubble formation during slow drying of sheets.

However, it should be noted that the addition of sodium bisulphite or metasulphite to latex should be done under controlled conditions and under no circumstances should excess of this chemical be added, as excess causes drying difficulties. If the coagulation of the latex is done quickly within 3 to 4 hours and drying is done in a perfect smoke house, contribution from this chemical to sheet rubber is nil.

E-13

WATER SOLUBLE MERCAPTAN FOR USE IN THE CREPE RUBBER INDUSTRY

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Latex crepe from Sri Lanka has earned a reputation for its high quality. The pure white colour and the high level of purity have been achieved by: (*a*) Fractionation of latex before coagulation to remove the yellow fraction; (*b*) Use of a chemical bleaching agent, to bleach the remainder of the yellow fraction.

Since crepe rubber is manufactured from latices of mixed clones, removal of a fraction in itself is insufficient to make good quality crepes, bleaching is also essential.

The traditional bleaching agent (RPA 3) has now been replaced by new bleaching agents containing tolyl mercaptan as the basic ingredient. However, a large number of disadvantages have been pin pointed by the users, in using this substance. An attempt was made to chemically modify the basic active ingtedient tolyl mercaptan in bleaching agents, to make it ionic and hence water soluble.

The alkaline metal salt of the thiol was made by dissolving tolyl mercaptan powder in caustic soda solution, and the properties of this substance was compared with that of ordinary tolyl mercaptan. It was found that it had properties which were in certain instances superior to the ordinary tolyl mercaptan, while it is very much more economical to use in crepe manufacture compared to ordinary tolyl mercaptan.

E-14

A LINEAR GEL/POLYMER SYSTEM BASED ON RADIATION PREVULCANIZED NR LATEX

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Radiation prevulcanized NR latex with controlled gel content can be prepared by varying the radiation dose. Effect of gel content on the extrusion properties of rubber prepared by mixing irradiated latex with normal latex prior to coagulation is being studied. It is observed that the blended rubber has good ageing resistance in addition to improved processability.

Reference

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E-15

RADIATION PREVULCANIZATION OF NATURAL RUBBER LATEX BY γ-IRRADIATION AND ITS POTENTIAL INDUSTRIAL APPLICATIONS

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Physical strength of films prepared from radiation prevulcanized natural rubber latex (RPVL) could le matched with conventional sulphur cured systems by using an optimum radiation dose of 5 Mrads in the presence of CCl_4 sensitizer at a level of 3 to 5% on the dry rubber content. The films have to be heat treated to achieve optimum properties. Antioxidants such as bisphenols added to latex subsequent to irradiation improves the ageing resistance of the films.

Viscosity stability of irradiated latex is more consistent with low ammonia (LA) latex types containing secondary preservative systems compared to high ammonia (HA) latex types.

SECTION E

E -16

IDENTIFICATION AND CHARACTERISATION OF THE PHENOLIC CONSTITUENTS OF SMOKE WHICH IS DEPOSITED ON RIBBED SMOKED SHEETS

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Ribbed smoked sheets (RSS) show better resistance to oxidation than other forms of natural rubber. This is due to phenolic compounds that are deposited during smoking. The present investigation is to separate and identify these phenolic compounds. Deposits were extracted with acetone and methanol. The phenolic compounds were then isolated and identified by gas liquid chromatography.

E -17

A PRELIMINARY INVESTIGATION ON THE USE OF METAL DERIVATIVES OF CASHEWNUT SHELL LIQUID AS ACTIVATORS IN SULPHUR VULCANIZATION OF NATURAL RUBBER

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Fatty acids and their metal salts are used as activators for sulphur vulcanisation of diene rubbers including natural rubber. It has been established that branched acids and some metal salts of higher fatty acids are more efficient than straight chain fatty acids and that a mixture of acids is more efficient than a single type of compound.

Anacardic acid is the main component of natural cashewnut shell liquid (CNSL) and the extraction/milling procedure adopted by Sri Lanka Cashew Corporation does not favour decarboxylation reaction and as such, the extracted liquid retains as high as 70% anacardic acid.

In the present study, cashewnut shell liquid was treated with sodium bicarbonate solution to convert the anacardic acid component to its sodium salt. Subsequently the mixture containing the soluble sodium salt was treated with a soluble salt solution of a metal to obtain its metal derivative. Metal derivatives synthesized include those of zinc, calcium, magnesium and aluminium. Their activity has been compared with that of stearic acid in ACS 1 formulation and in tyre tread formulations. The results obtained indicate that these compounds act as activators of rubber vulcanisation.

E -18

DROUGHT OF 1983

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The rainfall of January, February, March and April 1983 was analysed. The poor rainfall of the Northeast monsoon months was due to the low and mid tropospheric ridge system being stagnant to the South of its average position. The April rainfall which is normally associated with afternoon convective activity was less than average due to lack of cyclonic vortices forming on the Inter Tropical Convergence Zone (ITCZ) across the latitudes of Sri Lanka. These conditions may be teleconnected with other global circulation features.

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E - 19

STORM SURGE FORECASTING (AN APPLICATION OF JELESNIANSKI TECHNIQUE TO THE EAST COAST OF SRI LANKA)

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A significant part of the damage caused by a cyclone is associated with storm surges, that accompany the cyclone.

Accurate prediction of storm surge is vital for purposes of planning precautionary measures.

Nomograms prepared by C. P. Jelesnianski are used to forecast the storm surge heights at the east coast of Sri Lanka. These nomograms are based upon a "standard storm" passing over a "standard basin". The values obtained from these nomograms are then corrected for better agreement with actual storm and basin.

Depth profile correction factors for the east coast of Sri Lanka were found and making use of these values the standard basin values are corrected to the actual basin values of the east coast.

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E - 20

ON SOLUTION — VAPOUR EQUILIBRIA FOR MULTICOMPONENT SYSTEMS

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The relative activities of components in solution are frequently determined using partial vapour pressures of gases in equilibrium with liquid solution. Since a large number of measurements are usually involved, a check for the self-consistency of the measurements is useful. In the case of binary systems a check for self-consistency is available in terms of the relative volatility.[1] In this paper, equations are derived for extending this method to multicomponent systems.

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E 21

DEVELOPMENT OF AN ALUMINIUM BATTERY AND COMPARISON OF ITS PERFORMANCE WITH THE NORMAL DRY CELL

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Lechanche type manganese dioxide battery with zinc anode still remains the most widely used source of electrical power in the primary battery field. However, with the gradual depletion of world's zinc resources

it would become necessary, in the years to come, to develop a battery with a cheaper and a readily available metallic material such as aluminium. The objective of the present work has been to develop a manganese dioxide type battery with aluminium as the anode material instead of the conventionally used zinc anode. This seemed a reasonably good choice since aluminium yields a higher power per unit volume, is higher than zinc in the electrochemical series and is relatively abundant and cheap. The greatest handicap with aluminium is the presence of the stable oxide layer on its surface which contributes to a higher cell resistance.

In order to do a comparative study, two sets of test cells were made of PVC materials and the same cathode and cathode mix were used while one set had aluminium as the anode material and the other had a zinc anode. Their performance was checked by means of discharge curves and flash light tests. The aluminium cell developed showed a reasonably good performance (OCV = 1.50 = 1.56 V) under continuous and intermittent discharge. However, it showed relatively poor storage life due to the corrosion of aluminium. Cells with controlled pH of the electrolyte and with added inhibitors have been investigated in order to increase the storage life of the aluminium battery.

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E - 22

A COMPACT CI WAVEFUNCTION FOR HELIUM AND HYDRIDE ION

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Configuration interaction (CI) and explicit introduction of interelectronic coordinates are approaches commonly employed in obtaining wavefunctions which are more accurate than Hartree Fock. The disadvantage of the CI method is the large number of configurations required while the explicit introduction of interelectronic coordinates causes difficulties in integral evaluation. To overcome these problems the interelectronic coordinates are introduced via correlated Gaussians and the expansion functions taken to be $\bar{\Phi}_o$ the self consistent determinant and $\left\{\bar{G}_k^+ \bar{\Phi}_o\right\}$ is a function obtained from $\left\{\bar{G}_k^+ \bar{\Phi}_o\right\}$ which is constructed using a strong orthogonality projection operator[1], and is expressed entirely in terms of Gaussians and correlated Gaussians. The wavefunction for helium and hydride ion are presented using this method.

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E - 23

PHOTOREDUCTION OF CARBON DIOXIDE WITH SEMICONDUCTOR PHOTOCATALYSTS INITIATING TWO PHOTON PROCESSES

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Artificial simulation of photosynthesis seems to be the only long-term solution to the fuel crisis and carbon dioxide pollution. It is known that aqueous semiconductor powder dispersions have the capacity to photoreduce

carbon dioxide to free energy rich compounds such as formaldehyde and methyl alcohol. The quantum conversion efficiency of such systems with familiar stable semiconducting materials is low, because they predominantly excite only one photon process with relatively high energy (uv or near uv) photons that are deficient in sunlight. The success of natural photosynthesis depends on the efficient utilization of several low energy photons (optical region) for the reduction of one molecule of CO_2.

We have noted that two types of semiconducting photocatalysts can be produced to promote two photon processes in the photoreduction of CO_2. (1) Composite semiconducting particles where one component undergoes reversible photo-oxidation and reduction (2) Complex crystalline and molecular semiconducting solids showing multiple absorption bands, that initiate two photon processes via exciton-exciton interactions.

After testing a large number of substances that seemed promising on theoretical considerations, we found that processes (1) and (2) were practically realized to a high degree in mercury coated n - TiO_2 and n-HgCO $(CNS)_4$ respectively. Aqueous suspensions of these catalysts photoconvert CO_2 to H.CHO with a quantum yield 10 - 100 greater than the yield obtained with catalysts based on single photon reactions.

E - 24

ACTIVATION OF ELECTRONIC CONDUCTION IN SOLIDS BY DIPOLAR MOLECULES

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It is well known that the electronic conductivity of several semiconducting solids is greatly enhanced by the thermal generation of charge carriers from impurity levels of foreign atoms. We have found an analogous novel phenomenon involving foreign molecules in semiconductors and insulators. Several crystalline and molecular solids show much enhanced electronic conduction (electrons or holes) when doped with molecules of high dipole moment. This occurs in solids having free interstitial volume per unit cell, sufficiently large to accommodate the molecules. The enhancement of conductivity is explained as due to the reduction of the thermal activation energy of hopping conduction associated with the polarons, by the dipolar molecules. Experimental data on several molecular and crystalline solids doped with H_2O, HCN and HF is presented to show the quantitative agreement with the theoretical model.

E - 25

AMINO ALKYL AROMATIC COMPOUNDS AS FLUORESCENT pH INDICATORS: BASICITY DEPENDENCE ON THE STATE OF EXCITATION AND THE AMINE GROUP

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The ground state basicities of a series of Amino Alkyl Aromatics which are sparingly soluble in aqueous media, have been measured *via* their solubility-pH profiles. The excited state basicities of this same series have been obtained from their fluorescent pH indicator behaviour[1]. It is shown that, in support of our previous contention, these two basicities are nearly identical for both monobasic and dibasic members, though a small statistical correction is necessary in the latter case. The trend, though not the absolute values, of the observed basicities as a function of the amine group can be understood on the basis of conventional substituent effects

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SECTION E

E-26

MICELLAR EFFECTS ON ACID-BASE EQUILIBRA AS STUDIED BY FLUORESCENT pH INDICATORS

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The pK_a values of a series of fluorescent pH indicators[1] have been measured *via* fluorescent intensity-pH profiles in the presence of sodium lauryl sulphate micelles and compared with those values obtained in micelle-free aqueous solution. The relationships have been analyzed in terms of a simple thermodynamic cycle which shows that relatively hydrophobic organic ions can enter a micelle of opposite charge in preference to being hydrated in bulk water. This view that a micelle, unlike a simple hydrocarbon phase, can be accessible to organic ions has currently gained experimental support from others[2].

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E-27

THE SOLVENT SENSITIVITY OF THE FLUORESCENCE OF AN AMINO ALKYL AROMATIC COMPOUND

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The fluorescence quantum yield of 9, 10 bis (n-butyl amino) Anthracene has been found to show a sharp dependence on the solvent whereas other parameters such as the position and the shape of the fluorescence band are virtually solvent invariant. The controlling property of the solvent appears to be its polarity as manifested through polarization-polarizability and hydrogen bond donor ability[1]. The fluorescence quantum yield shows a virtual step function when plotted against solvent polarity. A simple theory based on Photo indueed eleetron transfer[2] can account for all the results, which therefore might have a more general significance. The utility of this type of system as a solvent polarity probe will be examined.

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E-28

EFFECT OF HUMIDITY ON THE DIELECTRIC PROPERTIES OF MICA

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The dielectric properties of local muscovite mica samples of different solid inclusion contents, equilibrated with atmospheres of 15% to 95% relative humidity in the temperature range 293 K to 333 K were investigated. AC conductivity and permittivity in the frequency range 100 Hz to 20 k Hz, measured using a three terminal electrode system, are presented in this paper.

The conductivity values were in the range 1.5×10^{-10} (ohm m)$^{-1}$ to 4×10^{-7} (ohm m)$^{-1}$ while the permittivity values were between 16 and 4. An increase in conductivity and a decrease in permittivity were observed with increasing frequency. Generally both the conductivity and the permittivity increased with humidity. This effect was more pronounced at the higher humidities and temperatures, at lower frequencies and in samples with higher inclusion contents.

It is suggested that the observed behaviour is due to Maxwell-Wagner effects[2] created by the moisture that has diffused in-between the sheets of the laminated mica structure and that the adsorption of this moisture onto the surfaces of these sheets is governed by the dynamic throry by sorption[1].

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E - 29

ELECTRICAL CONDUCTANCE AND DIFFUSE REFLECTANCE STUDIES OF SOLID STATE INORGANIC COMPLEXES

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The diffuse reflectance and electrical conductance studies were carried out for nearly 20 complexes each having a transition metal ion as part of either the anion or the cation.

The diffuse reflectance spectra were primarily used to evaluate the band gap of the solid material and the conductance measurements were carried out to determine its semi-conducting properties.

Of the systems studied so far, $Ag(SCN)$,$Zn_3(Fe(CN)_6)_2$ and $CuCrO_4$ were found to be good semiconducting substances.

Silver thiocyanate and copper chromate were found to be p-type semiconductors while the $Zn_3(Fe(CN)_6)_2$ was found to be of the n-type.

The diffuse reflectance spectrum of $Zn_3(Fe(CN)_6)_2$ showed a band at 530 nm. On drying this complex over P_2O_5 for several days, the band disappeared gradually. The occurrence of this band was not observed in other $Fe(CN)_6^{3-}$ complexes. Tentatively we attribute this band to an electronic transition of the type $^1A_{1g}$—$^1T_{2g}$ brought about by the presence of H_2O molecules in the vicinity of the complex.

The diffuse reflectance of the $CuCrO_4$ also showed a clear band at 460 nm. The inability to prepare pure $CuCrO_4$ devoid of traces of CuO, precluded the analysis of this spectrum.

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SECTION E

E - 30

PHOTO ACTIVITY OF SO_2 LEUCOBASES OF METHYL AND CRYSTAL VIOLET DYES

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The decolourization of aqueous solutions of methyl violet and crystal violet occurred on treatment with sulphur dioxide. The regeneration of the colour occurred on exposure to solar radiation. Crystal violet colour reappeared very rapidly and the methyl violet colour regeneration was slow. The reverse reaction occurred when the solutions were kept in the dark.

The controlled study of the reappearance of colour at different temperatures was carried out using a mercury lamp as the radiation source. The development of colour was monitored spectrophotometrically.

The analysis of data indicates an autocatalytic decomposition of the sulphur dioxide leucobases of both dyes. The rate constant and the free energy of the reaction and the possibility of using them as actinometers will be discussed.

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E - 31

BASIC STRENGTH PROPERTIES OF COCONUT (*COCOS NUCIFERA*) TIMBER

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In Sri Lanka 1.15 million coconut trees are being uprooted annually under replanting schemes. Most of them are used as cheap timber (i.e. rafters, fence posts etc.) and the portion unsuited for timber is used as a fuelwood in tile and brick kilns. A mature tree (over 55 years old) depending on its height and diameter, gives 0.75-1.0 m^3 of usable timber of which the density is above 500 kg/m^3. As the first step in the better utilization of coconut timber, its position and properties among other common timbers were investigated.

Four basic tests such as compressive strength test parallel to grain, shear strength test parallel to grain, static bending test perpendicular to grain and impact bending test perpendicular to grain, were carried out for 'tall' variety which is the most common in Sri Lanka. All the samples were seasoned for 3½ months and the moisture content was kept in between 16%-17% during the tests.

Coconut trunk of a tall palm around 60 years gave the following physical characteristics when tested between 0 - 14.4 meters in height.

	Minimum	*Maximum*
Density	290 kg/m^3	940 kg/m^3
Crushing strength (compression) (parallel to grain)	25.8 MPa	111.7 MPa
Shear stress (parallel to grain)	2.2 MPa	15.6 MPa
Equivalent fibre stress at maximum load (static bending)	50 MPa	114.4 MPa

	Minimum	*Maximum*
Modulus of elasticity	6.3 GPa	14.1 GPa
Impact bending—height of release for 1.5 kg weight	0.2 m	1.7 m

A linear relationship in between density and other strength properties were noted.

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E - 32

INFLUENCE OF PLANT EXTRACTS ON THE IMMUNE SYSTEM

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The lysis of rabbit erythrocytes by human serum utilising the alternative pathway of complement activity was used as a model system, to screen plants used in the ayurvedic medical system, for their influence on the immune system. The results were compared with that obtained for heparin, a known inhibitor of activity in the model system. A wide range of response was obtained from the 20 plant samples screened.

Reference

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E - 33

ACTIVITY DIRECTED FRACTIONATION OF THE FRUIT PULP OF *AEGLE MARMELOS*

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The water extract of the fruit pulp of *Aegle marmelos* was found to be an effective inhibitor of the alternative pathway of complement activity in the model system used by us to screen plants for their influence on the immune system. The activity directed fractionation of the extract, using the model system as a bio-assay showed that the activity lies in the pro-anthocyanidin fraction.

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SECTION E

E - 34

ATTEMPTS AT DRAWING UP STANDARDS FOR COMPLEX AYURVEDIC PRODUCTS

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The high demand for ayurvedic medicines in Sri Lanka is met only in part by the state-run Ayurvedic Drugs Corporation. The remainder is met by a number of private manufacturers. At present there is no standardisation of the products available in the market.

As a first step towards remedying this unhealthy situation, we have tested the possibility of using various physico-chemical measurements as standards for these products. Our results show that measurements such as loss on drying, ash content, sulphated ash, soluble extractives, quantitative determination of metallic elements and organic compound classes, can be used.

This work was supported by a NARESA grant.

E - 35

ANTIBACTERIAL AND ANTIFUNGAL ACTIVITY OF SOME SEAWEEDS IN SRI LANKA

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Compounds having antimicrobial activity are known to be present in seaweeds.[1] Extracts of 16 species of marine algae in the coastal waters of Sri Lanka were screened for antifungal (against yeast and *Cladoporium*) and antibacterial (against *Staphylococcus aureus* and *Escherichia coli*) activity with a view to isolating active compounds subsequently.

The extracts (methanol, petroleum and chloroform) of *Chondrococcus hornemanii* showed both antifungal and antibacterial activity on all four cultures. The activity was found to be in the least polar chromatographic fraction containing halogen hydrocarbons.

The extracts of *Chrysemania uvaria* (methanol and chloroform on *Staphylococcus aureus*, methanol on *E. coli*) and *Gracilaria corticata* (methanol) showed only antibacterial activity. The extracts of *Sarcodia ceylanica* (methanol), *Corynymorpha pristmatica* (methanol) and *Liogora* species (methanol and petroleum) suppressed the growth of *S. aureus* while the extract of *Spyridia aculeata* was active against *S. aureus* (methanol and petroleum) and yeast (petroleum).

The extracts of *Laurensia papillosa, Acanthophora delilei, Polyopes ligulatus, Gracilaria fergusonii, Ulva fasciata, Chnoospora fastigiata, Halimeda macroloba, Turbinaria conoides* and *Valonopsis pochynema* did not inhibit the growth of the microbes tested. The results obtained for the last two species are different to those from a previous report.[2] This may be due to a seasonable variation in the constituents of the seaweeds.

The extracts were prepared by digesting seaweeds in aq. methanol, light petroleum (b.p. 40-60°C) and chloroform, sequentially, at room temperature. Bacteriological testing of extracts against yeast, *S. aureus*, and *E. coli* was carried out using the standard disc method (6 mm discs). The activity against *Cladosporium* was investigated on thin layer chromatographic plates (0.55 mm x 20 cm x 20 cm). The extracts were partitioned

on the tlc plates using ethyl acetate and light petroleum (1 : 1). A nutrient solution containing spores of *Cladosporium* species was sprayed on the plates, and the plates were incubated in a moist chamber at room temperature for 47 h. The components showing antifungal activity were detected, visually.

We thank Prof. S. N. Arsecularatne for permitting the use of facilities for bacteriological testing and NARESA for a research grant.

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E 36

PURIFICATION OF ∝-GALACTOSIDASE FROM COCONUT ENDOSPERM BY HYDROPHOBIC INTERACTION CHROMATOGRAPHY

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A hydrophobic gel was prepared by binding ε-amino caproic acid to cyanogen bromide activated Sepharose 4B and covalently linking aniline to caproic acide using carbodiimide. This hydrophobic gel had a high capacity for ∝-galactosidase (0.5 mg/ml). The ∝-galactosidase (∝-D-galactosidase galactohydrolase; E.C. 3.2.1.22) purified by hydrophobic chromatography was shown to be homogeneous by polyacrylamide gel electrophoresis and by isoelectric focusing. The specific activity increased from 50 milliunits/mg protein to 24,500 milliunits/mg protein. The enzyme was purified 490 fold and the yield was 75%.

The amino acid composition of the enzyme was determined. Cyanogen bromide fragments were separated by HPLC. The ∝-galactosidase modified by reduction and by alkylation was studied by gel filtration for chain length.

This work was supported by NARESA (RGB/82/25) and University of Colombo.

E -37

SUCROSE PHOSPHORYLASE FROM *PSEUDOMONAS SACCHAROPHILA* AND SUCROSE SYNTHESIS BY PHOSPHATE PROCESS

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Pseudomonas saccharophila was grown in sucrose phosphate medium. Its growth reached the late log phase in 20 h when the innoculum was 30 h old. Tween 20 (0.2%) reduced the time taken to reach the late log phase to 10 h but the total growth as determined by turbidity measurements was halved. This limitation in growth was not observed when the concentration of sucrose in the incubation medium was increased from 0.2% to 2%. Tween 20 also doubled the activity of sucrose phosphorylase.

On purification of sucrose phosphorylase by salt precipitation, the highest specific activity (30.4 units/mg protein) was shown in the 50-60% ammonium sulphate fraction. Further purification of this fraction by hydrophobic interaction chromatography increased the specific activity to 48.4 units/mg proteins. The degree of purification was 103 fold and recovery was 34%.

The sucrose phosphorylase preparation in solution was more stable at 40°C than at 29°C or —2°C. The loss of activity at 29°C and —2°C were 28% and 99% after 15 days. Its temperature optimum was 30°C while its pH optimum was 7.0. The enzyme had a Km of 4.2×10^{-3}M for sucrose.

The ammonium sulphate fractionated sucrose phosphorylase was used for sucrose synthesis. Fifty five percent of the glucose-1-phosphate which was used as substrate along with fructose was converted to sucrose. However, on altering the equilibrium by the removal of phosphate, sucrose yield based on G-1-P increased to 98%.

This work was supported by NARESA RGB/82/20 and University of Colombo.

E-38

SOME OXIDO-REDUCTASES OF THE TRICARBOXYLIC ACID CYCLE (T.C.A.) OF COCONUT ENDOSPERM

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Coconut endosperm has been shown to be a non respiring tissue[1]. Hence the activities of some mitochondrial enzymes were studied. The extract was prepared by homogenizing the kernel in ice cold tris/HCl buffer (5 cm^3/g) of appropriate strength and pH and centrifuged at 700 g for 10 min. The supernatant was then centrifuged at 13,000 g for 20 min. The 13,000 g pellet/supernatant was used in enzyme assays.

The activity of mitochondrial enzyme, succinate dehydrogenase (E.C. 1.3.99.1) was not observed in the 13,000 g pellet nor in its supernatant[2].

The supernatant was checked for Malate dehydrogenase (E.C. 1.1.1.37) and isocitrate dehydrogenase (E.C. 1.1.1.41) activities. The Malate dehydrogenase activity was considerable (4,500 mu/g kernel) and Mn^{2+}. (0.018 M) did not show any effect on its activity[3].

Isocitrate dehydrogenase activity[4] was found to be 65 mu/g and this activity was stimulated by Mn^{2+}. In the presence of Mn^{2+} (0.08M) the activity increased to 460 mu/g.

This work was supported by NARESA and University of Colombo.

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E - 39

A STUDY ON PHOSPHOLIPIDS AND THEIR SIGNIFICANCE IN NATURAL RUBBER

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This paper deals with the isolation and analysis of phospholipids in natural rubber latex and their possible effects on the biochemical properties of latex and technological properties of natural rubber.

The types of rubbers selected for analysis were acid coagulated rubber, auto-coagulated rubber, polybag collected rubber and rubber obtained from latex treated with NaF. In addition, phospholipid content in

various fractions obtained by high speed centrifugation of latex was studied. Phospholipids were extracted from rubber by solvent extraction and separated by TLC.

The rubber latex treated with NaF solution was found to contain a higher phospholipid content than that of the untreated latex. Of the 3 main fractions obtained by centrifugation of latex, the rubber phase had the highest phospholipid content. Chromatographic analysis indicated the presence of 7 spots, and 3 of them were identified as phosphotidyl choline, phosphotidyl-ethanolamine and phosphotidyl-serine.

The phospholipase D was found to be present in the serum of *Hevea* latex and it was observed that the enzyme was destroyed or inhibited during bacterial growth in field latex.

The phospholipase D activities in sera obtained by (*a*) centrifugation of latex (C-serum) (*b*) freezing and thawing latex (F-serum) (*c*) freezing and thawing pallets of centrifuged latex (B-serum) were determined. The highest activity was found in F-serum. The kinetic behaviour of phospholipids at various temperatures, pH value and various inhibitor systems was studied.

Choline chloride, ethanolamine and phosphotidyl choline accelerated the vulcanization reaction of crepe rubber. Crepe rubber to which these phospholipids had been added also exhibited better raw rubber and technological properties than the control crepe rubber.

The raw rubber properties and technological properties of polybag rubber and NaF treated rubber, were better than the control rubber.

E-40

METHYLATION ANALYSIS OF A TRISACCHARIDE IN *LEUCAENA LEUCOCEPHALA* BY HPLC

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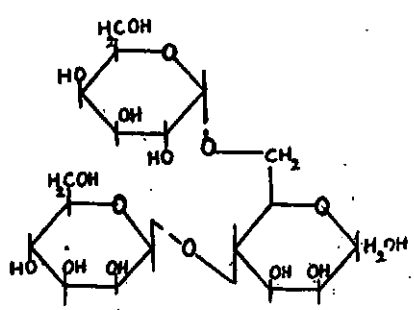
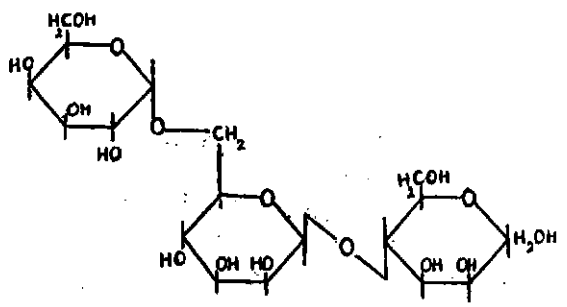
The oligosaccharide isolated from the enzymic Driselase—β—D mannase hydrolysis of the galactomannan from *Leucaena leucocephala* contained mannose and galactose in the ratio 2 : 1. Previous studies have shown that the structure is likely to be either A or B.



A



B

The hydrolysis of this methylated trisaccharide (A and B) will result in different hydrolytic products (one partially methylated galactose and two partially methylated nannose derivatives) depending on the structure.

A full methylation was done by Brimacombe method[1] using dimethyl formamide and sodium hydride. Hydrolysis of the methylated product was affected using 10% HCl at 95°C for one hour. After neutralization and deionization (zeriolide D M—F) the hydrolysate was analysed by high performance liquid chromatography, using a mixture of methanol and water (9 : 1) as the solvent.

The hplc analysis resulted in the identification of 2,3,6 tri-O-methyl—D mannose, 2,3,4 tri—O—methyl—D—mannose and 2,3,4,6 tetra—O—methyl D—galactose, thus confirming structure B.

This work was supported by a Colombo Plan scholarship.

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E - 41

PRINCIPLE-BASED SYSTEMATIZATION OF CHEMISTRY CONTENT

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Some sections of basic chemistry have been analysed so as to systematically organize it. There are many didactic advantages in deleting irrelevant concepts and unnecessary terminology. It is suggested that effective systematisation of chemical knowledge requires a consistent principle-based approach, and that other criteria (e.g. historical consideration in naming and stating laws and phenomena) should not be used.

Many examples of the use of irrelevant concepts and unnecessary terminology and inconsistency have been identified by our analysis. For example, Hess' law, Kohlrausch's law, Born-Haber cycle, Dalton's law . . all involve the same principle and best taught as examples of simple principle of additivity. Relative atomic and molecular mass is also an irrelevant concept, and Faraday's laws should have no place in a principle-based approach. Positive rays, alpha rays, beta rays are examples of unnecessary terminology and the definitions of ionisation energy and electron affinity are somewhat inconsistent.

This work was supported by NARESA.

E - 42

ANTIOXIDANT ACTIVITY AND MECHANISM OF ACTION OF SOME CARDANOL BASED MANNICH BASES AND DITHIOCARBAMATES

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Antioxidants are incorporated into rubber, plastics, lubricating oils and a variety of other substances to prolong their storage life and service life. The common rubber antioxidants are hindered phenols and amines which are all imported for use in the local rubber products manufacturing industry. This study is concerned with the synthesis of aminophenols and their corresponding dithiocarbamates from cardanol which is obtained from locally available cashewnut shell liquid.

Several new types of antioxidants have been synthesized using cardanol and metacresol as phenols and dimethyl amine and morpholine as amines by Mannich reaction using formaldehyde as the condensing agent. The dithiocarbamate derivatives of the Mannich bases were prepared by treating these compounds with carbon disulphide. The efficiency of these compounds in natural rubber and in model hydrocarbon substrates have been studied using oxygen absorption technique, volatility measurements, accelerated ageing tests and stress relaxation measurements. The mechanism of antioxidant action of the synthesized compounds has been studied by analysing the oxidation products of cumene and antioxidant induced decomposition products of cumene hydroperoxide, using gas liquid chromatography. The results show that the synthesized compounds are comparable in activity to some of the most popular commercial antioxidants, and their mode of action is predominantly by a chain breaking mechanism.

E-43

EFFECT OF ALKALI TREATMENT ON THE AGAR FROM *GRACILARIA CORTICATA*

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Agar, the polysaccharide complex obtained from red seaweeds is composed of at least three major fractions: (1) a sulphated galactan without gelling potential; (2) a sulphated agarose of low gel strength and (3) a neutral agarose of high gel strength which contains alternating units of 1→4 linked 3,6-anhydro α *L*-galactose and 1→3 linked β *D*-galactose residues. In this paper we report the effect of mild alkali treatment on the relative proportions of agarose, sulphated agarose and the sulphated galactan in agar samples isolated from the red seaweed *Gracilaria corticata*.

Gracilaria corticata was (*a*) extracted with hot water, 100°, pH 6, 2 h and (*b*) pretreated with 2% NaOH, room temperature, 24 h, washed and then extracted as before. The extracts were centrifuged, dialysed and further purified by the freeze-thaw procedure. The alkali treated agar sample had improved gel strength and also a higher 3,6 anhydrogalactose content.[1] Each agar sample (0.1g) was suspended in 50 mM NaCl at room temperature in a glass column and separated into three fractions by washing the agar with 50 mM NaCl at 20°, 50° and 100° to give fractions 1,2 and 3 respectively.[2] Results indicate that mild alkali treatment increased the relative concentration of agarose, but that the relative concentration of sulphated agarose remains almost unchanged. Determination of sulphate content[3] also indicated the absence of sulphate in fraction 3 of both agar samples.

	G.corticata	*G.corticata (after alkali treatment)*
Fraction 1 (sulphated galactan)	53	25
Fraction 2 (sulphated agarose)	28	26
Fraction 3 (agarose)	11	45

This work was carried out with financial support from NARESA, International Foundation for Science and the International Seminar in Chemistry.

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E-44

TWO NEW FRIEDELANE α — HYDROXY KETONES FROM *EUONYMUS REVOLUTUS*

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Two new friedelanes isolated from *Euonymus revolutus* (Celastraceae) have been established to be 2α-hydroxy-3-oxo-D : A-friedooleanane-28-oic acid, (1) and 3α-hydroxy 2-oxo-D : A—friedooleanane-28-oic acid(2).

Two triterpenes of very similar R_f were isolated from the cold dichloromethane extract of the stem bark of *Euonymus revolutus*. IR spectroscopy of the more polar compound (1), indicated the presence of a carboxylic acid group, hydroxy and carbonyl groups. ^{1}H-NMR and mass spectral data indicated a friedelane derivative. Acetylation gave a monoacetate (δ_H,4.89,*m*,1H,$w_{1/2}$ 4 Hz;2.09 s,3H). Acetolysis with zinc and acetic acid[1]

yielded canophyllic acid establishing that the carbonyl group and the carboxylic acid groups were at C-3 and C-28 positions respectively. (1) was reduced with sodium borohydride to give a diol which underwent ready oxidation with periodic acid, indicating that the hydroxy group in (1) was vicinal to the carbonyl group. The hydroxy group was placed at C-2, since a hydroxy group at C-4 will be tertiary and resistant to acetylation. Hence (1) was assigned the structure 2oc-hydroxy-3-oxo-D : A-friedooleanane-28-oic acid. (1) on treatment with either KOH-diethylether or acetic acid at room temperature gave rise to a second, less polar compound (2) which was also present in the plant extract. ^{1}H-NMR evidence (δ_H 3.85, *d* J $10H_Z$) indicated (2) to be a tautomer of (1) and hence (2) was assigned the structure 3oc-hydroxy-2-oxo-D : A-friedooealane-28-oic acid

This work was supported by a Reseerch grant from NARESA.

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E-45

TWO TRITERPENE 1,2- DIOLS FROM *EUONYMUS REVOLUTUS*

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Two triterpene 1,2-diols were isolated from the dichloromethane extract of the stem bark of *Euonymus revolutus* (Celastraceae). IR spectra of both compounds showed the presence of a carboxylic acid group. This was confirmed by the formation of the methyl ester on treatment with diazomethane. Acetylation in each case afforded a diacetate indicating the presence of two hydroxy groups. The formation of isopropylidenen derivatives with acetone and the ready oxidation with HIO_4 indicated the 1,2-nature of these two idols. The ^{1}H-NMR spectrum and the mass spectrum of the less polar diol suggested it to be a lup-20(29)-ene with the -COOH group and the two hydroxy groups in rings A and B. When (1) was refluxed with benzene containing a small amount of *p*-toluenesulphonic acid, a γ -lactone (γ/ν_{max} 1760 cm^{-1}) was obtained, indicating that one of the hydroxy groups and the -COOH group have a 1,3-relationship. The -COOH group could not be reduced with $LiAlH_4$ suggesting that the COOH group was in a sterically hindered environment, which would be C-25 in the lupane ring. Hence one of the hydroxy groups may be placed at either C-2 or C-6. The latter position was ruled out on the basis of ^{1}H-NMR data. The second hydroxy group may be placed at either C-1 or C-3. From biogenetic considerations C-3 is to be preferred.

The more polar triterpene has been tentatively identified as 2 α,3β-dihydroxy-urs-12-ene-28-oic acid by comparison of the reported m.p. and mass spectral data.

This work was supported by a research grant from NARESA.

E-46

CHEMICAL CONSTITUENTS OF *GLYCOSMIS PENTAPHYLLA* (RUTACEAE)

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The leaf and stem bark extracts of *Glycosmis pentaphylla* were studied as they show insecticidal activity. The presence of quinazolone, quinolone, carbazole and furoquinoline alkaloids were reported, in the rootbark and flowers.[1]

The cold methylene chloride extract of the twigs and leaves gave sitosterol and an alkaloid, m.p. 129° where mass spectra suggested it to be a furoquinoline alkaloid. Comparison of spectral data suggested the alkaloid to be dictamine.[2]

The cold methylene chloride extract of the stembark gave stigmasterol and one orange and two yellow cystalline compounds. The H1 NMR spectra of all these compounds showed the presence of dimethylchromenyl ring systems in their structures. The dimethylchromenyl ring is believed to be in an angular position in the xanthone as a singlet corresponding to 2-H occurs in its H1 NMR spectrum. A methoxy group which is also present should be at position 1 and the compound is therefore a 1-methoxy-3,4-chromenoxanthone.

One of the yellow compounds is believed to be an acridine alkaloid while the other is believed to be a xanthone. The alkaloid contained an aromatic methyl group in addition to the dimethychromenyl system.

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E-47

A NEW COUMARIN FROM *MURRAYA GLEINEI* (RUTACEAE)

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and **S. Balasubramaniam**
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The light petroleum extract of *Murraya gleinei* leaves contained several coumarins. Of these the 7-methoxycoumarins, murralongin, phebalosin and meranzin hydrate, the 5,7-dimethoxycoumarins mextocin and silbiricin[1] and the 7-hydroxy- 6-methoxycoumarin scopoletin have been reported from other plants belonging to the Rutaceae. The alkaloid skimiamine[2], the flavone, exoticin[3] and the sterol sigmasterol were also isolated.

A tenth compound isolated in low yield showed the spectral characteristics of a coumarin. The similarity of its 1-H NMR spectrum to that of meranzin hydrate in the 0-4 region with a dimethyl singlet at δ 1.35, 20H protons at 2.5 and a complex multiplet between δ 2.8-3.7 due to a CH_2-CH(OH) system suggested it to have the same 8 -side chain as meranzin hydrate. The soumarin contained three OMe groups and the aromatic signals which consisted of only one double doublet at δ 6-27 and 7-97 indicated a single *ortho*- coupling of aromatic hydrogens. The wide separation of the two doublets suggested that the unsubstituted positions were in the lactone ring. The coumarin must have the structure 5,6,7-*trimethoxy*-8-(2', 3'-dihydroxy-3'-methyl butanyl) coumarin and is a new coumarin.

This work was supported by NARESA grant RGB 81/18.

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E-48

A NEW STRUCTURE FOR MURRALONGIN

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Murralongin, a 7,8-substituted coumarin has been isolated from *Murraya elongata*[1] and *M. paniculata*.[2] We have isolated a compound murralongin II from *M. gleinei*[3] with the spectral and physical data of murtalongin.

SECTION E

The structure 7-methoxy-8-(1',2'-dimethylpropan-3'-al) coumarin has been proposed for the murralongin.[1] This structure with the 8-side chain -C(Me)=CMeCHO, was arrived at by Nuclear Overhauser effect studies on the compound. Phebalosin[4] also isolated from *M. gleinei* which has a similar ring structure to that of murralongin with the 1',2'-epoxy-3'-methylbut-3-ene side chain gave murralongin II on warming with p-toluene sulphonic acid. We confirmed that murralongin II was identical with murralongin by isolating murralongin from *M. paniculata* and showing it to be identical with that obtained from *M. gleinei* (mixed m.p. and IR). The formation of murralongin from phebalosin cannot be satisfactorily explained and our spectroscopic and chemical studies suggest that the side chain should be -C(CHO)=CMe_2. thus requiring a revision of the accepted structure for murralongin.

This work was supported by a NARESA grant.

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E-49

ISOLATION OF 5-HYDROXY-3,7,4'-TRIMETHOXYFLAVONE FROM *CROTON LACCIFER* AND EVALUATION OF ITS POTENTIAL AS A CHEMOTAXONOMIC MARKER IN THE GENUS *CROTON*

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and **S. Balasubramaniam**
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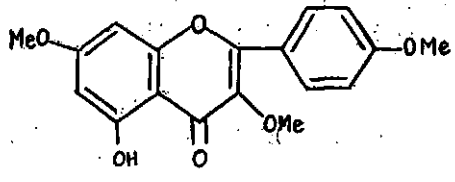
Croton laccifer (Euphorbiaceae), a widely distributed plant in Sri Lanka, finds applications in traditional agriculture and also in ethnomedical preparations. Apparent insecticidal properties of this plant have been noted in a recent study.[1] In the process of identifying the insecticidal constituents, we isolated 5-hydroxy-3,7,4'-trimethoxyflavone (1) from *C. laccifer*.

The hot methanol extract of fresh leaves of *C. laccifer* afforded, after chromatographic fractionation, a yellow crystalline solid (m.p. 147-148°C, lit.[2] 144-147°C) which was identified as the flavone (1) from its physical data (uv, ir, 1H nmr and mass spectra). This is the first report of this compound from the genus *Croton*.

To assess the potential of this flavone as a chemotaxonomic marker, seven species of *Croton* found in Sri Lanka were examined chemically for the presence of (1). *C. laccifer* and *C. persimilis* contained (1) in both fresh and dry leaves while the compound was absent in *C. bondplandianus*, *C. klotzschianus*, *C. tiglium*, *C. romaticus* and *C. hirtus*. The latter set of plants did not yield the flavone even after acid treatment of their extracts. This eliminates any possibility of the presence of flavone glycoside.

(1)



The presence of the flavone in *C. laccifer* and its absence in *C. aromaticus* support the view that the two are distinct species in contrast to Trimen's contention[3] that *C. laccifer* is a variety of *C. aromaticus*.

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SECTION F: SOCIAL SCIENCES

F - 01

AN ANALYSIS OF TRENDS IN INTERNATIONAL TOURIST ARRIVALS TO SRI LANKA DURING 1966 TO 1983

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International tourism is presently the second largest industry in the world next to the trade in petroleum. In Sri Lanka, international tourism was initiated on an organised basis with the enactment of the Ceylon Tourist Board Act in 1966. Since that time the tourist industry had registered a trend of continuous growth averaging an annual growth of 20 per cent.

This paper analyses the growth of international tourist arrivals from the different market regions for the period 1966 to 1983 together with the growth of the tourism infrastructure. The paper also attempts to identify the factors that determine the nature of the composition of tourist arrivals during the different growth periods. Special emphasis is laid on the period 1980-1983 where the arrivals from the traditional generating market of Western Europe began to register a decreasing trend.

F - 02

ECONOMIC IMPACT OF SEASONAL TANK FISHING ON PEASANTS IN THE DRY ZONE (THUNKAMA)

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Ministry of Fisheries started a pilot project for fish farming in the Dry Zone seasonal tanks, in 1979, at Thunkama in the Ratnapura district. Presently, seasonal tank fish farming has spread widely in the Dry Zone with success being recorded both technically and in socio-economic terms.

The Fisheries Master Plan (1979-1983) has a production target of 50,000 tons of fish through the inland fisheries. Since a fair extent of water bodies are seasonal tanks, the output of these may be useful to study its economic impact on peasants in those areas.

By visiting the project areas and making participation observations of peasants in Thunkama, the researcher found that it generated additional employment and village level economic activities which can be helpful in raising the socio-economic standards of peasants in the seasonal tank areas.

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F - 03

AN ANALYSIS OF THE CHRONOLOGY OF THE SOUTHWEST COASTLINE OF SRI LANKA

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This study attempts to understand the nature and the rate of coastline changes that have taken place during the past 18 decades by focusing on the chronology of selected coastline segments such as Seenigama, Hikkaduwa, Unawatuna, Piyandigama and Aranawala Historical. maps which belong to 1800 (for some segments), 1840, 1905-

15, 1917, 1934, 1945 and 1972 were enlarged into a larger scale, then superimposed by using the Kegel reflecting projector and were finally made into polyline maps. The land lost by sea erosion is estimated by a grid system especially for the 20th century, which is the period of the one inch series.

Results show higher progradation rates than aggradation rates. For example, larger headlands such as Seenigama, Midigama, Unawatuna with their long promontaries were destroyed during the 19th century. Aranawala which had a headland in 1840 was eroded and converted into an islet known today as Yakinigeduwa. Defunct headland beaches have lost their equilibrium afterwards and large portions of land have been subsequently eroded. Also extensive sandy beaches and hinterlands with unconsolidated beach materials have been washed by the sea. The total land lost during the 20th century has been computed. The cause of this land loss seems to be due to eustatic changes and resultant altered processes.

F - 04

PERCEPTIONS OF THE THIRD WORLD AMONG NORWEGIAN WOMEN'S ORGANISATIONS

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Norway generally has a positive image in the Third World as measured by its United Nations voting record and official aid performance. An important element in Norwegian relationships with the external world is its Non-Governmental Organisations. Further, women have become important as key 'targets' in resource transfers from Norway. This study examines and analyses the perceptions held on the Third World by the key personnel in the major women's organisations in Norway.

Eight leading women's organisations which have undertaken women's projects in the Third World and five new feminist organisations were selected for the study and their key members were subjected to extensive interviews both through a structured questionnaire and unstructured interviews.

The results indicate that key members of the first category do not necessarily match the positive external image of Norway's relations with the Third World. Many areas of ignorance and prejudice of the Third World were revealed in addition to broad positive aspects. Their members were largely in an older age bracket, motivated by charity and 'Christian' orientations without seeing the structural causes for underdevelopment in the Third World. The new feminist organisations consisted of a younger group of women more aware of the structural causes for under-development. They also brought a less paternalistic attitude towards relationships with the Third World.

The study also contrasts these results with those of a study by the author on Sri Lankan Women's Organisations.

F - 05

THE RISE OF THE SINHALA NOVEL AND THE CHANGING SOCIO-ECONOMIC STRUCTURE

Hema Goonatilake
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The rise of the Sinhala novel occurred in the first decade of the 20th century. This paper examines the relationship of the rise of the Sinhala novel to the changing socio-economic structure of Sri Lanka at the time. The first Sinhala novelists were Albert Silva, A. Simon de Silva, Piyadasa Sirisena, M. C. F. Perera, W. A. Silva and Martin Wickramasinghe. The social origins, careers and social aspirations of these novelists are analysed, in relation to the socio-economic changes that were taking place in the country at the time, specially along the Southern coastline, where all these writers originated. The socio-economic changes are identified and discussed.

The study reveals that these novelists belonged to the rural middle class. (Their fathers were Sinhala school teachers, ayurvedic physicians, village headmen and the like). They obtained their primary education in village schools and studied Sinhala classical literature under the guidance of Buddhist monks. They later migrated into the city for English education and clerical jobs. It is suggested that their marginal position between town and countryside, between a traditional Sinhala background and a colonially derived job which used English, provided the motive, the themes as well as the opportunity for the rise of the new genre.

F - 06

WATER USE, WATER LORDISM AND GROWING SOCIAL DISPARITIES IN A MAHAWELI SETTLEMENT VILLAGE

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The settlers in the Mahaweli are expected to enjoy equal opportunity regarding two main resources (land and water) essential for agricultural activity. Water is a very important input in irrigated areas. A specific quantity of water is required at the proper time for a successful crop. Thus, there is keen competition among settlers to get the required quantity at the required time. Certain privileged groups establish control over the distribution of water which ostensibly belongs to the total peasant community. Thus the distribution of water has given way to a kind of 'Lordism'. Due to emergence of this situation, a significant consequence is that the whole process of the original goals of equitable access to resources, equitable development, and hopefully equitable growth of income of the settler families tends to be displaced.

This paper presents the findings of a research study of a Settlement Village in Mahaweli H_1 area which uncovered the trends described above.

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F - 07

SOME ISSUES IN ECONOMICS OF PEASANT FARMING IN THE NEW SETTLEMENTS. A STUDY OF TWO VILLAGES IN THE GALNEWA REGION

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The farm allotment which is the prime unit of production in the new settlements falling within the Mahaweli Development programme had been made three acres in size, *i.e.* two and half acres of paddy and half acre of home garden. Although the experiences of Gal Oya, Minneriya and other similar settlement schemes and the results of controlled tests at various research centres would have advocated the viability of such an allotment, the settlement experiences at Galnewa region for the last five years appear to question this viability. Some of the recent changes in the cost structure of farm inputs and response of settler farmers towards these changes, have contracted production potentials. This has led to narrower producer margins.

The objective of this study is to explore the economics of peasant farming in this context to surface the subtle and complex mechanisms that affect the viability of peasant farming.

SECTION F

A sample survey was carried out towards the end of 1982 in two selected villages. Analysis of this data disclosed among other findings the incidence of a "vicious circle" of low income and poverty that make peasant farming in such allotments to be uneconomic and unrenumerative.

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මහවැලි සංවර්ධන ප්‍රදේශයේ ඉඩම් ජනාවාසකරණයෙහි වර්තමාන ප්‍රතිඵල — 'එච්' ප්‍රදේශයේ තෝරාගත් ගම්මාන කිහිපයක් ඇසුරෙනි

ජී. සෙනරත්

(භූගෝල විද්‍යා අධ්‍යයනාංශය, රුහුණ විශ්ව විද්‍යාලයීය විද්‍යායතනය, මාතර)

මෙම අධ්‍යයනය යටතේ මහවැලි සංවර්ධන ප්‍රදේශයෙහි තෝරාගත් ගම්මාන කිහිපයක් ඇසුරෙන්, මෙම සංවර්ධන ව්‍යාපාරය ආරම්භ කල අවස්ථාවෙහි තිබුණු තත්ත්වය සහ වර්තමාන තත්ත්වය පිළිබඳව අගැයීමක් කරනු ලැබේ. සංවර්ධන ව්‍යාපාරය ආරම්භ කල අවස්ථාවෙහි තිබූ පසුබිම 1975/1976 වර්ෂ ඇසුරෙන් කරන ලද අධ්‍යයනයකින් පැහැදිලි කරන අතර 1981 කරන ලද අධ්‍යයනයක් ඇසුරෙන් වර්තමාන තත්ත්වය පිළිබඳව සලකා බලා ඇත.

ඉඩම් ජනාවාසකරණය සිදුකල මුල් අවස්ථාවෙහි තිබූ තත්ත්වය සලකා බැලීමේදී වාරිමාර්ග කටයුතු, ඉඩම් පරිහරන ක්‍රමය, භෝග වගාවන්, ප්‍රජා සංවර්ධන කටයුතු ආදියෙහි මූලික ක්‍රියාත්මක වීම පිළිබඳව සලකා බලා ඇත. එම තත්ත්වය සංවර්ධන යෝජනා ක්‍රමය ක්‍රියාත්මකවී වසර 4ක පමණ කාලයක් පසුව කොතෙක් දුරට වෙනස්වී තිබෙද යන්න 1981 කරන ලද අධ්‍යයනය ඇසුරෙන් පැහැදිලි කර ඇත. වාරිමාර්ග කටයුතු, ඉඩම් පරිහරන රටාව, භෝග වගාවන්, සහ ප්‍රජා සංවර්ධන කටයුතු වල ඇතිවූ වෙනස්කම් සහ ඒවායේ ප්‍රතිඵල මේ යටතේ ඉදිරිපත් කෙරේ.

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ශ්‍රී ලංකාවේ ප්‍රාදේශිය විවිධත්වය සහ ප්‍රාදේශිය මට්ටමේ සංවර්ධන සැළැසුම් කිරීමේ අවශ්‍යතාවය පිළිබඳ විමසුමක්

ඇම්. රත්නායක,

(භූගෝල විද්‍යා අධ්‍යයනාංශය, රුහුණ විශ්ව විද්‍යාලයීය විද්‍යායතනය)

අන්තර් ජාතික මට්ටමෙන් රටවල් අතර පවතින විවිධත්වය මෙන්ම ශ්‍රී ලංකාව තුලද දිස්ත්‍රික් මට්ටමෙන් විශාල විවිධත්වයක් දක්නට ලැබේ. මෙම විවිධත්වය සලකා බැලීමත්, එම විවිධත්වයට අනුකූලවන පරිදි සංවර්ධන සැළසුම් කිරීමත් පිළිබඳව මෙම අධ්‍යයනයෙන් විමසා බැලේ. දිස්ත්‍රික් මට්ටමේ විවිධත්වය පහත සඳහන් අංග වලින් සලකා බලනු ඇත.

1. **ජනගහනය සම්බන්ධ කරුණු**–ජන ඝනත්වය, යැපුම් අනුපාතය, ග්‍රාමීය නාගරික ජන අනුපාතය, සේවා නියුක්ති අනුපාතය, උපත් අනුපාතය, මරණ අනුපාතය, ස්වාභාවික වර්ධනය ආදිය.
2. **නිවාස තත්ත්වය**–ස්ථිර නිවාස ප්‍රතිශතය, නිවාස ඝනත්වය, නිවසක සාමාන්‍ය ප්‍රමාණය, විදුලිය සහිත නිවාස ප්‍රතිශතය, නල ජලය සහිත නිවාස ප්‍රතිශතය, ආදිය.
3. **අධ්‍යාපන තත්ත්වය**–ලිවීමේ හා කියැවීමේ හැකියා අනුපාතය, අවුරුදු 14 ට වැඩි පාසල් යන ශිෂ්‍ය අනුපාතය, ගුරු-ශිෂ්‍ය අනුපාතය, කුඩා පාසල් අනුපාතය, විද්‍යා ගුරුවරුන්ගේ අනුපාතය, ආදිය.
4. **සෞඛ්‍ය තත්ත්වය**–ජීවිත අපේක්ෂාව, එක් වෛද්‍ය වරයකුට අයත්වන ජන සංඛ්‍යාව, මන්දපෝෂණ අනුපාතය, රෝහල් ව්‍යාප්තිය, ආදිය.
5. **ආර්ථික තත්ත්වය**–කෘෂිකර්මාන්තයේ යෙදී සිටින ජන අනුපාතය, කාර්මික කටයුතු වල යෙදී සිටින ජන අනුපාතය, ඒක පුද්ගල කාර්මික හා කෘෂිකාර්මික නිෂ්පාදනය, රජයේ මුදල් වෙන්කිරීමේ අනුපාතය, ආදිය.

මෙම සාධකවල ප්‍රාදේශීය විවිධත්වය 1971 හා 1981 ජන සංගණන දත්ත ආශ්‍රයෙන් හා මෑත වර්ෂවල ලබාගත් දත්ත ආශ්‍රයෙන් විමසා බැලේ.

ඉහත සඳහන් සාධක මත ප්‍රාදේශීය විවිධත්වය සහ ප්‍රාදේශීය අවශ්‍යතා දිස්ත්‍රික් මට්ටමෙන් හඳුනා ගැනේ. එසේ හඳුනාගත් ලක්ෂණයන්ට අනුකූල වන පරිදි ප්‍රාදේශීය මට්ටමේ සංවර්ධන සැළසුම් කිරීමේ අවශ්‍යතාවය පෙන්වාදීමත් ඒ සඳහා පවතින බාධක හැදින්වීමත් කර ඇත. මෙතෙක්කල් ක්‍රියාත්මක වූ ජාතික මට්ටමේ සැළසුම් වලින් සිදුවූ සේවය තුලනාත්මකව අඟැයුම් කරන අතර ප්‍රාදේශීය මට්ටමේ සැළසුම්වල වැදගත්කම ඉස්මතු කෙරේ. ඒ සඳහා දැනට ක්‍රියාත්මක කෙරෙන ප්‍රාදේශීය මට්ටමේ සැළසුම් පිළිබඳව අඟැයුමක් කෙරෙනු ඇත. මෙම අධ්‍යයනයේ අවසාන පරමාර්ථය වන්නේ ප්‍රාදේශීය මට්ටමේ සැළසුම් කිරීමේ අවශ්‍යතාවය පෙන්වාදීම සහ ඒ සඳහා ක්‍රියාමාර්ගයක් යෝජනා කිරීමයි.

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ආර්ථික සංවර්ධනය පිළිබඳ ක්ෂේත්‍රීය විග්‍රහය සහ ශ්‍රී ලංකාවේ සංවර්ධන අවධිය

පියදස හේවගේ,
(භූගෝල විද්‍යා අධ්‍යයනාංශය, රුහුණ විශ්ව විද්‍යාලීය විද්‍යායතනය, මාතර)

ආර්ථික සංවර්ධන සංකල්පය ගතවූ දශක තුන තුලදී, විෂයය ක්ෂේත්‍ර රාශියක විමර්ශණයට භාජනය විය. මේ පිළිබඳව වූ විවිධ මත වලින්, ආර්ථික සංවර්ධනයෙහි ක්ෂේත්‍රීය මුහුණුවර ගැනද නිගමණ ප්‍රකාශ විය. ආර්ථික වශයෙන් සංවර්ධනය වූ ප්‍රදේශ හා එසේ නොවූ ප්‍රදේශ පිළිබඳ ද්විත්වය අද පවා නව අදහස්වලින් පෝෂණය වෙයි.

මෙම ලිපියෙහි අරමුණ වන්නේ ආර්ථික සංවර්ධනයෙහි ක්ෂේත්‍රීය මුහුණුවර සැලකිල්ලට ගනිමින් එය හඳුනා ගැනීමට යත්න දැරීමයි. ලිපිය ප්‍රධාන කොටස් දෙකකින් සමන්විතය. එහි පළමුවන කොටසෙන්, ආර්ථික සංවර්ධනයෙහි ක්ෂේත්‍රීය විග්‍රහය ආදර්ශකයක් ඇසුරෙන් සාකච්ඡා කරනු ලැබේ. එම ආදර්ශකය පදනම් කොට ගෙන ශ්‍රී ලංකාවෙහි වර්තමාන සංවර්ධන අවධිය හඳුනාගැනීම ලිපියෙහි දෙවන කොටසට අයත් වෙයි. ශ්‍රී ලංකාවෙහි තෝරාගත් සාධකවල දිගුකාලීන උපනතියෙන් හෙළිවන නිගමණ මෙම දෙවන කොටසට ඇතුළත් කෙරේ.

ආර්ථික සංවර්ධනය ගතික ක්‍රියාවලියක් ලෙස සැලකිල්ලට ගන්නා විට, කාලය එහි වැදගත් අවධි පෙන්වා දෙයි. එමෙන්ම ආර්ථික සංවර්ධනයෙහි ක්ෂේත්‍රීය ලක්ෂණ විමසීමේදී, ප්‍රාදේශීයව බිහිවන විවිධත්වය පිළිඟත හැකිය. මෙම විවිධත්වය කාලයට සාපේක්ෂව වෙනස්වනු ඇත. මේ අනුව ආර්ථික සංවර්ධනය **කාලය** සහ **ක්ෂේත්‍රය** යන ද්විමානයෙන් නිරූපණය කෙරෙන චිත්‍රයකි. එක් අවස්ථාවකදී අපට හඳුනාගත හැකි වන්නේ නිරන්තරයෙන් වෙනස්වන මෙම චිත්‍රයෙහි කොටසකි. ආර්ථික සංවර්ධනය නිරන්තරයෙන් වෙනස් වන්නේ වුවද එහි ප්‍රමුඛ අවධි කිහිපයක් හඳුනා ගැනීම අපහසු නොවේ. විශේෂයෙන් දියුණුවන රටවල වර්තමාන ලක්ෂණ විමසීමෙන් පැහැදිලි වන්නේ මෙම අවධිමය ස්වරූපයයි.

ඉතාම මෑතදී, ආර්ථික සංවර්ධනය ක්ෂේත්‍රීයව සහ කාලීනව ගොඩනැඟෙන ආකාරය, චතුර් අවධි ආදර්ශකයක් මඟින් පැහැදිලි කරනු ලැබිය. ආසියානු සහ අප්‍රිකානු යටත් විජිත ලෙස පැවැති රටවල කොරතුරු ඇසුරෙන් එඩ්වර්ඩ් ටෝප් මෙම ආදර්ශකය ඉදිරිපත් කරන ලදී. පසුව පිටර් ගෝල්ඩ්, ආර්. මෝරිල් සහ පිටර් හැගට් යන අය ආදර්ශකය පිළිබඳව විවේචනාත්මක අදහස් ද දැක්වූ අතර නිරීක්ෂණද රාශියක් ඉදිරිපත් කරන ලදී. ආචාර්ය පී. සී. එච්. රණසිංහ (1972), ආදර්ශකය ශ්‍රී ලංකාවේ නියෝජනය වන ආකාරය සැලැකිල්ලට ගෙන තිබේ.

ආදර්ශකය ශ්‍රී ලංකාවේ නියෝජනය වන ආකාරය පරීක්ෂා කිරීම සඳහා පහත සඳහන් දිගු කාලීන සාධක සැලකිල්ලට ගන්නා ලදී.

1. මුළු ජනගහන සංඛ්‍යාව — ජන සංඛ්‍යාව වර්ධනය වූ ආකාරය.
2. මහාමාර්ග පරිවහන ජාලය — සබැඳුම වර්ධනය වූ ආකාරය.
3. නාගරීකරණය — නාගරික කේන්ද්‍රස්ථාන ගණන සහ නාගරික ජන සංඛ්‍යාව වර්ධනය වූ ආකාරය.

ශ්‍රී ලංකාවේ වර්තමාන සංවර්ධන අවධිය, ආදර්ශකයෙහි දෙවන සහ තෙවන සංවර්ධන අවධි අතර 'අන්තර් අවධිය' හා අනුරූප වන බව පෙනේ.

SECTION F

F - 11

SOME SOCIAL UNDERPINNINGS OF TUITION CLASSES

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Students attending tuition classes have been increasing in recent years. Among the reasons adduced for this phenomenon had been the acute competition to gain admission to the Universities. While this is important, attention to the growing tuition system had tended to ignore or underscore the fact that only children who can afford the tuition costs can attend tuition classes, thus eroding the aims of the free education system introduced in the mid 1940s, with the egalitarian ideology that all children should have equitable access to education.

In this study an attempt is made to assess students' socio-economic background and explore whether any correlation exists between this background and tuition attendance and non-attendance. The methodology was quantitative. Data was collected through a questionnaire administered to 576 students in grade 10 and grade 12 in two purposive sample of schools in the Colombo City and Kegalle District. Colombo City sample included 8 schools categorised into 4 groups ranked on the schools' prestige or status. In Kegalle district 3 schools were selected on an urban rural dimension.

The data reveals that a greater number of students in more prestigious schools, and from better socio-economic background attend tuition classes and also that they attend more expensive tuition classes with presumably better quality of teaching, etc. It is supportive of a strong nexus between tuition classes and income groups and ultimately to the social underpinnings that this study uncovers viz. the linkage between tuition class and social class. The data shows a significant curve up in the percentage attending tuition classes as one moves up the income groups and the reverse or a declining curve of students not attending tuition on the income group dimension.

F - 12

THE RELEVANCE OF EDUCATION IN PREVENTION AND REDUCTION OF ROAD ACCIDENTS

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This paper analyses the occurrence of road accidents in Sri Lanka during the last 30 years, with special attention to the city of Colombo. Its aim is to describe causation and some of the dimensions of the problem, and to illustrate the relevance of education in producing counter measures to minimise the number of accidents and to reduce the severity of consequences. A correlation is done between the increased volume of traffic and the increased number of road accidents. This infers that the road accidents are man-induced and the prevention and reduction of accidents should be a genuine concern of the road user. The analysis of the data on the losses due to accidents shows that the prevention and the reduction of accidents are very essential from the economic as well as from the social point of view. The solution is not impossible provided that there is sufficient awareness of the gravity of accidents and the realization of the importance of the reduction and control of the occurrence of accidents to everyday life. This can be achieved through education. There is a continuous need for road user education, as each new generation should learn for itself how and why accidents should be prevented. Therefore, there should be a long term process of educating the road user than having individual campaigns and programmes which could only have short term effects. This paper highlights some of the aspects that should go into the field of education at different levels in order to reduce and to prevent the occurrence of road accidents.

F - 13

SOCIAL SEGREGATION AS A MODE OF ADJUSTMENT IN AN UNDERDEVELOPED URBAN SITUATION; THE CASE OF A COMMUNITY OF SETTLED URBAN POOR IN THE CITY OF COLOMBO, SRI LANKA

S. T. Hettige

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An important feature of the distribution of the settled poor in the city of Colombo is that they are segregated, both spatially and socially. What is the sociological significance of this pattern? This paper attempts to answer this question in the light of the empirical evidence gathered during a case study of a squatter settlement.

The fact of social segregation has led some earlier researchers to assume that the poor are trapped in a vicious circle of poverty. This line of argument is evident in the diverse notions of marginality [1,2]. A major weakness of this thesis is that it does not view the communities of the urban poor as part of a larger urban system and, hence is incapable of taking into account the fact of crucial interdependence between the former and the latter.

It is argued in this paper that social segregation is a mode of adjustment adopted by the poor. As a social mechanism, it helps demarcate the social and sub-cultural boundaries of the settlements of the poor but does not obstruct constant economic and political transactions between the segregated and the macro-urban system.

This work was supported by a NARESA research grant.

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F - 14

DESIGN REQUIREMENTS AND DIMENSIONS FOR A COMFORTABLE WORK SEAT FOR SRI LANKANS

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A work seat may be called an essential requirement for most workers, either to perform work with less fatigue or as an aid for relaxation. Sitting takes the weight off the legs, reduces energy consumption and avoids unnatural body postures. There are also drawbacks such as slackening of abdominal muscles due to prolonged sitting and curvature of spine that may cause inter-vertebral disc pressure resulting in backache. In order to maximise the advantages and to minimise the drawbacks it is important to apply medical and ergonomic ideas in the design of seats for work.

A National Survey of body dimensions was conducted by the author in Sri Lanka and the standard dimensions of Sri Lankans are now available. Based on this data recommended dimensions for a comfortable work seat that could suit 90% of the male population are given in Figures 1 and 2. Dimensions for a female work seat are also given in parenthesis.

The other important recommendations are: a backward tilt of the seat surface of 14-24° to the horizontal to prevent buttocks sliding forwards, a high back rest where occasional lean back is required, a lumbar support on the back rest and an inclined back rest 105-110° to seat or 110-130° to the horizontal. (The lumbar region is the part of the vertebra between the lowest rib and the upper hip bone). For arm chairs, arm rest height from seat surface of 19.8 cm for males and 18.5 cm for females are recommended.

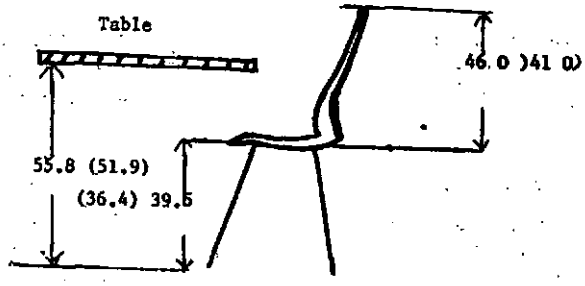

Figure 1 Work seat *(Side view)*

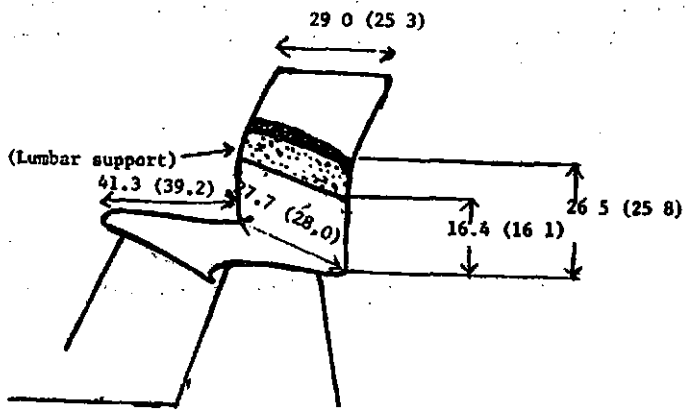

Figure 2 Work seat *(Front view)*

All measurements in centimeters

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ESTIMATES OF CURRENT FERTILITY FOR SRI LANKA, DERIVED BY APPLYING THE OWN-CHILDREN METHOD TO THE 1981 CENSUS

Kanthi Ratnayake
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The analysis of fertility decline in Sri Lanka has evinced much interest among demographers in recent times. National censuses, vital registration records and more recently, the World Fertility Survey, have provided a wealth of information for computing, identifying and understanding trends in fertility.

Unfortunately, the Census of 1981 had not extracted any information on fertility. The present paper reports on the application of a special technique known as the Own-Children Method, to the 1981 Census of Sri Lanka, in order to derive fertility estimates. This method is a census or survey based reverse-survival technique for estimating fertility rates for several years, prior to a census, by matching enumerated children to mothers

within households. In the present study, the Own-Children Method was applied to a 10 per cent sample from Sri Lanka's 1981 Census, in order to derive estimates of total fertility rates and age-specific birth rates for all women as well as currently married women, for the 15 year period, 1966 to 1980.

Since Sri Lanka has a rich diversity of peoples and cultures, arising from a variety of socio-economic factors, the paper also identifies and attempts to explain recent fertility trends in terms of important socio-economic variables such as ethnicity, religion, level of education and urban-rural residence, for the 15 year period. It is evident that national aggregates and fertility trends do not replicate themselves within the identified socio-economic sub-groups.

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THE PSYCHOLOGICAL CAUSES AND CONTROL OF INFLATION

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The economic causes and control of inflation are well known, though different economists may emphasize different aspects. The demand-pull, cost-push and monetary causes and the control through fiscal, monetary and income policies have been exhaustively analysed and prescribed. But in recent decades, with the universal adoption of full-employment policies in the developed countries, there is no break to the inflationery trend hrough the periodical intervention of uncontrolled depressions and deflation.

A more integrated, inter-disciplinary approach is essential to find a cure to this universal problem and the psychological aspects play a vital part in such comprehensive analysis. The predominant place given to the profit motive, motivated by greed and envy and the craving of each group to increase its share of the total income is the psychological root of inflation.

The psychological consequences are nervous strains and tensions, struggles and conflicts and the consequent increase of civilization diseases. Material goods are used excessively with wastage of resources, pollution of environment without realizing a balanced high quality of life.

The cure is to promote the universally accepted values of temperance and moderation with optimization of the use of material goods and not maximization and the increasing satisfaction of non-material, cultural, artistic, aesthetic and social needs. Such a change in the general attitudes, interests and motives can easily help to control inflation.