ලංකා විද්‍යාභිවර්ධන සංගමය

இலங்கை விஞ்ஞான முன்னேற்றச் சங்கம்

CEYLON ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PROCEEDINGS

OF THE

TWENTY EIGHTH ANNUAL SESSION

13th to 16th December, 1972

PART I

SECTIONAL PROGRAMMES AND ABSTRACTS

COLOMBO 1972

CEYLON ASSOCIATION
FOR THE
ADVANCEMENT OF SCIENCE

PROCEEDINGS
OF THE
TWENTY EIGHTH ANNUAL SESSION

13th to 16th December, 1972

PART I

SECTIONAL PROGRAMMES AND ABSTRACTS

COLOMBO 1972

SECTION A: MEDICAL AND VETERINARY SCIENCES

(Physics Theatre)

Wednesday, 13th December:

8.40	..	Lactase Deficiency in Ceylonese – B. Senewiratne, J. Hettiarachchi and Shanthi Thambipillai.
9.00	..	Structurally abnormal Haemoglobins in Kandy– B. Senewiratne and Shanthi Thambipillai.
9.20	..	Beta-Thalassaemia in Ceylon – S. B. Ellepola and K. V. Sivasubramaniam.
9.40	..	Sickle Cell – Haemoglobin D disease in the Sinhalese – N. Nagaratnam, D. P. K. M. de Silva and A. M. P. Attapattu.
10.00	..	Haemoglobin E disease – A clinical and laboratory study – W. A. S. de Silva, Priyani E. Soysa, R. C. Blackwell and D. D. Abeyratne.
10.20	..	The bacteriology and antibiotic sensitivity pattern of urinary tract infections in Ceylon – B. Senewiratne, J. Hettiarachchi and Kamalini Senewiratne.
11.00	..	Presidential Address: "Ayurvedic Research geared to the modern scientific approach" – K. Mahadeva.
2.00	..	Some clinical manifestations of toxoplasmic heart disease – N. Nagaratnam.
2.20	..	Electromyography in rectal prolapse – A. P. R. Aluwihare.
2.40	..	Poisoning – a two year study – B. Senewiratne, Shanthi Thambipillai, Enpavathy Williams and Vasanthi Pooranampillai.

Thursday, 14th December:

8.20 .. Diet and Iron Deficiency Anaemias in Sri Lanka – Beatrice V. de Mel.

8.40 .. Vitamin B 12 absorption in nutritional megaloblastic anaemia – B. Senewiratne, J. Hettiarachchi and Kamalini Senewiratne.

9.00 .. The effect of tea and coffee on the serum lipid levels of rats – C. C. Mahendra, S. Sentheshanmuganathan, W. P. A. Perera and R. L. Wickremasinghe (Jointly with Section E) *(Physics Theatre)*

9.20 .. Endemic fluorosis in Ceylon (a) The distribution of fluoride containing water – B. Senewiratne, J. Hettiarachchi, Shanthi Thambipillai and Kamalini Senewiratne.

9.40 .. Endemic fluorosis in Ceylon (b) Dental fluorosis – B. Senewiratne, Shanthi Thambipillai, J. Hettiarachchi and Kamalini Senewiratne.

2.00 .. The Identity of Mycobacterial Infections in Ceylon as determined by the Differential Tuberculin Test – M. R. M. Pinto, S. N. Arseculeratne, C. G. Uragoda and L. V. Weliange.

2.20 .. The Identity of Acid-Fast Bacilli from Patients diagnosed as having "Tuberculosis" (Pulmonary Disease) in Ceylon – M. R. M. Pinto, S. N. Arseculeratne, C. G. Uragoda and L. V. Weliange.

2.40 .. The Mycobacteria of the Ceylon Environment I. A. Preliminary Study – M. R. M. Pinto, S. N. Arseculeratne, C. Navaratnam, J. B. Karalliyadda, M. M. Gunaratne and L. V. Weliange.

3.00 .. Tuberculin Sensitivity in the Buffalo (Bubalus Bubalis Bubalis) – D. D. Wanasinghe, M. R. M. Pinto and K. V. Ravindran.

Friday, 15th December:

8.40 .. Active chronic hepatitis in Sri Lanka patients – N. Nagaratnam, D. P. K. M. de Silva and S. P. de Silva.

9.00 .. The relation of Arbovirus infection to Viral Hepatitis – I. The incidence of Arbovirus antibodies in the blood of Viral Hepatitis patients – U. T. Vitarana, Y. E. Hermon, M. Kanapathipillai and M. Anandarajah.

9.20 .. The relation of Arbovirus infection to Viral Hepatitis – II Arobovirus antibody in cases of hepatitis that were positive for Australia/SH antigen– U. T. Vitarana, M. Kanapathipillai, M. Anandarajah, S. Ramachandran, C. N. A. Rajapakse, J. E. J. Aiyathurai and H. A. Kanthie.

9.40 .. A study of virus antibody patterns in children suffering from Infectious Hepatitis – U. T. Vitarana, M. Kanapathipillai, M. Anandarajah, J. E. J. Aiyathurai, N. S. Thalagahagoda, Sakdhy Veeragathy and Nimala Fernando.

10.00 .. Ribosuria in Viral Diseases – J. E. J. Aiyathurai, Shiransi Thalgahagoda, D. P. Kuruppu and S. Sentheshanmuganathan (Jointly with Section E) *(Physics Theatre)*.

10.20 .. Methods of estimation of Aflatoxins in Cocount products – U. Samarajeewa and S. N. Arseculeratne (Jointly with Section E) *(Physics Theatre)*.

2.00 .. A study on the grey discolouration in sliced cooked ham – P. E. Dias and K. S. Kularatne (Jointly with Section D) *(Physics Theatre)*.

2.20 .. Stability of the bacteriological status of material for culture when stored in different transport media – A preliminary study – M. C. L. de Alwis.

Saturday, 16th December:

8.40 .. Binding of sulphadimidine to serum proteins in patients with hypoalbumenaemia – K. Balasubramaniam.

9.00 .. Nodal Gap substance of diabetic nerve – K. N. Seneviratne and S. Vairavanathan.

9.20 .. Properties of the para-nodal gap substance in diabetic nerve – K. N. Seneviratne and A. Weerasuriya.

9.40 .. Evaluation of Radioisotope Renogram in normal subjects – M. Gembicki, K. B. Herath, R. D. Piyasena and T. W. Wikramanayake.

10.00 .. Thyroid radioiodine (1311) uptake studies on some normal Ceylonese – M. Gembicki, K. B. Herath and T. W. Wikramanayake.

10.20 .. Business Meeting.

LACTASE DEFICIENCY IN CEYLONESE

B. SENEWIRATNE, J. HETTIARACHCHI
(Department of Medicine, University of Ceylon, Peradeniya)

and

SHANTHI THAMBIPILLAI
(Clinical Research Laboratory, General Hospital, Kandy)

72 adult subjects without gastrointestinal symptoms were given orally 1.5g/kg body weight lactose, and the blood sugar determined every 20 minutes for 80 minutes. There was a rise of 20 mg% or more in only 19.5%, a rise of 10 – 19 mg% in 30.5%, less than 10 mg% in 36.1% and a fall in 13.9%. This indicates a deficiency (or reduced activity) of intestinal lactase in a high percentage (80%) of Ceylonese adults. Glucose absorption was normal. There were no sex differences in lactose absorption. In some subjects with lactase deficiency, the lactose produced severe abdominal pain and diarrhoea. However, the correlation with biochemical changes was poor, indicating that clinical features alone are unsatisfactory as an index of activity of the enzyme.

In the 14 patients who absorbed lactose, the maximum rise in blood sugar occurred at a variable time. In only 5 (35.7%) was the maximum rise at 20 minutes. In 9 (64.3%), a rise of 20 mg% was noted at 60 minutes. As a screening test, the 60 minute sugar seems to be more reliable. Studies on new-born infants showed the presence of the enzyme at birth. Studies on one of us (B. S.), a regular milk drinker, showed a completely flat lactose curve. This would suggest that the loss of activity of the enzyme is more likely to be genetic than a consequence of the lack of substrate (milk).

Acknowledgements

This work was entirely supported by a grant from the Nuffield Foundation, London.

STRUCTURALLY ABNORMAL HAEMOGLOBINS IN KANDY

B. SENEWIRATNE *and* SHANTHI THAMBIPILLAI
(Department of Medicine, University of Ceylon, Peradeniya and Clinical Research Laboratory, General Hospital, Kandy)

It has been claimed ('Necheles, Allen & Finkel, 1969) that 15% of Ceylonese have Hb E. Lehmann & Huntsman (1966), in an authoritative monograph claim that in Ceylon, Hb E is confined to the Veddha. The literature fails to confirm or refute either of these claims.

1500 consecutive admissions to the Medical Unit wards of the General Hospital, Kandy were studied. Haemoglobin electrophoresis was done on starch gel. Abnormal haemoglobins were indentified by their relative mobility to known markers, and by their mobility on agar gel.

In a second study, 35 relatives of 4 patients in whom abnormalities of haemoglobin had been detected were studied.

Of the 1500 blood samples analysed, only 5 (0.003%) had structurally abnormal haemoglobins. They consisted of 2 cases of Hb E, 2 of Hb D, and 1 of Hb F. The incidence of Hb E (0.001%) is far below the claimed incidence of 15%. The very low incidence of Hb D (0.001%) is also of interest. This haemoglobin is found in 3% of people in the Punjab, and also in the Gujerati in Bombay. If this abnormal haemoglobin was present in a high frequency in Ceylon, it would support the contention that our people migrated from North India. The low frequency found in this study does not support this.

In the family study, 9 out of 35 (25.7%) relatives of patients with haemoglobinopathies were abnormal. The abnormalities were similar to those of the proband with the exception of the patient with Haemoglobin H. She gave birth to a child with a haemoglobin which consisted entirely of γ chains (Hb Barts), thus confirming the transmission of a defect in α chain synthesis from mother to child.

The conclusion is that structurally abnormal haemoglobins do occur, but are very rare in Kandy.

References

Necheles, T. F., Allen, D. M. and Finkel, H. E. (1969) Clinical disorders of haemoglobin structure and synthesis, p. 77, New York Appleton-Century-Crofts.

Lehmann, H. and Huntsman, R. G. (1966) Man's Haemoglobins p. 193, *Amsterdam, North-Holland Publishing Company.*

BETA-THALASSAEMIA IN CEYLON

S. B. ELLEPOLA *and* K. V. SIVASUBRAMANIAM
(Department of Pathology, General Hospital, Badulla)

24 cases of beta-Thalassaemia trait and 7 cases of beta-Thalassaemia were studied.

The patients were between the ages of 5 months to 17 months. The sex ratio was equal. All cases were Kandyan-Sinhalese except one who was a Ceylon Tamil. In all cases except one an enlarged spleen was a constant feature. They presented with failure to thrive, upper respiratory tract infection and one with heart failure. The haemoglobin percentage varied from 2.5g to 5.0 g. The blood film showed hypochromasia with anisocytosis, poikilocytosis, fragmented red cells and normoblasts. Reticulocyte count varied from 3 to 14%, Serum bilirubin was above normal. The typical X'ray changes of the skull was noted only after the age of one year. Foetal haemoglobin as detected by the one minute alkali-denaturation technique of Singer varied from 14.6 to 91%. No abnormal haemoglobin was detected on cellulose acetate paper electrophoresis.

Beta-Thalassaemia trait appears to be fairly common in the Province of Uva, among the Kandyan-Sinhalese and the Ceylon Tamils.

Foetal haemoglobin was detected in 50% of the cases but the concentration was less than 6%. The Haemoglobin A2 varied from 5.5 to 17% but the average was 10.4%. In three cases the haemoglobin A2 was in the normal range.

SICKLE CELL - HAEMOGLOBIN D DISEASE IN THE SINHALESE

N. NAGARATNAM, D. P. K. M. DE SILVA *and* A. M. P. ATTAPATU
(*Government Hospital, Gampaha, W. P.*)

and

P. K. SUKUMARAN
(*Cancer Research Institute, Tata Memorial Centre, Parel, Bombay* 12)

The double heterozygous state for Haemoglobin S and Haemoglobin D is a rare combination. This is the first study of Haemoglobin S-D disease and the first finding of Haemoglobin D in Sri Lanka.

Both these haemoglobins have the same electrophoretic mobility on paper at pH 8.6 and similar chromatographic behaviour. Haemoglobin D, however, can be distinguished from Hb S by solubility test, electrophoresis on agar gel at acid pH, and by family study.

This is a study of a Sinhalese family from a village near Hambantota, with such a combination and is of interest because of its geographical and possible anthropological implications. The propositus had SD, the father carried the Hb S trait, the mother Hb D trait, two siblings HbS-D combination and another Hb S trait.

The isolated fraction of Hb D in this report when fingerprinted was that of Haemoglobin D Punjab. It showed Tp XXII to be missing and new more positively charged tyrosine positive peptide instead. All other peptides were present and gave necessary staining reactions.

This study suggests that the origin of the Sinhalese pose an interesting problem and the finding of abnormal haemoglobins indicate that a detailed anthropological study including abnormal haemoglobins and other genetic parameters would be rewarding.

THE BACTERIOLOGY AND ANTIBIOTIC SENSITIVITY PATTERN OF URINARY TRACT INFECTIONS IN CEYLON

B. SENEWIRATNE, J. HETTIARACHCHI *and* KAMALINI SENEWIRATNE
(*Department of Medicine, University of Ceylon Peradeniya and Clinical Research Laboratory, General Hospital, Kandy*)

Escherichia coli is the commonest organism isolated from urinary tract infections and is believed to be sulphonamide sensitive in most instances, at least in first urinary tract infections. However, the antibiotic sensitivity of bacteria depend on the pattern of use of antibiotics in that environment. In Ceylon where gastrointestinal and respiratory infections are common, antimicrobial drugs such as sulphonamides, tetracycline and ampicillin, are widely used. It is possible that these drugs alter the antibiotic sensitivity pattern of the bacteria resident in the gastro-intestinal tract which are known to cause urinary infections.

The pattern of sensitivity of urinary pathogens are of special interest in this country where facilities for bacterial sensitivity testing are very limited.

The findings in 200 urinary tract infections (134 first infections) are reported. The commonest organism in both first and recurrent attacks was E. coli which was responsible for 91.1% of first infections and 74.2% of recurrent infections.

The antibiotic sensitivity pattern showed that in first infections, only 37.7% of E. coli were sensitive to sulphonamide. The sensitivity to other antibiotics was tetracycline (48.4%), ampicillin (61.5%), cephaloridine (73.7%), colomycin (84.3%), nalidixic acid (90.5%), sulphamethoxazole-trimethoprim (91.0%), and nitrofurantoin (98.2%). In second and recurrent infections, only 26.5% of E. coli were sensitive to sulphonamide. The sulphonamide sensitivity, irrespective of the organism was, 37.3% in first infections, and 30.3% in recurrent infections.

The conclusion is that sulphonamide is no longer the drug of choice in urinary infections in this country, since the widespread use of this drug, tetracycline, and ampicillin have caused a high degree or resistance among urinary pathogens.

Acknowledgements

We wish to thank Burroughs Welcome, London, for the supply of sensitivity discs.

SOME CLINICAL MANIFESTATIONS OF TOXOPLASMIC HEART DISEASE

N. NAGARATNAM

(Government Hospital, Gampaha, W. P.)

It is well known that Toxoplasma gondii can affect the myocardium as the primary target organ, as the sole manifestation of the illness, or the heart can be affected as part of a generalised infection.

This study includes 11 patients with myocardial toxoplasmosis and their family members. All patients and their families underwent complete diagnostic evaluation which included a history, physical examination, electrocardiographic, radiological and serological studies.

The study revealed a spectrum of clinical manifestations in toxoplasmic myocardial disease, varying in severity. It may be acute but the more usual picture is one of chronic heart disease. Many have only minimal symptoms or they may be completely asymptomatic. The pericardium may be involved. A familial incidence with cardiomegaly, electrocardiographic and serological changes in several members of families is seen at times. It may present with other cardiovascular manifestations without obvious involvement of the heart such as a sudden hemiplegia. It may complicate other forms of heart disease.

This study suggests that toxoplasmosis should be looked for not only in patients with obscure heart disease of a chronic nature but also in the acute forms with myocardial and or pericardial involvement. It should be considered in cases of familial heart disease and in those with extracardiac vascular manifestations. Toxoplasma might be commoner in this country as an aetiological agent in obscure cardiac conditions than is usually realised.

ELECTROMYOGRAPHY IN RECTAL PROLAPSE

A. P. R. ALUWIHARE

(Department of Surgery, University of Ceylon, Peradeniya)

The aetiology of rectal prolapse, especially in young men, is controversial. This study is being done to see whether electromyography helps in understanding the pathophysiology, and in determining treatment.

The series consists of ten patients, average age 28 years, with total rectal prolapse. 9 are males. They were studied (i) clinically, (ii) with X-rays of the anorectal angle, (iii) with electromyography at different rectal volumes, and (iv) correlating intrarectal pressure with the volumes and electromyograms in 3 patients. The electromyogram was done on the puborectalis.

In 7 patients the tone of the anal muscles appeared clinically normal. The anorectal angle was near normal in eight. In 7 patients studied by electromyography the intrarectal volume at which desire to defaecate and discomfort was felt, and at which sphincter inhibition occurred, was over twice the normal. Intrarectal pressures were very high at the time at which inhibition occurred. Straining caused prolonged inhibition of puborectalis activity while the proplase emerged.

Those whose electromyograms were grossly abnormal, or who could only reduce their prolpase manually, were treated by pelvic, floor repair. The rest are being managed by Thiersch 'wiring' and bowel training.

Conclusions

There is essentially a reduction in the sensitivity of the anorectal reflexes – necessitating a large rectal volume and much straining. Then prolonged sphincter inhibition allows defaecation and rectal prolapse.

It may be possible to treat the early cases with minor surgery.

Reference

Goligher, J. C. (1967) 'Surgery of the Anus, Recum, and Colon'; London; Bailliere, Tindall and Cassel.

POISONING: A TWO YEAR STUDY

B. SENEWIRATNE, SHANTHI THAMBIPILLAI, ENPAVATHY WILLIAMS

and

VASANTHI POORANAMPILLAI

(Department of Medicine, University of Ceylon, Peradeniya and Clinical Research Laboratory, General Hospital, Kandy)

472 cases of poisoning were admitted to the Kandy hospital in 1970 and 1971. 112 (23.7%) died, an insecticide being responsible for 44.2% of all cases, and 66.9% of fatalities. In 18%, the poisoning was accidental, the commonest poisons being an insecticide (28.2%) and kerosene (16.5%). A fifth of those who took insecticides accidentally, died. In the suicide group, the commonest poison was again, an insecticide (47.9%). Others causing fatalities were acetic acid, rat poison, drugs and "Niyangala" (Gloriosa superba). Kerosene although frequently taken caused no deaths.

Unlike in western countries, barbiturates accounted for only 5.5% of all poisonings and was responsible for only 2.6% of deaths.

In 12% of cases the poison could not be identified, making specific therapy difficult.

In about 80%, the victim was less than 30 years. In the 11 – 20 age group, there was a significantly higher percentage of females.

In Kandy, we are losing one young adult a week, mainly from insecticides. An alarming feature in some cases was the rapidity of death after the ingestion of the insecticide. A state of unconsciousness on admission carried a grave prognosis. In admissions "outside working hours", a senior doctor was not summoned. In view of the numbers of useful lives lost, and the strong possibility that many of these are suicidal gestures, there is a strong case for establishing a poisoning unit.

Acknowledgements

We wish to thank the Nuffield Foundation for a research grant to one of us (B. S.).

DIET AND IRON DEFICIENCY ANAEMIA IN SRI LANKA

BEATRICE V. DE MEL

(Department of Nutrition, Medical Research Institute, Colombo)

Iron deficiency Anaemia is an important nutritional problem affecting chiefly the more vulnerable sections of the lower socio-economic groups in Sri Lanka. Wickramasuriya (1937) was the first to draw attention to the fact that anaemia was the chief cause of maternal mortality. It is still the chief cause of infant mortality as well.

The findings of dietary surveys correlating iron intakes of mothers, unmarried young girls and young children with the prevalence of anaemia is presented. These findings compare favourably with the "apparent" iron intakes of the comprehensive socio-economic survey (Census & Statistics, 1969–70) which covered the whole Island according to Sectors, (Urban, Rural, Estate) and Agro climatic Zones, (I, II, III, IV) with a further breakdown according to income. The socio-economic survey spotlights clearly the inadequacy of dietary iron at the lower socio-economic levels in all sectors and zones, when compared with the recommended allowances for Sri Lanka.

The nature of iron intakes of the above groups together with the findings of the first chemical balance study done on 8 rural girls in an institution is discussed in relation to the absorption of iron from different sources of food. The high cost of the more freely available iron from animal sources will be related to the low intake of animal protein at lower socio-economic levels.

The long term but apparently simple solution lies in the fortification of some commonly eaten food. The most suitable items of food fortification and the amount and nature of iron to be added is discussed. It will be necessary, however, to carry out a pilot study to establish its beneficial effects before the measure is adopted.

References

Wickramasuriya (1937) *Malaria and Ankylostomiasis in the Pregnant Woman.* Oxford University Press, London: Humphrey Milford.

Census and Statistics (1969–1970) *Socio-Economic Survey,* Ceylon Government Publication 1972.

VITAMIN B 12 ABSORPTION IN NUTRITIONAL MEGALOBLASTIC ANAEMIA

B. SENEWIRATNE, J. HETTIARACHCHI
and
KAMALINI SENEWIRATNE
(Department of Medicine, University of Ceylon, Peradeniya and Clinical Research Laboratory, General Hospital, Kandy)

Vitamin B 12 and folic acid co-enzymes play an essential role in nucleoprotein synthesis in all cells. Morphologically abnormal cells have been found not only in the bone marrow, but also in cells of the oral and gastric epithelium (Farrant, 1958; Massey & Rubin, 1958; Sauli *et al.*, 1963). It is possible that this failure of nucleoprotein synthesis will not only affect the structure, but also the function of these cells. This might result in either a failure of secretion of intrinsic factor or a failure of absorption of the B 12 – IF complex. Schloesser and Schilling (1963) reported studies on a single patient with megaloblastic anaemia who was unable to absorb oral vitamin B 12. No conclusion can be drawn from this single study. We have investigated 31 patients with megaloblastic anaemia. All of them had gastric free-acid. The aetiological diagnoses were B 12 deficiency (40%), folic acid deficiency (50%), mixed (10%). All except one patient with a vitamin B 12 deficiency responded to a 4μg dose of oral vitamin B 12. In one patient, there was no response to an oral dose but he responded to a 1μg/day dose of intramuscular B 12.

The overall findings do not support those of Schloesser and Schilling. The vast majority of patients with megaloblastic anaemia in Ceylon can be treated with an oral dose of vitamin B 12 or folic acid.

Observations have also been made on the supply of folic acid in human physiology.

References

Farrant, P. C. (1958) Nuclear changes in oral epithelium in pernicious anaemia, *Lancet*, **1**, 830.

Massey, B. W. and Rubin, C. E. (1954) The stomach in pernicious anaemia. A cytologic study. *American Journal of Medical Science*, **227**, 481.

Sauli, L. C., Astaldi, G. and Malassim, L. (1963) Histopathology of intestinal mucosa obtained by Crosby's biopsy in pernicious anaemia before and after vitamin B 12 therapy. *Acta vitamin (Milano)* **17**, 443.

Schloesser, L. C. and Schilling, R. F. (1963) Vitamin B 12 absorption studies in a vegetarian with megaloblastic anemia. *American Journal of Clinical Nutrition*, **12**, 70 – 74.

Acknowledgements

This work was entirely supported by a grant from the Nuffield Foundation, London.

THE EFFECT OF TEA AND COFFEE ON THE SERUM LIPID LEVELS OF RATS

C. C. MAHENDRA, S. SENTHESHANMUGANATHAN
and
W. D. A. PERERA
(Medical Research Institute, Colombo 8)
and
R. L. WICKRAMASINGHE
(Tea Research Institute, Kandy)

Considerable evidence exists which links elevated serum lipid levels with the development of atherosclerosis and its principal lethal manifestation, coronary heart disease. It has been suggested that coffee drinking may be a factor in the causation of atherosclerosis and tea drinking a factor in its prevention, through an action on the serum lipid levels (Little *et al.*, 1966).

The present study was undertaken to determine the effect on the serum lipid levels of long term feeding of diets containing either added coffee, or one of different freeze dried extracts of tea, to adult rats. The total esterified fatty acids, triglyceride and cholesterol levels in the serum of the rats were estimated at the end of 100 days.

The animals fed on the different freeze dried extracts of tea had significantly lower serum cholesterol levels than the animals fed on a "control" diet i.e. without the addition of tea or coffee. The coffee diet did not produce any significant lowering of the serum cholesterol level. There was a significant lowering of the triglyceride levels on both the tea and coffee containing diets when compared with the "control". However, the animals fed the different tea diets generally had significantly lower triglyceride levels than the animals fed on the coffee diet.

Reference

Little, J. A., Shanoff, H. M., Csima, A. and Yano, R. (1966) Coffee and Serum lipids in coronary heart disease, *Lancet*, (i) p. 732.

ENDEMIC FLUOROSIS IN CEYLON
(a) THE DISTRIBUTION OF FLUORISE CONTAINING WATER

B. Senewiratne, J. Hettiarachchi, Shanthi Thambipillai

and

Kamalini Senewiratne

(*Department of Medicine, University of Ceylon, Peradeniya and Clinical Research Laboratory, General Hospital, Kandy*)

Extensive dental mottling is frequently seen in children in the North Central Province of Ceylon. Clark (1942) notes that water from certain districts in Ceylon contains fluorine. However, Karunanayake, Dharmasena and Mahadeva (1969) found less than 1.1.p.p.m. of fluoride in all areas of the Island. In another study, Ramanathan (1970) concluded that our waters contain only minute traces of natural fluoride. These findings are incompatible with the above observations.

About 300 samples of drinking water obtained 5 miles apart in the Central, North Central, North Western, Eastern, Northern and Western Provinces were analysed for fluoride using an ion specific electrode. A further intensive study of all the wells in two small areas was done in order to determine the local variations in fluoride content.

The results show that there is an extensive area of fluoride containing water north of a horizontal line passing through Dambulla.

A very high concentration was found in the North Central Province where concentrations reached 9. p.p.m. No fluoride was detected in the water from the Western and Central Provinces. Rivers, irrigation channels and tanks contained a low concentration of fluoride.

Striking variations have been found in water from wells of similar depth which were only 100 yards apart.

The implications of this study are that if fluoride is to be supplied as a prophylaxis against dental caries (as it is done in western countries) the supply should be limited to the area south of Dambulla.

References

Clark, A. (1942) Further notes on the Effects of Inhibitory substances in Foods. Article 7. *Journal of Tropical Medicine and Hygiene*, **45**, 49.

Karunanayake, E., Dharmasena, K. D. and Mahadeva, K. (1969) Fluoridation of water supplies as a prevention of dental caries. Ayurveda Pradeepika, **1**, 54.

Ramanathan, S. (1970) Fluorine content of water supplies in Ceylon. Proceedings of the Twenty-sixth annual session, C.A.A.S. 106.

Tilakaratne, L. (1966) Dental caries in University Students. *Ceylon Journal of Medical Science*, **15**, 7.

Acknowledgement

This work was entirely supported by a grant from the Nuffield Foundation London to one of us.

ENDEMIC FLUOROSIS IN CEYLON

(b) DENTAL FLUOROSIS

B. SENEWIRATNE, SHANTHI THAMBIPILLAI, J. HETTIARACHCHI

and

KAMALINI SENEWIRATNE

(Department of Medicine, University of Ceylon, Peradeniya and Clinical Research Laboratory, General Hospital, Kandy)

In view of the findings in the previous paper, a survey was done of dental fluorosis and dental caries in school children in the Anuradhapura and Polonnaruwa districts and Peradeniya. 3066 children were examined, and 416 rejected because they had not lived all their lives in the study area. The incidence of fluorosis was: – Anuradhapura (77.5%), Polonnaruwa (56.2%), Peradeniya (13.0%). Most of the cases from the North Central Province could be explained on fluoride from drinking water, but in Peradeniya drinking water contained no fluoride. Other sources such as tea, rice and salt were investigated but have failed to show from where the children in the latter area get fluoride.

As would be expected, the incidence of dental caries was strikingly different. The DMF index in Peradeniya (153.3) was three times greater than that in Anuradhapura (46.3) and Polonnaruwa (53.3). In Peradeniya, only 4% of children were caries-free as against 73% in the North Central Province.

The findings indicate that despite the low incidence of caries (when compared with the western world), a substantial improvement in teeth can result from a supply of fluoride. The implementation of such a programme in a community that drinks from wells is discussed.

Acknowledgements

This work was entirely supported by a grant from the Nuffield Foundation, London.

THE IDENTITY OF MYCOBACTERIAL INFECTIONS IN CEYLON AS DETERMINED BY THE DIFFERENTIAL TUBERCULIN TEST

M. R. M. PINTO, S. N. ARSECULERATNE, C. G. URAGODA

and

L. V. WELIANGE

(Department of Bacteriology, Faculty of Medicine, University of Ceylon, Peradeniya and Chest Clinic, Kandy)

One of the methods of establishing the identity of a mycobacterial infection is by determining the pattern of response to the differential tuberculin test. This assumes, that in the case of the individual infected with only one spp. of mycobacterium, the dominant reaction is elicited by the homologus antigen when equivalent doses of antigen are used in this test. This hypothesis has been supported to some extent by studies in experimental animals (Edwards, Hopwood & Palmer, 1965), and in tuberculous human patients (Pinto *et al.*, 1972).

The differential tuberculin test was done on 1351 individuals in different rural areas in Ceylon. Of these 1275 had been given 4 antigens including PPD-S (from M. tuberculosis) and PPD-G (from 'Gause' strain Scotochromogen)–the other two antigens being from the following: PPD-Y – from M. kansasii; PPD-B – from 'Battry' bacilli; PPD-A from M. avium; PPD-F – from M. fortuitum.

In our test population it was found that approximately 45% showed dominant reactions (3 mms or more in size from next largest reaction) to one of the six antigens used. In all areas the largest percentage of dominant reactions were seen to PPD-G – suggesting infection with Runyon's Gp. II or related organisms. The incidence of dominant reactions to PPD-S (suggesting infection M. tuberculosis) was less than to PPD-G and was more or less similar in all areas. The "Sensitivity profiles" of the means of the dominant reactions to different antigens on comparison with those of experimental animals show some close similarities with some antigens, and some differences with others.

The implications of these findings in the clinical and epidemiological situation in Ceylon are discussed.

References

Edwards, L. B., Hopwood, L. and Palmer, C. E. (1965) "Identification of Mycobacterial Infections" Bull. Wld. Hlth. Org., **33**, 405.

Pinto, M. R. M., Arseculeratne, S. N., Uragoda, C. G. and Hemawardena, D. M. (1972) "The differential tuberculin test in tuberculosis patients" in preparation.

THE IDENTITY OF ACID-FAST BACILLI FROM PATIENTS DIAGNOSED AS HAVING "TUBERCULOSIS" (PULMONARY DISEASE) IN CEYLON

M. R. M. Pinto, S. N. Arsecularatne, C. G. Uragoda

and

L. V. Weliange

(Department of Bacteriology, Faculty of Medicine, University of Ceylon, Peradeniya and Chest Clinic, Kandy)

Acid-fast bacilli were cultured from "spot" specimens of sputa obtained from patients with pulmonary lesions (clinically diagnosed as "Tuberculosis"); using the modified Petroff's method of decontamination and Lowenstein-Jensen medium. The characteristics of the acid-fast bacilli were studied using 22 different tests.

A total of 243 consecutive patients were studied, 150 patients presenting with no history of previous anti-tuberculosis treatment, and 93 patients presenting for "retreatment" of "tuberculous" disease. An acid-fast organism was considered to be M. tuberculosis ("human type" tubercle bacilli) if the organism was a slow grower, showed no pigmentation in the dark or on exposure to light, and was niacin positive.

By this definition we found that of patients presenting for initial treatment of lesions diagnosed as "tuberculous", 138 individuals yielded M. tuberculosis alone. Two subjects yielded both M. tuberculosis and Scotochromogens. 10 other patients yielded cultures of nontuberculous mycobacteria all of which were

of Runyon's Group IV. One patient having pulmonary and disseminated disease which terminated fatally, yielded a Group IV strain on culture of peritoneal fluid and omental biopsy. Of the patients presenting for "retreatment" (total 93), 89 yielded M. tuberculosis, while 4 yielded nontuberculous mycobacteria; one subject on separate occasions yielded both a Group IV rapid grower and M. tuberculosis. Three others yielded nontuberculous mycobacteria one of which was of Runyon's Group I, and 2 of Group IV. No strains of M. bovis ("bovine type" tubercle bacilli) were isolated.

The variations of characteristics of Ceylonese strains of M. tuberculosis from those described as typical of this strain are also evaluated and discussed.

THE MYCOBACTERIA OF THE CEYLON ENVIRONMENT: I. A. PRELIMINARY STUDY

M. R. M. Pinto, S. N. Arsecularatne, C. Navaratnam, J. B. Karalliyadda, M. M. Gunaratne

and

L. V. Weliange

(Department of Bacteriology, Faculty of Medicine, University of Ceylon, Peradeniya)

Ceylon has been shown to be a country with a high level of non-tuberculous mycobacterial sensitisation in the general population (Pinto *et al.*, 1972). Such sensitisation is presumed to be due to infection by mycobacteria found in the environment. Little is known about these mycobacteria, and no published literature on mycobacteria of the Asiatic and tropical environments could be traced.

Specimens of soil, mud, water etc. were collected from various localities and shaken up with sterile distilled water to suspend any organisms. The supernatant suspension was then treated by the modified Petroff's method and inoculated on Lowenstein-Jensen medium. Subcultures were made from colonies of acid-fast bacilli grown, and studied. When contamination did not occur almost every specimen yielded strains, and some, as many as 2 to 3 morphologically different strains.

These strains were studied using a battery of 15 different tests. The vast majority of strains cultured were of Runyon's Group IV, while the others were from Group II, with a few from Group III. No organisms of Group I were isolated.

It has been shown that infection with non-tuberculous mycobacteria confers a low degree of immunity to tuberculous disease (Klugh & Pratt, 1962). It has also been suggested that such infection may modify the course of tuberculosis (Frimodt-Moeller, 1966). The relevance of these findings, to the Ceylon situation are discussed.

In Ceylon, the occurrence of sensitisation was commonest to Groups II and III while the sensitisation to Group IV was least.

Among the soil isolates, the findings were reversed, and the significance of the latter is discussed.

References

Frimodt-Moeller, J. (1966) "Comparative Mantoux Tests with standard tuberculin and purified protein derivatives obtained from Mycobacteria different from M. tuberculosis", Proceedings of the 21st Tuberculosis and Chest Disease Workers Conference, Calcutta, February 1966.

Klugh, G. A. and Pratt, P. C. (1962) "Experimental Immunisation of guinea pigs with photochromogenic acid-fast bacilli", Amer. Rev. resp. Dis., **85**, 78.

Pinto, M. R. M., Arsecularatne, S. N., Uragoda, C. G. and Hemawardene, D. M. (1972) "Differential Tuberculin Testing in Rural Populations in Ceylon", Tubercle, **53**, 182.

TUBERCULIN SENSITIVITY IN THE BUFFALO (BABALUS BUBALIS BUBALIS)

D. D. Wanasinghe *and* K. V. Ravindran
(Department of Agriculture)
and
M. R. M. Pinto
(Department of Bacteriology, Faculty of Medicine, University of Ceylon, Peradeniya)

Little is known about tuberculosis in the buffalo, and no comprehensive studies of tuberculin sensitivity have been reported in the world literature in this species. A study of tuberculin sensitivity was carried out, in two farms – at Ridiyagama and at Tamankaduwa, using the single comparative (differential) intradermal test. Two sensitins, mammalian and avian PPDs were used and 571 buffaloes tested.

The results show that as with cattle, (Bongso & Pinto, 1972), avian sensitisation is much more prevalent in the buffalo as compared to mammalian sensitisation in Ceylon. But, definite evidence of specific sensitisation to mammalian bacilli was also found. However, the lack of reports of tuberculous disease in the buffalo in this country suggests that such sensitisation is probably transient, and its probable causes are discussed.

The predominant avian sensitisation in the absence of reports of avian tuberculosis and avian type bacilli in Ceylon too, suggests sensitisation is probably due to cross sensitivity produced by infection with antigenically related mycobacteria of the environment.

The patterns of sensitisation in the buffalo and cattle in this country are compared and their significance discussed. It was found that as with cattle, the differential test has distinct advantages as compared with the single antigen test, in identifying the tuberculous infected animals in Ceylon.

Reference

Bongso, T. A. and Pinto, M. R. M. (1972) Studies in Tuberculin Sensitivity of Livestock in Ceylon: Patterns of Tuberculin Sensitivity in cattle (Bos spp.)

Paper read at Scientific Sessions of Ceylon Veterinary Association. Peradeniya.

ACTIVE CHRONIC HEPATITIS IN SRI LANKA PATIENTS

N. NAGARATNAM, D. P. K. M. DE SILVA

and

S. P. DE SILVA

(Government Hospital, Gampaha, W. P.)

The purpose of this paper is to present the clinical, laboratory and pathological studies in 10 Sri Lanka patients with active chronic hepatitis, to review critically and to discuss possible aetiological relationships and aetiological factors confined to like situations.

The clinical and biochemical findings were in no way different from previously published cases. Two followed an attack of viral hepatitis, 3 had nutritional deficiencies and all had taken Ayurvedic decoctions at some stage of their illness. Four had raised globulins and all had hypergammaglobulinaemia.

The histological appearances were those seen in other reports, but the majority also showed marked fatty change. There appeared to be no likely explanation for this, but the possible significance is discussed. Whether these changes reflect a different pattern of the disorder or reflect the influences of such factors as malnutrition or hepato-toxins is not evident.

THE RELATION OF ARBOVIRUS INFECTION TO VIRAL HEPATITIS – I. THE INCIDENCE OF ARBOVIRUS ANTIBODIES IN THE BLOOD OF VIRAL HEPATITIS PATIENTS

U. T. VITARANA, Y. E. HERMON, M. KANAPATHIPILLAI

and

M. ANANDARAJAH

(Department of Virology, Medical Research Institute, Colombo 8)

A high incidence and high levels of Arbovirus antibodies were noted in the blood of adult patients having viral hepatitis. This was compared with levels in the blood of patients suffering from clinical "arbovirus infections", using specimens received at the MRI.

The Arbovirus antibody levels were determined in blood that had been sent for liver function tests to the Medical Research Institute. The absence of a significant difference between those with raised bilirubin and those with normal bilirubin levels suggested that the levels of bilirubin did not influence the Arbovirus antibody titre.

The Arbovirus antibody titres were determined in patients suffering from leptospirosis, a non-viral infectious cause of liver damage, and found to be present less often and at lower levels than in cases of viral hepatitis.

This would suggest that the raised arbovirus tires observed in cases of viral hepatitis is not due to an elevated bilirubin level in the serum or to some other factor associated with liver damage.

THE RELATION OF ARBOVIRUS INFECTION TO VIRAL HEPATITIS – II. ARBOVIRUS ANTIBODY IN CASES OF HEPATITIS THAT WERE POSITIVE FOR AUSTRALIA/SH ANTIGEN

U. T. VITARANA, M. KANAPATHIPILLAI *and* M. ANANDARAJAH

(Department of Virology, Medical Research Institute, Colombo 8)

and

S. RAMACHANDRAN, C. N. A. RAJAPAKSE, J. E. J. AIYATHURAI

and H. A. KANTHIE

(Medical Unit 2 and Paediatric Unit, General Hospital, Ragama)

Australia/SH Antigen is an accepted marker of long incubation viral hepatitis (Virus B or Serum Hepatitis). The occurrence of Australia/SH Antigen is higher in the general population of tropical and sub-tropical countries than in temperate countries. In the absence of a greater use of parenteral procedures, a possible explanation is that a natural injection (e.g. by a mosquito) performs this function in the tropics.

Arbovirus infection is common in Ceylon and those detected are all mosquito borne. If the Australia/SH Antigen associated hepatitis virus is also mosquito borne one would expect some correlation between the two.

Blood from consecutive viral hepatitis cases admitted to Medical Unit 2 of Ragama General Hospital were tested for Australia/SH Antigen by Gel Diffusion. Those that were positive for Australia/SH antigen showed a significantly higher incidence and level of Arbovirus antibody than those in which Australia/SH antigen could not be detected. A similar result was obtained with blood sent to the Department of Virology, MRI for detection of Australia/SH antigen and the Biochemistry Department, MRI for Liver Function tests.

A correlation of Australia/SH antigen and Arbovirus antibody was also found on the basis of their age distribution. The incidence of both increased with age. Under ten years of age Australia/SH antigen was not detected while the levels of Arbovirus antibody were also very low; this was most clearly seen in the Paediatric Unit, Ragama.

The significance of these results is discussed specially in relation to the recent detection of Australia/SH antigen in mosquito pools, (Prince *et al.*, 1972).

Reference

Prince, A. M., Metselaar, D., Kafuko, G. W., Mukwaya, L. G., Ling, C. M. and Overby, L. R. (1972) Hepatitis B antigen in wild-caught mosquitoes in Africa, *Lancet*, **11**, 247.

A STUDY OF VIRUS ANTIBODY PATTERNS IN CHILDREN SUFFERING FROM INFECTIOUS HEPATITIS

U. T. VITARANA, M. KANAPATHIPILLAI *and* M. ANANDARAH

(Department of Virology, Medical Research Institute, Colombo 8)

and

J. E. J. AIYATHURAI, N. S. THALGAHAGODA *and* SAKDHY VEERAGATHY

(Paediatric Unit, Colombo North Hospital, Ragama)

and

NIMALA FERNANDO

(Virus Laboratory, Colombo South Hospital, Kalubowila)

At the Ragama Hospital an increase in hepatitis cases was noticed when there was an increase in viral fevers.

A preliminary report is presented of virus studies done on the blood of children under ten years of age admitted to the Paediatric Unit for hepatitis. The presence of hepatitis was confirmed by estimating the serum levels of glutamic pyruvic transaminase, bilirubin and alkaline phosphatase and liver biopsy in some cases.

The blood samples were tested for the presence of Australia/SH Antigen by the Gel Diffusion Test and found to be negative. Paired sera (acute and convalescent) were tested for the presence of Arbo, Adeno and Influenza virus antibodies.

In some cases there was evidence of infection by one of these viruses, but not by the others. No single virus was consistently associated with all cases of hepatitis. In other cases none of these antibodies were detected, or antibodies to one of them was found at significant level, but without definite evidence of infection. A few showed antibodies to more than one virus.

With the failure throughout the world to demonstrate the causative virus of infectious hepatitis, the possibility of this being a syndrome that affects the liver of some individuals following infection by several different viruses is considered.

RIBOSURIA IN VIRAL DISEASES

J. E. J. AIYATHURAI, SHIRANSI THALGAHAGODA *and* D. P. KURUPPU
(Paediatric Unit, General Hospital, Ragama)
and
S. SENTHESHAMUGANATHAN
(Department of Biochemistry, Medical Research Institute, Colombo)

Pentosuria is said to be either alimentary in origin where the sugars excreted are xylose and arabinose or essential, where it is L-xylulose. Ribose is found in the urine of healthy people, the 24hr. excretion being up to 30mg. Slightly larger quantities may be found in the urine of some patients with muscular dystrophy (Hsia, 1964).

We are reporting the presence of significant amounts of ribose in the urine of children suffering from viral infections and of its decrease with clinical improvement. This has been observed by us in cases of infective hepatitis, measles, mumps, infectious mononucleosis, other viral fevers and in Reye's syndrome.

The examination of the urine of children admitted to hospital with metabolic acidosis following viral infections indicated the presence of some reducing substance by Benedict's test. This proved not to be glucose when tested by the glucose oxidase method (Clinistix). Further investigation using specific colour reactions for pentoses and ribose showed that it was probably ribose. Thin layer chromatographic examination of the 2:4-dinitrophenyl-hydrazone of the sugar showed it to be ribose. In infectious hepatitis, we obtained ribose outputs ranging from 1.35 – 8.4g/24hr., while in other viral fevers the output varied from 0.125 – 1.45g/24hr.

In muscular dystrophy, the ribose is thought to arise from muscle co-enzymes of degenerating muscle (Hsia, 1964).

It is unlikely that this is the major source in infective hepatitis in that a study of acute and convalescent urine show no significant change in the levels of creatine, creatinine, urea and aminoacids while there was a significant reduction in ribose excretion in convalescence.

Reference

Hsia, D. Y. Y. (1964) In *Diseases of Metabolism*. Ed. G. G. Duncan, Philadelphia, Saunders Co. 348–349.

METHODS FOR ESTIMATION OF AFLATOXINS IN COCONUT PRODUCTS

U. SAMARAJEEWA *and* S. N. ARSECULERATNE
(Department of Bacteriology, Faculty of Medicine, Peradeniya)

The economic importance of aflatoxin contamination of coconut products has only been recently highlighted (Asian coconut community proceedings, Djakarta, 1971).

In the absence of any literature on methods of assay applicable to coconut products a comparison of methods already in use for groundnuts, (Maggon *et al.*, 1970) for rapid quantitative extraction and estimation of aflatoxins was made using coconut products inoculated with *Aspergillus flavus* NRRL 2999 (for aflatoxin production). The substrates used were fresh coconut, commercial poonac, mechanically and solvent extracted poonac from inoculated grated coconut. Methods involving shaking, blending at high speeds, Soxhlet extractions were tried.

Optimum conditions for extraction of more than 90% of aflatoxin present were established for each method. Estimations were done by visual TLC comparison with standard samples.

A chloroform water system extracted relatively high amounts, but oil was extracted along with aflatoxin.

For a 55% aqueous methanol – hexane system values were relatively low, but extracts were clean. Loss of aflatoxin to the hexane phase in high aflatoxin samples was 1%. But higher percentages pass into hexane with commercial samples of low aflatoxin content.

70% aqueous acetone extracts were clean, and values intermediate.

Soxhlet extraction using methanol need longer times. Many other compounds interfering on TLC were extracted with aflatoxin, by this method.

Advantages and disadvantages of methods with regard to efficiency, purity and convenience for different types of coconut products are discussed.

References

Maggon, K. K., Viswanathan, L. and Venkitasubramanian, T. A. (1970). The Chemistry of Aflatoxins. *Journal of Scientific and Industrial Research*, **29**, (1), 8 – 17.

A STUDY ON THE GREY DISCOLOURATION IN SLICED COOKED HAM

P. E. Dias *and* K. S. Kularatne

(Ceylon Cold Stores Limited, Colombo 2)

It was found that cooked ham soon after slicing possessed its characteristic pink colour, but when kept in chilled storage for several days developed grey patches. This work attempts to elucidate the causes for this grey discolouration.

Firstly, the concentrations of sodium chloride, sodium nitrite and the total bacterial count per gram of the samples of cooked ham were assessed over a period of time. A second set of experiments was carried out to ascertain the effects of varying levels of sodium chloride and sodium nitrite on the grey discolouration and the bacterial growth in the hams. A third series of experiments was performed to determine the effect of light on the colour and bacterial growth in the cooked hams.

The development of grey discolouration in sliced cooked ham is accompanied by an increase in the aerobic bacteria. The process of greying as well as the growth of bacteria are accelerated by exposure to light but, are not affected by the normal concentrations of sodium chloride and sodium nitrite used in the curing mixtures.

Predominant among the microflora present in the grey patches were several types of aerobic coagulase negative micrococci, generally known to produce discolouration in foods. Aerobic gram positive spore formers and gram negative bacilli were also observed.

STABILITY OF THE BACTERIOLOGICAL STATUS OF MATERIAL FOR CULTURE WHEN STORED IN DIFFERENT TRANSPORT MEDIA: A PRELIMINARY STUDY

M. C. L. de Alwis

(Veterinary Research Institute, Peradeniya)

Centralization of veterinary bacteriological services makes it necessary for veterinarians throughout the island to despatch material for culture to Peradeniya. Consequently, a considerable delay occurs between collection and examination. Collection under field conditions does not permit the strict observance of asepsis. Also, a large proportion of specimens are collected from carcasses, where post-mortem invaders are invariably present. Under such circumstances, the use of cotton wool swabs have been shown to be unsatisfactory (De Alwis, 1972).

The suitability of three different media for use under these conditions was evaluated.

Medium A – a simple non nutrient, anaerobic medium.

Medium B – a nutrient medium.

Medium C – commercial Stuart's transport medium.

These media were inoculated with the test organisms and daily viable counts were made for 6 to 7 days. The test organisms were *Salmonella, Shigella, E. coli, Staphylococcus, Streptococcus, Pasteurella multocida, Proteus* and a spore bearing bacillus.

At room temperature, all organisms survived for one week in media A & B. *Streptococcus* and *Pasteurella* survived only for 3 to 4 days in medium C. Daily viable counts were most stable in medium A, and most variable in medium B. All organisms survived in all three media for one week at 5°C, and the viable counts were more stable than at room temperature. Medium A was suitable for use at room temperature and where the contamination rate was high. Medium B was preferred when less viable organisms like *Streptococcus* and *Pasteurella* were present, where contamination was low or absent, or where refrigeration was possible.

Reference

De Alwis, M. C. L. (1972) Bacteriological changes in specimens during transport. 1. Changes occurring in inoculated cotton wool swabs. *Ceylon Veterinary Journal*, **20**, in press.

BINDING OF SULPHADIMIDINE TO SERUM PROTEINS IN PATIENTS WITH HYPOALBUMENAEMIA

K. BALASUBRAMANIAM

(Faculty of Medicine, Peradeniya)

Many drugs are reversibly bound to serum proteins. The kinetics of the binding have been extensively studied in normal individuals. Very little information is available about drug binding in patients with hypoalbumenaemia.

The degree of attachment of sulphadimidine (S.D.) to the protein was measured by ultrafiltering human serum to which S.D. had been added. The ultrafilteration was carried out at 37°C and a pH of approximately 7.4 Chemical estimation of S.D. was based on the method of (Bratton & Marshal, 1939). Pooled sera from the following were used:

1. Healthy male controls.
2. Male patients with nutritional anaemia and hypoalbumenaemia.

The experimental results were used to calculate the number of binding sites on the albumen molecule and the association constants (Scatchard, 1949).

The results showed the presence of two binding sites on human albumen for S.D. On analysis of published results (Newbould, B.B. & Kilpatrick, R., 1960) only one single binding site was evident. The binding characteristics of S.D. to serum proteins in patients with hypoalbumenaemia were similar to those of the control subjects.

References

Bratton, A. C. and Marshal, E. K. (1939) A new coupling component for sulphanilamide determination. *Journal of Biology and Chemistry*, **128**, 537.

Newbould, B. B. and Kilpatrick, R. (1960) Long-acting sulphonamides and protein binding. *Lancet*, **1**, 887.

Scatchard, G. (1949) Annals of the New York Academy of Science, **51**, 660.

NODAL GAP SUBSTANCE OF DIABETIC NERVE

K. N. SENEVIRATNE *and* S. VAIRAVANATHAN

(Department of Physiology, Faculty of Medicine, University of Ceylon, Colombo)

Several authors have confirmed the presence of a nodal gap substance which surrounds the exposed portion of the axon at the node of Ranvier of myelinated peripheral nerve. More recent studies have drawn attention to the affinity of this gap substance for a wide variety of metallic cations and attributed this property to the presence of non-sulphated mucopolysaccharides in the gap substance. Seneviratne, Peiris & Weerasuriya (1972) have suggested that the physico-chemical properties of this gap substance and its distribution, fit the requirements which an effective functional barrier must possess if it is to account for the excitability changes which have been observed in healthy human and rat nerve during ischaemic or anoxic inactivation. Seneviratne & Peiris (1970) have also shown that the peripheral nerves of alloxan diabetic rats show an increased resistance to anoxic inactivation and have attributed this to an increase in the permeability of a hypothetical periaxonal diffusion barrier. The experiments described in this study provide evidence that there is a highly significant reduction in the K' binding capacity of the nodal gap substance of diabetic nerve and this evidence lends support to the hypothesis that the nodal gap substance constitutes an effective functional diffusion barrier in myelinated peripheral nerve.

References

Seneviratne, K. N. and Peiris, O. A. (1970) J. Neurol. Neurosurg. Psychiat., **33**, 310–318.

Seneviratne, K. N., Peiris, O. A. and Weerasuriya, A. (1972) J. Neurol. Neurosurg. Psychiat., **35**, 149–155.

PROPERTIES OF THE PARA-NODAL GAP SUBSTANCE IN DIABETIC NERVE

K. N. SENEVIRATNE *and* A. WEERASURIYA
(Department of Physiology, University of Ceylon, Colombo)

When the isolated sciatic nerve of a healthy rat is made anoxic in a conventional moist nerve chamber it goes through a phase of hyper-excitability before it is inactivated. The peripheral nerve of the alloxan diabetic rat, however, shows a significantly slower rate of anoxic inactivation. Seneviratne & Peiris (1969) have suggested that the sequence of excitability changes during anoxia are determined by the presence of a peri-axonal diffusion barrier which serves to limit the efflux of K^+ from the anoxic nerve. They have attributed the resistance of diabetic nerve to anoxic inactivation to the increased permeability of the peri-axonal diffusion barrier of the diabetic nerve. The experiments described below were carried out to investigate the properties of two such peri-axonal diffusion barriers – the mucopolysaccharide nodal gap substance and the perineurium.

Comparison of nerves made anoxic with and without the sheath indicate that the desheathed nerves get inactivated faster. Diabetic nerves behave similarly, suggesting that the perineurial sheath in diabetic nerve is not significantly different from that of normal nerve.

Properties of the nodal gap substance were investigated in desheathed normal and diabetic nerves which were immersed for 30 minutes either in Locke's solution or Locke + 5 mM KCl solution prior to anoxia. The results indicate that the presence of additional 5 mM K increases the rate of anoxic inactivation when compared to nerves immersed in Locke. The diabetic nerves show a significantly ($P < .001$) greater increase in the rate of inactivation. These results lend support to the view that the paranodal gap substance constitutes a functional diffusion barrier in the myelinated peripheral axon, and that it is the permeability of this barrier which is greater in the diabetic nerve than in the healthy control.

Reference

Seneviratne, K. N. and Peiris, O. A. (1969) J. Neurol. Neurosurg. Psychiat., **33**, 462-469.

EVALUATION OF RADIOISOTOPE RENOGRAM IN NORMAL SUBJECTS

M. GEMBICKI, K. B. HERATH, R. D. PIYASENA
and
T. W. WIKRAMANAYAKE
(Radiobiology Unit, Faculty of Medicine, University of Ceylon, Peradeniya)

The radioisotope renogram which has been extensively used in several centres is considered to provide a safe, rapid and reliable assessment of individual renal function.

Evaluation of the curves obtained vary from centre to centre. In some cases only a simple qualitative analysis is made whereas in others, attempts have been made to quantitate the results obtained on the basis of various parameters. In the present study, a quantitation of the results obtained is proposed by calculation of a number of chosen indices.

The subjects were from the General Hospital, Kandy and had normal kidney function according to clinical assessment.

A dose of about 10 μC of sodium iodohippurate (hippuran) labelled with ^{131}I was administered intravenously and the function of the kidneys assessed by external monitoring using scintillation counters linked to a ratemeter and fed into a multi-channel pen recording system.

97 subjects (ages between 18 years and 70 years) were studied and the curves obtained have been evaluated by consideration of the following factors:

1. Time taken for the kidney activity to reach a peak level (vascular and secretory phase) — T_A.
2. The total time taken to reach 75% of peak activity on the disappearance curve (excretory phase) — Y_{A75}.
3. The total time taken to reach 50% of the peak activity on the disappearance curve — T_{A50}.
4. Time between peak activity and 50% of the peak on the disappearance curve — $T_{A50} - T_A$.

The results obtained are considered to provide a clinically useful indication of normal values from which abnormal kidney function could be distinguished.

THYROID RADIOIODINE (^{131}I) UPTAKE STUDIES ON SOME NORMAL CEYLONESE

M. GEMBICKI, K. B. HERATH *and* T. W. WICKRAMANAYAKE
(Radiobiology Unit, Faculty of Medicine, Peradeniya)

The estimation of orally administered radioiodine uptake by the thyroid gland has been widely used as a simple test for thyroid function. The normal values obtained in different countries vary depending upon such factors as geographical position and diet. It is therefore necessary to establish a range of values for normal individuals in Sri Lanka and the present study was directed towards obtaining some information on this.

The subjects for this survey were drawn from the student population of the Peradeniya Campus (ages between 20 and 25 years) and from patients at the General Hospital, Kandy (ages between 20 and 65 years). All subjects were without clinical signs or symptoms of abnormal thyroid function.

A dose of about 2.5 μC was administered orally and the uptake of ^{131}I by the thyroid gland was estimated after 2, 6 and 24 hours, by external counting, using a scintillation counter equipped with a thallium activated sodium iodide crystal, diameter 4.5 cm., and a flat field collimator. The percentage of radioiodine trapped by the gland was estimated by comparison with a standard, counted under the same conditions of geometrical symmetry.

The results obtained indicate that ^{131}I uptake of subjects from the Central Province differs significantly from that of subjects from the Northern and Western Provinces. There is no significant difference in uptake between subjects from the Central Province and the Southern Province and between subjects from the Western Province and the Northern Province.

The number of subjects studied from the Eastern Province is as yet inadequate for any conclusions to be drawn.

SECTION B: AGRICULTURE AND FORESTRY

(Arts Theatre)

Wednesday, 13th December:

8.30	..	The nitrogen nutrition of young tea plants in sand culture — I. Patterns of use in the early growth stages — S. Krishnapillai and U. Pethiyagoda.
8.45	..	The nitrogen nutrition of young tea plants in sand culture — II. Response to increasing supplies of different forms of nitrogen and the influence of different levels of potassium — U. Pethiyagoda and S. Krishnapillai.
9.15	..	Effect of potassium fertilizer, liming and types of nitrogenous fertilizer on leaf nutrient content and yield of tea — M. Watson and D. T. Wettasinghe.
9.30	..	Loss of ammonia by volatisation from surface dressings of urea containing rubber fertilizer mixtures — C. G. Silva, A. M. A. Perera and D. R. Peiris.
10.00	..	Some manganese relationships in high organic matter content montane soils — V. Pavanasasivam and F. S. C. P. Kalpage.
10.15	..	A study of Clay Minerals in some Paddy Soils of Ceylon — S. Kathirgamathaiyah, O. D. T. B. Perera and H. Kawasaki.
1.30	..	Differential behaviour of rice varieties to bronzing — S. D. G. Jayawardena and S. L. Amarasiri.
1.45	..	Nutrient removal by paddy in the dry zone and its significance — S. L. Amarasiri and W. R. Perera.

2.00 .. Influence of nutrient pH on the uptake and distribution of Fe, Mn, Cu, Zn, and boron in coconut seedlings — M. A. T. de Silva, P. A. D. G. Appuhamy, B. J. A. F. Mendis and G. D. George.

2.15 .. Effect of macronutrient deficiencies on the distribution of Fe, Mn, Cu, Zn and boron in leaf components of coconut seedlings — M. A. T. de Silva, B. J. A. F. Mendis, P. A. D. G. Appuhamy and G. D. George.

Thursday, 14th December:

8.00 .. Some Observations on Post-prune Growth of the Tea Plant — K. Sivapalan (Jointly with Section E) *(Chemistry Theatre)*.

8.20 .. Feasibility of producing Oil and Saponins from Tea Seeds on a commercial scale — U.L.L. de Silva and G. R. Roberts (Jointly with Section E) *(Chemistry Theatre)*.

9.00 .. Business Meeting.

10.00 .. Effect of Time of Harvesting, Moisture content and Method of Drying on Milling Qualities of Rice — S. D. G. Jayawardena.

10.15 .. An Effort towards Utilization of Land under Cultivation for Maximum Food Production — S. H. Upasena.

1.30 .. The Pest Ecology of the Shot-Hole Borer Beetle of Tea — D. Calnaido, K. Thirugnanasuntharan and M. A. S. K. Ranasinha.

1.45 .. The Chemical Control of the Shot-Hole Borer Beetle of Tea — D. Calnaido, M. A. S. K. Ranasinha and K. Thirugnanasuntharan.

2.00 .. The Sampling Techniques for the Shot-Hole Borer Beetle Pest of Tea — S. Calnaido, M. A. S. K. Ranasingha and K. Thirugnanasuntharan.

2.15 .. The Significance of a New Outlook on the Pest Management of Tea — D. Calnaido.

Friday, 15th December:

8.00 .. The present position with respect to the incidence of rice diseases in Sri Lanka — S. N. de S. Seneviratne, B. S. Unamboowe and D. L. Wickremasingha.

8.15 .. A programme for the screening of rice varieties and hybrids against bacterial leaf blight *(Xanthomonas oryzae)* — S. N. de S. Seneviratne, S. P. Hemachandara, P. S. Y. Fernando, V. Gunasingham and H. Dayananda.

8.30 .. The effects of treatment with certain agro-chemicals on the incidence of and crop losses caused by bacterial leaf blight of rice *(Xanthomonas oryzae)* — S. N. de S. Seneviratne, B. S. Unamboowe, V. Gunasingham, G. K. Hemachandra, A. L. Gunasekera and K. Wickremaratne.

8.45 .. The effects of treatment with certain agro-chemicals on the incidence of and crop losses caused by sheath blight of rice *(Corticium sasakii)* — S. N. de S. Seneviratne and W. W. V. P. Fernando.

9.30 .. A New Look on an Old Crop — S. Ponnuchamy (Jointly with Section F) *(New Lecture Hall)*.

11.00 .. Presidential Address: "Development of Agriculture in Sri Lanka" — M. W. Thenabadu *(Physics Theatre)*.

1.30 .. Factors influencing the incidence of rice blast and the relationship of disease ratings in highland nursery tests to blast incidence under conditions of normal cultivation — S. N. de S. Seneviratne and D. L. Wickremasingha.

1.45 .. A comparison of the efficacy of Benlate and certain other fungicidal treatments for the control of rice blast *(Pyricularia oryzae)* — S. N. de S. Seneviratne and W. W. V. P. Fernando.

2.00 .. Correlation between Crop Loss and Blister Blight Infection on Unshaded Vegetatively-Propagated Tea — R. L. de Silva, T. V. Saravanapavan and S. Murugiah.

2.15 .. Virus diseases affecting passion fruit *(Passiflora edulis* var. *flavicarpa)* in Sri Lanka — S. N. de S. Seneviratne and D. L. Wickremasingha.

Saturday, 16th December:

8.30 .. Seminar on the Mahaweli Development Project (Jointly with Sections C, D and F) *(K. G. Hall)*.

THE NITROGEN NUTRITION OF YOUNG TEA PLANTS IN SAND CULTURE

1. PATTERNS OF USE IN THE EARLY GROWTH STAGES

S. KRISHNAPILLAI *and* U. PETHIYAGODA

(Tea Research Institute, Talawakele)

An arrangement has been employed which allows the collection of all percolations of applied nutrient solutions and of leachates from tea plants growing in sand culture in the glasshouse. These collections were periodically analysed. Analyses of the plants at the conclusion of the experiment provide figures for nutrients absorbed during growth. In the experiment reported, nitrogen was the element under study. Estimates of water used were simultaneously obtained.

When a final balance sheet for nitrogen was compiled, up to 80% was found to have been assimilated by the plants while about 95% of the total applied nitrogen could be accounted for.

Analyses furnish figures for the applied nitrogen that was not utilized by the plants over successive fortnightly periods. As the quantities applied are precisely known, it is possible to determine the patterns of absorption through the duration of the experiment.

The results are discussed in relation to the effects on nitrogen uptake, of the age, size, leaf area and growth phase of the young plants. Periods of bright sunlight result in enhanced nutrient uptake while artificial shade reduces it. The absorption of water is generally, similarly affected.

There are differences between clones in their ability to absorb nitrogen from the supplying solution as also in their ability to synthesise proteins. Some conclusions can be reached on their relative efficiencies of absorption and utilization of nitrogen.

The results are discussed in relation to developing optimal techniques for the management of tea plants in sand culture and to suggest certain practices that may be useful in tea nurseries.

THE NITROGEN NUTRITION OF YOUNG TEA PLANTS IN SAND CULTURE

2. RESPONSE TO INCREASING SUPPLIES OF DIFFERENT FORMS OF NITROGEN AND THE INFLUENCE OF DIFFERENT LEVELS OF POTASSIUM

U. PETHIYAGODA *and* S. KRISHNAPILLAI

(*Tea Research Institute, St. Coombs, Talawakele*)

Nitrogen can be supplied to plants as ammonium salts, nitrates or as urea. The form of nitrogen exerts a profound effect on growth and chemical composition and these effects vary with the plant species. In a previous paper we have reported that young tea plants in sand culture grew best when their nitrogen was supplied as a mixture of ammonium and nitrate salts.

In the experiment now reported, ammonium sulphate, ammonium nitrate, calcium nitrate and urea, each designed to provide five levels of nitrogen in a balanced nutrient solution were compared.

In confirmation of the earlier reports, high levels of supply of ammonium or nitrate nitrogen alone resulted in abnormal growth.

When ammonium sulphate was employed as the supplying salt, growth was reduced as level of supply increased. In all other treatments growth increased with increased supply. This difference in performance is discussed in relation also to the quantities of nitrogenous compounds estimated by leaf analysis.

Antagonism between potassium and nitrogen was investigated in an experiment that combined three levels of potassium with three levels of nitrogen. The effects of these combinations on growth are discussed in relation to current fertilizer practices and the bearing of the leaf contents of these two nutrients on the value of foliar analysis as a basis for fertilizer recommendations for tea is considered.

EFFECT OF POTASSIUM FERTILIZER, LIMING AND TYPES OF NITROGENOUS FERTILIZER ON LEAF NUTRIENT CONTENT AND YIELD OF TEA

M. WATSON *and* D. T. WETTASINGHE

(*Tea Research Institute, Low Country Station, Ratnapura*)

A long-term field experiment designed to study the effect of types and levels of nitrogenous fertilizers, levels of potassium, phosphorus and lime on tea (TRI 2026) was conducted at Hapugastenne Estate, Ratnapura, from 1966 to 1971. This paper presents some of the results of this experiment.

Sulphate of Ammonia (SA.) gave significantly higher yields than Urea and Calcium Ammonium Nitrate (CAN). Liming at the rate of ½ ton per acre per year significantly depressed yields. Application of K did not have a beneficial effect on yield.

Leaf samples were collected in July, 1971 and analysed for K,Ca, Mg and Mn. The pH of the soil was also determined. The K and Ca content of leaves were not influenced by the type of nitrogen. Tea receiving Sulphate of Ammonia had the highest Mn content and lowest Mg content in leaves. Sulphate of Ammonia significantly increased soil acidity. There was a significant negative correlation ($r = -0.48$) between soil pH and leaf Mn.

Liming significantly lowered the K content of leaves at the zero level of potash fertilization. However, when potash was applied at 60 and 120 lb per acre per year liming did not decrease the K content of leaves. Liming did not significantly increase the Ca content of leaves, but increased the soil pH and lowered Mn content significantly.

Potash application increased K and depressed the Mg content of leaves. The Mn content was unaffected by potash. Ca Ca content was lowered by potash application but this was not statistically significant.

LOSS OF AMMONIA BY VOLATALISATION FROM SURFACE DRESSINGS OF UREA CONTAINING RUBBER FERTILIZER MIXTURES

C. G. SILVA, A. M. A. PERERA *and* D. R. PEIRIS

(Rubber Research Institute of Ceylon, Agalawatta)

It is expected that with the manufacture of urea in Ceylon, the rubber industry will have to use it as the main source of nitrogen in fertilizer mixtures.

The possibility that appreciable quantities of Ammonia may be lost to the atmosphere through valatalisation and greater quantities of fertilizer nitrogen can be leached from urea containing mixtures as compared to those containing ammonium sulphate should be carefully investigated.

In field tests, only small quantities of ammonia were lost when the standard quantities of fertilizer mixtures were applied to the bare soils of the Agalawatta series. At different moisture levels ranging from 17% to 30% moisture the losses were negligible. When broadcast in the soils of the Agalawatta series the losses were appreciable.

SOME MANGANESE RELATIONSHIPS IN HIGH ORGANIC MATTER CONTENT MONTANE SOILS

V. PAVANASASIVAM

and

F. S. C. P. KALPAGE

(Department of Agriculture, University of Ceylon, Peradeniya)

Soils from forest, patana and deniya profiles in Ambawela, Bopatalawa and Horton Plains were analysed for total and 'extractable' forms of manganese. Retention of added manganese was studied in relation to the effect of organic matter.

Total manganese varies from 55–667 ppm (av: 228 ppm). Extractable forms of manganese are much lower than the critical values. Exchangeable and easily reducible forms average 0.3

per cent and 3.1 per cent respectively of total manganese. 1.5 per cent and 0.8 per cent respectively were extracted by Morgans' reagent and by M $NH_4H_2PO_4$. pH does not seem to be the main factor affecting availability of manganese.

Large amounts of manganese, added in the form of $MnSO_4$, were retained in the soils. Bopatalawa soils retained the most manganese (av: 490 ppm) followed by Ambawela soils (av: 499 ppm) and Horton Plains soils (av: 453 ppm). pH and humus fraction of organic matter seem to affect the retention capacity of these soils. More manganese is retained in an exchangeable form (av: 233 ppm or 49.5 per cent) rather than in the easily reducible form (av: 75 ppm or 15.5 per cent).

About 32 per cent of the retained manganese is fixed. The amount fixed bears a significant negative correlation with manganese in organic combination ($r = -0.4904$) and also with total manganese ($r = -0.5623$). Fixed manganese is not directly related to total organic matter but to some specific part of it, probably humic acid. Fixed manganese bears a significant positive correlation ($r = +0.5649$) with humic acid but not with fulvic acid.

A STUDY OF CLAY MINERALS IN SOME PADDY SOILS OF CEYLON

S. KATHIRGAMATHAIYAH, O. D. T. B. PERERA

and

H. KAWASAKI

(Department of Agriculture, Peradeniya)

The clay fraction of three paddy soils from Hingurakgoda, Kalawewa, Matara and Gampola was subjected to mineralogical analysis using X-ray diffraction, D. T. A. and electron microscopy techniques. The dominant minerals in the Hingurakgoda profile were montmorillonite and kaolnite. Small amounts of illite and halloysite were also present. Kalawewa soils contained Kaolinite and montmorillonite and small amounts of illite. The amount montmorillonite in Hingurakgoda soils was higher than in the Kalawewa soils. In the case of the Matara and Gampola soils

the dominant mineral was kaolinite. Appreciable amounts of halloysite was also present. A little illite and gibbsite was also identified in these soils.

DIFFERENTIAL BEHAVIOUR OF RICE VARIETIES TO BRONZING

S. D. G. JAYAWARDENA

(Paddy Research Station, Bombuwela)

and

S. L. AMARASIRI

(Agriculture Research Station, Maha Illuppallama)

Several varieties of rice were grown in a poorly drained acidic soil in the low country wet zone where bronzing of rice plants is common. IR-8, BG-11-11 and LD-66 were among the varieties which were most susceptible to bronzing. IR-442-35, IR-20, Engatek, BW-64 and MI-273 were among the varieties which showed the greatest resistance to bronzing. The chemical analysis of leaf samples of susceptible and resistant varieties and the possible causes for the differential behaviour of the varieties to bronzing are presented.

NUTRIENT REMOVAL BY PADDY IN THE DRY ZONE AND ITS SIGNIFICANCE

S. L. AMARASIRI

and

W. R. PERERA

(Agriculture Research Station, Maha Illuppallama)

The straw, husk and grain of eight varieties of paddy were chemically analysed for their nutrient content. The paddy crop removes large amounts of N, K and Si. About 90% of the total potassium removed and about 70% of the total silicon removed are present in the straw. Continuous cropping with removal of

straw from the field may give rise to heavy depletion of the native K and Si in the soil. Comparatively, small quantities of P, Ca and Mg are removed. Addition of recommended dosages of phosphate fertilizer may help to balance the P removal. Irrigation water supply of Ca and Mg may adequately replace the Ca and Mg removed.

INFLUENCE OF NUTRIENT pH ON THE UPTAKE AND DISTRIBUTION OF Fe, Mn, Cu, Zn, AND B IN COCONUT SEEDLINGS

M. A. T. DE SILVA, P. A. D. G. APPUHAMY, B. J. A. F. MENDIS

and

G. D. GEORGE

(Coconut Research Institute, Lunuwila)

Sprouted coconut seednuts were treated in sand culture with nutrient solutions buffered to pH values of 4, 5, 6, 7 and 8. Precipitation of the phosphates of calcium, magnesium and iron in the nutrient solutions at pH values above 6 was prevented by incorporating a calculated amount of EDTA. However, as EDTA has been shown to influence the uptake of iron and possibly other micronutrients (Hewitt, 1966), equivalent amounts of EDTA were incorporated into all buffered stock solutions. A non-buffered nutrient solution, free of EDTA served as the treatment for control plants.

The growth of plants treated with EDTA incorporated solutions was generally less than that of the controls, and hence some of the observed effects could be attributed to the chelating agent.

The uptake and distribution of iron, manganese and boron, as seen from the nutrient contents in laminae, midribs, rachis and roots, has been observed to be adversely affected by the solution reaction in plants treated with nutrient solutions of pH 4 and 6. However, plants treated with the solution of pH 5 had levels of iron, manganese and boron comparable with the control plants.

In general, contents of iron, manganese, zinc and boron tended to increase with increase of nutrient pH in all plant components. However, for copper, a similar effect of nutrient pH was observed only in the midribs. The uptake and distribution of copper was generally found to be reduced in the presence of EDTA.

References

Hewitt, E. J. (1966) *Sand and Water Culture Methods Used in the Study of Plant Nutrition.* 2nd Ed. pp. 229 – 235. Bucks. England. *Commonwealth Agricultural Bureaux.*

EFFECT OF MACRONUTRIENT DEFICIENCIES ON THE DISTRIBUTION OF Fe, Mn, Cu, Zn AND B IN LEAF COMPONENTS OF COCONUT SEEDLINGS

M. A. T. DE SILVA, B. J. A. F. MENDIS, P. A. D. G. APPUHAMY

and

G. D. GEORGE

(Coconut Research Institute, Lunuwila)

The distribution of micronutrients in leaf components of the youngest fully opened leaf of seedlings subjected to seven different treatments was investigated. The treatments were, – N, – P, –K, – Ca, – Mg, – all nutrients and + all nutrients. Three months after the commencement of the experiment, half the number of replicates in each treatment were subjected to an amputation process as described by Nathanael (1959), to separate the nuts from the young plants, and nine months later samples of amputated and non-amputated plants were uprooted for chemical examination.

The growth of amputated seedlings was less vigorous than their corresponding non-amputated plants for all treatments. Partly on account of this phenomenon, the uptake of micronutrients has been generally low in amputated seedlings.

The total amounts of iron, zinc and boron in leaf components of plants receiving the 'plus all' treatment was understandably higher than in those of other treatments. However, higher concentrations of iron and boron were found in the leaf components of plants deprived of potassium and magnesium.

The distribution of manganese in leaf components was higher in plants starved of nitrogen and calcium, but low in plants deficient in phosphorus.

It was also observed that considerable amounts of copper and zinc accumulated in plants receiving no nutrients. Although this may be a compensatory uptake, the copper levels in laminae and midribs may have exceeded the upper tolerance level.

The significance of these observations are discussed in detail.

References

Nathanael, W. R. N. (1959) Report of the Chemist, *Report of the Coconut Research Institute of Ceylon for* 1958. p. 25.

EFFECT OF TIME OF HARVESTING, MOISTURE CONTENT AND METHOD OF DRYING ON MILLING QUALITIES OF RICE

S. D. G. JAYAWARDENA

(Paddy Research Station, Bombuwala, Kalutara)

The moisture content of grain and the method of drying are equally important factors which determine the total head rice recovery in paddy. The optimum time of harvesting and the correct method of drying paddy, can reduce breakage losses in rice by 8 to 12 per cent. Use of breakage resistant varieties by farmers can further reduce losses by 6 to 10 per cent. This study spotlights certain practices within the control of the farmers which are responsible for causing 10 to 15 per cent losses due to breakages in milling.

AN EFFORT TOWARDS UTILISATION OF LAND UNDER CULTIVATION FOR MAXIMUM FOOD PRODUCTION

S. H. UPASENA

(Agricultural Research Station, Maha Illuppallama)

Of about 4.5 million acres of cultivable land in the country today almost 50% is occupied by perennial plantation crops like tea, rubber and coconut. Even two decades later, with additional cultivable acreage under giant irrigation projects, the irrigable cultivable extent of land will not exceed 3 – 3.5 million acres. But the population of the country will be in the region of 20 million

and feeding the nation will indeed be a problem. If at all there is a way of easing this situation, it is not by increasing agricultural production horizontally but vertically. In this context Multiple Cropping could be considered as a system of agriculture by which the agricultural production or the food production in the country could be raised by an additional factor of 3–4.

This paper deals with studies of Multiple Cropping systems conducted at the Agricultural Research Station, Maha Illuppallama where 5 to 6 crops were grown on the same land in a calendar year, with supplementary irrigation. The crops, cropping sequences, methods of planting, dates of planting, the economics etc. are discussed in this paper.

The data show

1. A suitable cropping pattern in the dry zone of Ceylon could produce a gross income of rupees 20,000/– per acre per year.
2. Chillies, onions and vegetables have contributed much in increasing the income of a cropping pattern in general.
3. Crops of caloric and high protein value have given low incomes.
4. In order to accelerate the farming operations and also to gain time to grow as much as 5 to 6 crops a year mechanisation to a certain degree is desirable.
5. Multiple Cropping will indeed ease the problem of attaining self-sufficiency in food production.

THE PEST ECOLOGY OF THE SHOT-HOLE BORER BEETLE OF TEA

D. CALNAIDO, K. THIRUGNANASUNTHARAN

and

M. A. S. K. RANASINHA

(Tea Research Institute, Mid-Country Station, Kandy)

The shot-hole borer beetle of Tea, *Xyleborus fornicatus* Eichh. is the most serious pest of Tea. This paper reports the results of a ten year ecological study of this pest and focusses attention on several important aspects of its ecology. The relationship of

the pest with its host-crop is elucidated and the chief factors regulating the populations of this beetle borer in Tea are assessed. A survey of the distribution of the pest in Tea in Ceylon shows a clear altitudinal distribution, regulated by temperature. The intensity of infestations in Tea is governed by the type of clone and *jat*. Further, crop tolerance and susceptibility to the pest have been recorded. The patterns of infestation are chiefly determined by the pruning cycle, which regulates the growth of young wood, on which the borer populations depend. The damage the pest causes is reflected in crop-loss, chiefly in the second year of the pruning cycle, and in time, some of the galleries lead to wood-rot. The unique aspects of the tea crop and the specific characteristics of the pest are evaluated. These unique aspects of the Pest Ecology of the shot-hole borer beetle explain its unsatisfactory control, even after seventy-five years of research.

THE CHEMICAL CONTROL OF THE SHOT-HOLE BORER BEETLE OF TEA

D. CALNAIDO, M. A. S. K. RANASINHA

and

K. THIRUGNANASUNTHARAN

(Tea Research Institute, Mid-Country Station, Kandy)

Attempts at effective and economical control of the shot-hole borer beetle pest of tea have to-date been unsuccessful. A review of these attempts to control the pest, culturally and with the use of chemicals, is presented. All past experimental trials have been analysed, in the light of the new knowledge of the Pest Ecology of Tea, in relation to "population skill", "gallery protection", and "recovered crop-loss". The effectiveness of the insecticidal method, in relation to dosage, frequency of application, persistence, timing and mode of application are discussed, and the mechanics of control with insecticides explained. The results of all insecticidal trials on shot-hole borer have been examined and it is concluded that the chemical control of the shot-hole borer beetle pest is neither ecologically feasible nor economically worthwhile.

The present knowledge of the Pest Ecology of shot-hole borer reveals the reasons for the failure of the insecticidal method of control and indicates that borer populations could be regulated by

cultural methods, so as to minimize the damage it causes. This appears to be the only ecologically feasible and economically worthwhile way of dealing with this pest, particularly, in the wider context of the Pest Management in Tea.

THE SAMPLING TECHNIQUES FOR THE SHOT-HOLE BORER BEETLE PEST OF TEA

D. CALNAIDO, M. A. S. K. RANASINHA

and

K. THIRUGNANASUNTHARAN

(Tea Research Institute, Mid-Country Station, Kandy)

A convenient, effective and economical sampling method is a vital requirement in any assessment of insect populations; more so in ecological studies. All sampling methods of shot-hole borer infestations in tea are reviewed. A comparative study of some of these methods shows that the "standard-unit method" (Judenko, 1958), is the most suitable technique for sampling the shot-hole borer pest of tea. The "standard-unit method" was found to consistently sample a proportionate amount of the absolute borer infestations in tea, both in terms of borer populations and galleries.

The "standard-unit method" of sampling was extensively used in a ten year ecological work and it has been confirmed that this is the most convenient, reliable and feasible method of sampling the pest in the crop, in all its stages, and also for studying the different aspects of this pest problem.

References

Judenko, E. (1958) Trials with a method of assessment of infestation caused by shot-hole borer *(Xyleborus fornicatus* Eichh.) on old Tea. *Tea Q.*, **29**, 51–59.

THE SIGNIFICANCE OF A NEW OUTLOOK ON THE PEST MANAGEMENT OF TEA

D. CALNAIDO

(Tea Research Institute, Mid-Country Station, Kandy)

An intensive ten year study on the Pest Ecology of Tea has spotlighted some unique aspects of the tea crop and the specific characteristics of pest infestations in Tea. This new knowledge on the Pest Ecology of the crop calls for an ecological approach to Pest Management in Tea (Calnaido, 1971 & 1972).

The unique aspects of the Pest Ecology of Tea explain the unsatisfactory chemical control of many pests of Tea, such as, tea tortrix, mites and shot-hole borer. Evidence from past experimentation with insecticides in Tea has revealed that in many instances the use of insecticides for pest control has proved to be neither ecologically feasible nor economically worthwhile.

Therefore, pest control in tea, which in the past has been over-dependent on the use of the chemical method, with the emphasis on protection, should in future be oriented towards bio-cultural techniques of regulating pest populations, aimed primarily at production, so that we arrive at safe, effective and economic Pest Management in Tea.

References

Calnaido, D. (1971) *The Environment and Agriculture.* An ecological approach to pest management in Tea. *Tea Q.*, **42**, 175–181.

Calnaido, D. (1972) An ecological approach to pest management in Tea. *Tea Q.*, **43**, 16–18.

THE PRESENT POSITION WITH RESPECT TO THE INCIDENCE OF RICE DISEASES IN SRI LANKA

S. N. DE S. SENEVIRATNE, B. S. UNAMBOOWE

and

D. L. WICKREMASINGHA

(Central Agricultural Research Institute, Peradeniya)

In assessments, since Yala 1969, of the incidence of disease in recommended and new improved varieties at eight test locations representing the main agro-climatic regions of the island, the

following diseases have been observed: Bacterial leaf blight *(Xanthomonas oryzae)*, blast *(Pyricularia oryzae)*, leaf scald *(Rhynchosporium oryzae)*, sheath blight *(Corticium sasakii)* and the spotting of foliage and seed caused by *Cochliobolus miyabeanus (Helminthosporium oryzae)*, *Sphaerulina oryzae (Cercospora oryzae)*, *Alternaria padwickii (Trichoconis padwickii)* and *Curvularia* spp.

In general, the incidence of disease has been negligible in the early stages of growth and crops have been affected mainly in the maturing stages. The most widespread and conspicuous condition observed has been leaf spotting associated with the fungi *Cochliobolus, Sphaerulina, Alternaria* and *Curvularia*. However, it does not appear to have a marked effect on yields. The effects of bacterial leaf blight and sheath blight, have also been negligible. Blast has caused yield losses but the performance against the disease of the new varieties has been very satisfactory.

With the incidence and economic effects of diseases reduced to marginal levels in the new varieties there is reason for cautious optimism that rice diseases are being contained satisfactorily. However, continuous vigilance is necessary for any shift in this situation.

The incidence of sheath rot caused by a seed-borne fungus *Acrocylindrium oryzae*, has recently been observed. Another dangerous disease, bacterial leaf streak *(Xanthomonas translucens* f. sp. *oryzicola)*, also seed-transmitted, has not occurred here yet. As it is prevalent in the neighbouring countries, the danger of its introduction ought to receive very serious attention.

A PROGRAMME FOR THE SCREENING OF RICE VARIETIES AND HYBRIDS AGAINST BACTERIAL LEAF BLIGHT *(XANTHOMONAS ORYZAE)*

S. N. DE S. SENEVIRATNE, S. P. HEMACHANDRA, P. S. Y. FERNANDO, V. GUNASINGHAM

and

H. DAYANANDA

(Central Agricultural Research Institute, Peradeniya)

Methods suitable for a programme of routine screening of rice varieties and hybrids were investigated. The aspects investigated included the selection of suitable media, the production of

inoculum in adequate quantity a method of speedy and economic inoculation while at the same time enabling detection of differential reactions.

A highly potent inoculum was obtained with a yeast peptone agar medium which was better than potato sucrose peptone agar and sucrose peptone agar media. Liquid cultures enabled economies of time and materials and yielded excellent inoculum. The development of a device for rapid multineedle prick inoculation has made possible its application as a very satisfactory inoculation method for the screening programme.

In the system of routine screening now adopted, all test varieties are transplated in nurseries, inoculated at late tillering with selected virulent strains of *Xanthomonas oryzae*. Ratings are based on lesion assessments, three weeks after inoculation, on 50 leaves using a nine unit scale.

In a second phase of the programme, resistant varieties are subjected to natural infection in a nursery increased disease incidence is induced by borders of the very susceptible Taichung Native 1.

Since Yala 1970, of the 1900 samples tested 150 were rated as resistant. Some of the most outstanding lines were: A 23–55–4 (Ambalantota); 70–14, 70–1428, 70–1439 and 70–1460 (Batalagoda); LH 2 and LH 3 (Bombuwela) and PD 17 (Peradeniya). Mention should also be made of the series from Bombuwela, BW 191–212, recently tested, the majority of which were rated as resistant.

THE EFFECTS OF TREATMENT WITH CERTAIN AGRO-CHEMICALS ON THE INCIDENCE OF AND CROP LOSSES CAUSED BY BACTERIAL LEAF BLIGHT OF RICE *(XANTHOMONAS ORYZAE)*

S. N. DE S. SENEVIRATNE, B. S. UNAMBOOWE, V. GUNASINGHAM, G. K. HEMACHANDRA, A. L. GUNASEKERA

and

K. WIKREMARATNE

(Central Agricultural Research Institute, Peradeniya)

Field trials were carried out at four stations, in which the effects of five agro-chemicals were investigated – Celdion [fentiazon (3–benzylideneamino–4–phenylthiazoline–2–thion)[, Sankel (nickel dimethyldithiocarbamate), Phenazin (phenazin–5–oxide), TF 130

(a systemic antibacterial agent) and Streptocycline (an antibiotic containing streptomycin and chlortetracycline). In addition, application of two supplementary dressings of potash were included together with the basal dressing as a treatment. In all trials the varieties IR -8 or Bg -34-6 were transplanted. Four sprays of the formulations tested were applied at different stages of the crop commencing shortly after transplanting till after flowering.

Seedling mortality, was not observed in any of the trials. The leaf blight phase, usually appeared in the maturing stages of the crop.

Differences between the untreated control and the treatments were not statistically significant, and in all except two trials with relatively low yields, the untreated controls yielded over 100 bushels/acre despite leaf infection.

The effect of the leaf blight phase on yield, particularly when it occurs in the maturing stages, is marginal. Agro-chemicals and potash dressings have generally had no appreciable effect either on disease occurrence or yield and are not recommended. The appearance of the disease only in the late stages of the crop in sites where it was prevalent the previous season raises interesting questions on the ecological aspects of the disease.

THE EFFECTS OF TREATMENT WITH CERTAIN AGRO-CHEMICALS ON THE INCIDENCE AND CROP LOSSES CAUSED BY SHEATH BLIGHT OF RICE *(CORTICIUM SASAKII)*

S. N. DE S. SENEVIRATNE

and

W. W. V. P. FERNANDO

(Central Agricultural Research Institute, Peradeniya)

Sheath blight of rice occurs mainly in the wet areas and Tuzet, a formulation containing methylarsine-bis-dimethyl dithiocarbamate, has been recommended as a chemical control measure.

This paper presents the results of a series of field trials carried out at two wet zone stations, Bombuwela (Kalutara District) and Karapincha (Ratnapura District), the objectives of which

were to observe the nature of disease incidence and to determine the effect of various agro-chemicals applied to the soil or as sprays on disease incidence and yield losses.

The varieties used in the trials included H-4, LD -66, Bg -35-2 and KP -23. The fungicides tested included Tuzet and Monsan (organoarsenical), Brassicol (PCNB), Brestan 60 (fentin acetate + maneb), Benlate (benomyl), Cercobin-M (thiophanate methyl) and Valida (Validamycin A).

Although disease incidence occurred, this was observed mainly in the late stages of the crop. The most severe incidence observed was at Karapincha in the variety Bg -35-2 with lesions spreading high into the culmns. However, although more than 50% of the tillers were infected, about 20% severely, even severely affected tillers had good panicles. Yield differences between untreated controls and agro-chemical treatments were not statistically significant. The same trends were observed at Bombuwela. Some of the fungicides tested, particularly Benlate reduced infection considerably. However, the effect of the infection itself appears to be of no practical importance as neither the crops nor the yields were adversely affected by it. The application of agro-chemicals in controlling the disease is therefore no longer recommended.

FACTORS INFLUENCING THE INCIDENCE OF RICE BLAST AND THE RELATIONSHIP OF DISEASE RATINGS IN HIGHLAND NURSERY TESTS TO BLAST INCIDENCE UNDER CONDITIONS OF NORMAL CULTIVATION

S. N. DE S. SENEVIRATNE

and

D. L. WICKREMASINGHA

(Central Agricultural Research Institute, Peradeniya)

In the past, rice blast *(Phyricularia oryzae)* was widely prevalent locally. The position has changed radically in recent years with the extended cultivation of new improved varieties.

In the studies reported here, the influence of seasonal environmental conditions on blast ratings in highland nursery tests, the relationship of these ratings to disease incidence under mudland conditions, and the degree of blast resistance actually necessary under normal cultivation conditions were investigated.

Twenty selected indicators ranging from highly susceptible to highly resistant in their reaction to blast were planted at monthly intervals in both highland and mudland at Peradeniya. A variation of blast ratings occurred in the highland with the time of planting – optimal conditions of humidity and other environmental factors prevailing only during certain months when varieties rated resistant to highly resistant, under conditions less favourable for disease development, received moderately resistant to moderately susceptible ratings. In comparable plantings in the muldland however, with the exception of the very susceptible varieties Pachchaiperumal and SLO –15, none of the other varieties were severely affected.

These observations indicate that even varieties with moderate levels of resistance as determined in highland tests are adequate for normal cultivation, generally, and a highly resistant blast rating is not an essential characteristic for varieties to be extended. Such a conclusion is supported by observations on the incidence of blast in eight locations where the new varieties have been tested in the Co-ordinated Rice Varietals Trials Programme and in which, with rare instances, varieties have not been adversely affected by blast.

A COMPARISON OF THE EFFICACY OF BENLATE AND CERTAIN OTHER FUNGICIDAL TREATMENTS FOR THE CONTROL OF RICE BLAST *(PYRICULARIA ORYZAE)*

S. N. DE S. SENEVIRATNE

and

W. W. V. P. FERNANDO

(Central Agricultural Research Institute, Peradeniya)

Benlate [methyl 1–(butylcarbamoyl) –2– benzimidazolecarbamate] is reported to have systemic properties and the new formulation of Manzate D (maneb containing zinc) is said to have very finely ground particles and an improved stabilising zinc salt which enhances its efficacy. A synergistic action between Benlate and Manzate D had also been reported. These fungicides in various combinations and other fungicides such as Kasumin (Kasugamycin), Hinosan (O-ethyl-S-S-diphenyl-dithiophosphate) and experimental

formulations were tested. Initially, fungicidal treatments were evaluated in highland nurseries. The most promising treatments were subsequently tested in field trials.

The following treatments involving combinations of Benlate (BN), Manzate D (MD) and Surfactant N (SN) were the most effective (dosages being expressed as % formulation): BN 0.03 + MD 0.1 + SN 0.25, BN 0.06 + SN 0.25, BN 0.03 + MD 0.1 and MD 0.3 + SN 0.25. They were superior to Kasumin at 0.1 – 0.15 and Hinosan at 0.1 – 0.15.

Treatment was effective curatively. However, at a station where blast incidence is often severe, protective sprays against neck rot in the susceptible variety Pachchaiperumal with BN 0.03 + MD 0.1 + SN 0.25 resulted in an acre yield of 56.8 bushels as against 42.5 bushels with Kasumin at 0.1, 39.9 bushels with Hinosan at 0.15 and 24.1 bushels from the untreated control.

The use of Benlate for the control of rice blast will be governed by the cost and the economics.

CORRELATION BETWEEN CROP LOSS AND BLISTER BLIGHT INFECTION ON UNSHADED VEGETATIVELY-PROPAGATED TEA

R. L. DE SILVA, T. V. SARAVANAPAVAN

and

S. MURUGIAH

(Tea Research Institute of Ceylon, Talawakele)

It was reported (de Silva, Murugiah & Saravanapavan, 1972) that control of Blister Blight *(Exobasidium vexans* Massee) was economically worthwhile in the first and second years of the pruning cycle on unshaded seedling tea, but that control of the disease in the third and fourth years of the cycle did not result in the prevention of crop loss on seedling tea.

The present paper reports the results of experiments on high-yielding, vegetatively-propagated tea of a susceptible clone, TRI 2024. As in the case of seedling tea, it was found that there was a

correlation between the dose of fungicide applied, and the degree of protection obtained, but that, over the entire cycle, there was no economic advantage in controlling the disease, within the range of concentration of fungicide used.

In one experiment, harvesting and assessment of disease infection was done every day, for more than one year. The effect of sunshine and rainfall which affect both disease infection and crop were investigated. It was found that sunshine affected disease infection critically, and rainfall affected crop, but the effect of sunshine on crop and the effect of rainfall on disease incidence did not appear to be always directly related.

Reference

De Silva, R. L., Murugiah, S. and Saravanapavan, T. V. (1972) Losses of tea crops caused by *Exobasidium vexans Massee*. 1. Unshaded Seedling Tea. *Tea Q.*, **43**, (4), In the press.

VIRUS DISEASES AFFECTING PASSION FRUIT *(PASSIFLORA EDULIS* VAR. *FLAVICARPA)* IN SRI LANKA

S. N. DE S. SENEVIRATNE

and

D. L. WICKREMASINGHA

(Central Agricultural Research Institute, Peradeniya)

Three conditions, viral in nature, have been identified on the basis of their symptoms and tentatively designated as follows:

(1) *Passion decline* – This condition is characterised by a retardation of growth and stunting. The leaves are dark green and leathery, reduced in size, deformed, twisted and puckered, and with chlorosis and vein clearing. Productivity is severely affected.

(2) *Passion mottle* – The characetristic symptom of this condition is the light and dark green mottle of leaves. Mottled areas are usually sunken. Growth does not appear to be severely affected by the disease and economic crops may be obtained despite infection with adequate fertilization, irrigation and crop management.

(3) *Passion mosaic* – This condition is characterised by a bright yellow chlorosis of leaves with prominent areas of green and yellow. Growth and productivity of vines do not appear to be severely affected by the condition.

All three conditions have been graft-transmitted to healthy stock seedlings using bark chips from diseased vines and the typical symptoms reproduced.

A sap transmissible virus has been isolated from diseased vines with passion mottle which produces chlorotic primary lesions on *Chenopodium amaranticolor* Coste & Reyn. Seed transmission of the mottle virus has not been found to occur but it is easily transmitted from infected to healthy plants in secateurs while pruning.

SECTION C: ENGINEERING

(King George's Hall)

Wednesday, 13th December:

8.30 .. ඌණ සංවර්ධන රටක 'නොදියුණු' ශිල්පී ක්‍රම ගැන හැඳින්වීමක් (ලංකාවේ උදල්ල භාවිතය සම්බන්ධයෙනි) ඇන්. ජී. ගුණසේකර

(Jointly with Section F) *(K. G. Hall).*

9.30 .. Southern Area Development Plan – D. L. O. Mendis and M. S. M. de Silva (Jointly with Section F) *(K. G. Hall).*

10.30 .. Highway Construction and Maintenance in Tropical Countries – Recent Trends in Research – G. M. Yoganandan.

1.30 .. දේශීය අමුද්‍රව්‍ය යොදගනිමින් ආලේපිත මෘදු වානේ වෙල්ඩින් ඉලෙක්ට්‍රෝඩ් නිෂ්පාදනය සඳහා කරණ ලද ගවේශණ'' – කේ. ඩී. අමරසේන, බී. ප්‍රේමරත්න, එම්. එච්. සී. විජේතුංග සහ එස්. ඩී. පෙරේරා.

2.30 .. Do Developing Countries always require Expensive, Sophisticated Equipment for Research? – A. Denis N. Fernando.

Thursday, 14th December:

8.30 .. A Statistical Analysis of Kelani Floods – V. R. Baghirathan.

9.30 .. A New Method of Testing Adhesion and Stripping Characteristics of Road Binders – M. J. Fernando.

10.30 .. Business Meeting.

1.30 .. ග්‍රාමීය කුඩා පරිමාණ අංශය මගින් ශ්‍රී ලංකා ලුහු ඉංජිනේරු කර්මාන්ත සංවර්ධනය – ඩබ්ලිව්. ඒ. ජයසිංහ සහ ඩී. ඇල්. ඕ. මෙන්ඩිස්

(Jointly with Section F) *(New Lecture Hall).*

2.15 .. Fine Structure of the Turbulent Boundary Layers – M. A. V. Devanathan and Vinodhini Guruswamy (Jointly with Section E) *(K. G. Hall).*

2.30 .. Highway Planning and Design methods necessary to improve its performance in relation to existing land use pattern, in assisting development activity in Ceylon – P. Thirumal.

3.30 .. Presidential Address: "Trends in Highway and Traffic Engineering'' – T. Wijesinghe *(Physics Theatre).*

Friday, 15th December:

8.30 .. Failure of Railway Drawbar Hooks – A. R. T. de Silva.

9.15 .. Studies of Rate of Ion Exchange in 'Organically Fouled' Resins – S. Perasiriyan (Jointly with Section E) *(K. G. Hall).*

9.30 .. The Fatigue Resistance of Rotating Shafts – A. de S Jayatileka and A. R. T. de Silva.

10.30 .. Traffic Trends in Colombo and Suburbs – M. K. X. Sabar and M. D. C. Gunatilake.

1.30 .. Model Tests on Reinforced Concrete Piles – M . W. D. C. S. Gunasekera.

2.00 .. Landslide on Rattota Gammaduwa Road – J. B. Dissanayake.

2.30 .. Geology in Government: Its growing responsibilities under environmental stress – A. W. Woodland (Jointly with Section D) *(Biology Theatre).*

Saturday, 16th December:

8.30 .. Seminar on the Mahaweli Development Project (Jointly with Sections, B, D and F) *(K. G. Hall).*

SOUTHERN AREA DEVELOPMENT PLAN

D. L. O. MENDIS *and* M. S. M. DE SILVA

(Ministry of Planning and Employment)

The Southern Area of Sri Lanka consists of the South Western Wet Zone and the South Eastern Dry Zone. The South Western Wet Zone includes three major rivers – the Kaluganga, Ginganga and the Nilwalaganga which together carry about 10 million acre foot of rainfall to the sea annually, causing perennial flood damage. The Wet Zone also has the most intensive population distribution of approximately 1000 people per square mile. On the other hand, the South Eastern area has a sparse population density chiefly because of the inadequacy of water during nine months of the year. Future development must therefore be planned to divert the growing population from the South West to the undeveloped land in the South East.

A proposal to divert the excess water from the three basins of the Kaluganga, Ginganga and Nilwalaganga to irrigate upto a million acres of new land in the South Eastern area is described in this paper. Some implications of this project from various standard points such as the sociological and ecological aspects are mentioned. The sum total of the proposal amounts to a Regional Development Plan on a scale that has not been undertaken in this country to-date.

HIGHWAY CONSTRUCTION AND MAINTENANCE IN TROPICAL COUNTRIES – RECENT TRENDS IN RESEARCH

B. M. YOGANANDAN

(Department of Highways)

This paper presents in brief the recent trends in research in the field of road construction and maintenance in tropical countries. Tropical countries have a high annual rainfall and the temperature during most of the year is in the eighties (°F). Laterites occur commonly and high quality road aggregate is expensive due to the high cost of transport. These conditions cause special problems.

The first of several problems considered is that of improving the engineering properties of in situ materials by the addition of small quantities of cement or lime, 3% lime or 5% cement added

to lateritic soils improves the strength considerably – as measured by the C.B.R., increases the resistance to the damaging influence of water and reduces the changes in volume that go with moisture variations. This alternative to the traditional "metalling & bitumen grouting" (a variation of penetration macadam) is cheaper and fits in well a programme of stage construction. Simple machinery required for construction of stabilized roads is available in agricultural countries.

A soil stabilized with cement sometimes develops cracks due to shrinkage. These cracks are wider than hair cracks and might occur at intervals of several feet. These cracks are sufficiently wide to cause deflection cracking in the wearing surface. Research is presently proceeding in various laboratories to control the shrinkage by addition of inert fillers and by proper curing methods. The period of curing and the question of opening of the road to traffic soon after construction has been the subject of full scale trials.

Very often roads in tropical countries have to be improved to cope with the large increase in traffic. This implies that the residual strength of existing pavements has to be determined. Present research is geared to the use of a Mechanized Benkelman beam to measure transient deflections for the evaluation of pavements (Deflectograph).

The construction of a road interferes with the drainage and run off and increases the possibility of erosion. Some methods of controlling erosion are discussed.

What is the method of design of asphaltic concrete suitable for tropical countries? is a question often asked. Some answers to this question are presented.

"දේශීය අමු ද්‍රව්‍ය යොදා ගනිමින් ආලේපිත මෘදු වානේ වෙල්ඩින් ඉලෙක්ට්‍රෝඩ නිෂ්පාදනය සඳහා කරණ ලද ගවේෂණ"

කේ. ඩී. අමරසේන, බී. ප්‍රේමරත්න, එම්. එච්. සී. විජේතුංග
(ලංකා විද්‍යාත්මක හා කාර්මික පර්යේෂණ ආයතනය)

සහ

එස්. සී. පෙරේරා
("සීමාසහිත ලංකා ඔක්සිජන්")

ආක් වැල්ඩිං කුරු පිළිබඳ ඉල්ලුම අතිශයින් වැඩිවී ඇති බව හා ඒ අනුව රටින් වටිනා විදේශීය විනිමය ප්‍රමාණයක් ඇදී යන ආකාරයත් පසුගිය වර්ෂ කීපයේ රේගු වාර්තා පෙන්නුම් කරයි. විදේශ විනිමය හිඟකම නිසා උපකරණ ආනයනයට ඇතිවූ අවහිරකම් හේතු කොට ගෙන, විශේෂයෙන් ප්‍රවාහනසේවා නිෂ්පාදන උපකරණ හා ඉංජිනේරු කර්මාන්ත ආදියේදී අලුත් වැඩියා කිරීම් හා නඩත්තු කිරීම් වලට වුවමනා වැල්ඩිං ඉලෙක්ට්‍රෝඩ සඳහා ඇති අවශ්‍යතාවය වැඩිවී ඇත. අප බලාපොරොත්තු වන කාර්මික හා ආර්ථික දියුණුව සමගම වැල්ඩිං කුරු පිළිබඳ ඉල්ලුමත් කීප ගුණයකින් වැඩිවීම අනිවාර්යය.

වෙල්ඩිං කාර්මික විද්‍යාවට කෙලින්ම සම්බන්ධවූ පර්යේෂණවල නිරතව සිටින කතෘන් විසින් මෘදු වානේ ආක් වෙල්ඩිං කුරු සඳහා ආලේප මිශ්‍රණ සෑදීමට දේශීය අමු ද්‍රව්‍ය සාර්ථක ලෙස යොදවාගනු ලැබ ඇත. මේ ආලේප ඉතා සතුටුදායක ලෙස පහත සඳහන් එහි මූලික අවශ්‍යතා සපුරාලන බව සොයා ගෙන ඇත. එනම්:

(i) සම්බන්ධ කරණ ලෝහ වස්තු හා ඉලෙක්ට්‍රෝඩය අතර විදියුත් චාපයේ අයනීකරණය ඇති කිරීම.

(ii) ලෝබොර හා වායු ආවරණය මගින්, ද්‍රවවූ ලෝහයට වාතය ඇතුල්වීම වැලැක්වීම.

(iii) රසායනික හා ලෝහ කාර්මික ප්‍රතික්‍රියා මගින් ද්‍රවවූ ලෝහය ප්‍රසාදනය කිරීම.

(iv) ඉලෙක්ට්‍රෝඩයේ සිට සම්බන්ධ කරණ වස්තුව වෙත ලෝහ සංක්‍රමණය පහසු කිරීම.

(v) වෙල්ඩයේ ගතිගුණ දියුණු කිරීමට වෙනත් අවශ්‍ය මූල ද්‍රව්‍ය මිශ්‍ර කිරීම.

[The authors, who are actively involved in research studies directly related to Welding Technology, have been successful in the utilization of locally available constituents to formulate coating mixtures for Mild Steel Aro-Welding Electrodes, and the coatings have been found to satisfactorily perform their essential functions. The paper discusses the success of this research, in terms of these functions.]

DO DEVELOPING COUNTRIES ALWAYS REQUIRE EXPENSIVE, SOPHISTICATED EQUIPMENT FOR RESEARCH?

A. Denis N. Fernando
(Ministry of Irrigation, Power and Highways)

It is perhaps universally acknowledged that in the context of a developing economy, it is absolutely essential to develop a scale of priorities within which development could be defined and guided. Where scarce resources have to be so marshalled and administered that they achieve maximum effect in terms of human welfare, certain tasks would obviously be more important and worthwhile than certain other tasks. This is the fundamental basis of all economic planning.

Translating this concept within the field of scientific research, the question that is relevant to scientific research in a developing country is that of identifying fields of scientific research which are worthwhile and important or even urgent. There should surely be a scale of priorities in research work. Though pure and applied research are not mutually exclusive and are certainly complementary to each other, in a developing country, both types of research could be pursued – but in a manner that is economical to the country.

Ill-planned and ill-managed research activities have resulted in considerable wastage, not only of scientific personnel, but also of equipment and research apparatus that is in most cases under-utilised. All this implies social wastage.

In certain fields of activity which are obviously important to the economy, it is perhaps quite relevant even to utilise sophisticated – equipment and embark upon programmes of scientific research which may otherwise appear highly advanced. Other fields of

scientific activity where sophisticated research equipment is not required but only theoretical research is involved, could also be identified as being unobjectionable.

In this context, it is important that scientific personnel should attempt to redefine their attitudes to current and potential research programmes. The measure should be the relevance of their activities to the practical needs of the country. It is only then that the efforts of scientists will be significant to the country.

A STATISTICAL ANALYSIS OF KELANI FLOODS

V. R. BAGHIRATHAN

(18, De Fonseka Rd., Colombo 5)

Though the Kelani River floods with monotonous regularity there is no firm flood forecasting system connecting Colombo and Hanwella, due mainly to the paucity of information made immediately available. This paper aims at forming a basis for a forecasting system under the existing circumstances. It is basically a systematic statistical analysis of 8 'floods' between 1957 and 1972.

Under the existing conditions, only the hourly stage heights at Hanwella and Nagalagam Street are made immediately available at the flood headquarters in Colombo.

The analysis was directed at obtaining a fairly accurate basis for forecasting the behaviour at Nagalagam Street, knowing the conditions at Hanwella. It establishes graphical relationship between the following:

(a) Initial gradients at Nagalagam Street and Hanwella.
(b) Periods of rise at Nagalagam Street and Hanwella.

The use of rainfall information, which is generally not available on time, is substituted by using the fact that,

(a) behaviour of river at Hanwella reflects rainfall in upper catchment (i.e. catchment above Hanwella).
(b) behaviour of river at Nagalagam Street reflects rainfall in whole catchment.

The graphs and results obtained form a basis for forecasting the behaviour at Nagalagam Street. When tried out on past floods the results have been satisfactory.

In the absence of vital rainfall information it is difficult to develop a forecasting system based on conventional methods. The system proposed above, though not foolproof, will help to bridge the gap till communications during flood times are improved.

A NEW METHOD OF TESTING ADHESION AND STRIPPING CHARACTERISTICS OF ROAD BINDERS

M. J. FERNANDO

(Chemistry Division, Research and Development Office, Highways Department, Ratmalana)

The stripping characteristics of road surfaces are extremely important in evaluating the adhesion of road binders such as tar and bitumen to road aggregates. The problem of stripping may be disastrous when the bituminous mixture is permeable to polar liquids such as water.

The usual 'Boil Test' and 'Water Immersion Test' used in bitumen work are highly inadequate to study the stripping characteristics of road surfaces. These tests are based on visual observation. Further, they are highly qualitative in nature and subject to a number of personal errors, not reliable and laborious.

Hence, a new qualitative test is described based on the solubility of exposed area of the aggregate using oxalic acid. Basic type of aggregate such as limestone is used in this test. Oxalic acid reacts with calcium carbonate and forms an insoluble precipitate of calcium oxalate adherent on the surface. No further reaction takes place after about twenty minutes. From the quantity of acid consumed, the surface area exposed can be calculated by using a simple equation derived.

ග්‍රාමීය කුඩා පරිමාණ අංශය මගින් ශ්‍රී ලංකා ලුහු ඉංජිනේරු කර්මාන්ත සංවර්ධනය

ඩබ්ලිව්. ඒ. ජයසිංහ සහ ඩී. ඇල්. ඕ. මෙන්ඩිස් විසිනි

(ක්‍රම සම්පාදන හා රැකී රක්ෂා අමාත්‍යාංශය)

මුළු මහත් කාර්මික අංශයේ ඉතා තීරණාත්මක ලෙසින් වැදගත් ලුහු ඉංජිනේරු කර්මාන්තයේ වැදගත් කම ගැන 1972–76, පස් අවුරුදු සැලැස්ම යුක්ති සහගත ලෙස අවධාරණයෙන් පෙන්වා දෙයි. ඒ අතර සැලැස්මේ සාමාන්‍ය අවධාරණය කුඩා පරිමාණ අංශයේ සංවර්ධනයක් රටේ ඇති සම්පත් භාවිතයක් ප්‍රාග්ධන ක්ෂුක්ෂම ක්‍රමවලට වඩා ශ්‍රම ක්ෂුක්ෂම ක්‍රම තෝරා ගැනීමක් කෙරෙහිය.

බෙනට් (1843) ආනන්ද කුමාරස්වාමි (1908) සහ වෙනත් අය විසින් ප්‍රසංසාත්මක මුඛයෙන් වර්ණනා කරන ලද පැරණි කාර්මික සම්ප්‍රදයන් ශ්‍රී ලංකාවේ ඓතිහාසික වශයෙන් ඇත. 19 වෙනි ශත වර්ෂයේ අවසාන භාගයේදී පමණ අනගාරික ධර්මපාල තුමා මෙම සම්ප්‍රදය නගා සිටුවීමටත් ගම්බද කාර්මිකයාගේ තාක්ෂණය නවීනරණය, කිරීමටත් උත්සාහ ගන්නාලදි.

මෑතකදී කොත්මලේ ප්‍රාදේශය සංවර්ධන මණ්ඩල ව්‍යාපාරයක් ලෙස ගම්බඳ කම්මල් කරුවා නගා සිටුවීමට ගත් වෑයමක් අසමාන සාර්ථකත්වයට පැමිණ ඇත. මේ අනුව ක්‍රම සම්පාදන අමාත්‍යාංශය මගින් අරඹා ඇති දීප ව්‍යාප්ත වැඩ පිළිවෙලක් තුළින් ලුහු ඉංජිනේරු කර්මාන්තය ගම්බද කම්මල් කරුවන් මත පදනම් කිරීමටත් එම පුනරුත්ථාපනය නාගරික අංශය හා රාජ්‍ය ලෝහ භාණ්ඩ සංස්ථාව සමග සම්බන්ධ කිරීමේ ව්‍යාපාරයකටත් තුඩු දී ඇත. තාක්ෂණය ප්‍රගතිශීලීව වැඩි දියුණු කිරීමට සැලැස්මේ වැදගත්ම අංශයක්වේ. මෙම යෝජනා ක්‍රමයෙන් මෙතෙක් දක්වා ඇති ප්‍රගතිය ලිපියෙන් විස්තර වේ.

මැටි හා රෙදි විවීම වැනි වෙනත් සම්ප්‍රදයාන කර්මාන්ත කෙරෙහිද මෙම අත්දැකීමේ බලපෑම් සාකච්ඡා කෙරෙනු ඇත.

මෙම වැඩ පිළිවෙලින් ආර්ථික, සාමාජීය හා දේශපාලන අවශ්‍ය තාවයන් වශයෙන් ගැනෙන විදේශ විනිමය ඉතිරිකර ගැනිමට හා රැකියා සැපයීමත් හැර පෙරදී වැයම් නොකරණ ලද ප්‍රමාණයේ දේශීය අමු ද්‍රව්‍ය භාවිතයෙන් නිෂ්පාදනයන් ඇති කිරීමට සැලස්මක් පිළියෙල කරණ අන්දම පෙන්වා දෙයි.

[A recent attempt to revive the village blacksmith in Kotmale area under a Development Council project has been an unqualified success. This has led

to an island wide scheme launched by the Ministry of Planning and Employment to base the development of the light engineering industry on the village blacksmith linked with the urban sector and the State Hardware Corporation. Progressive development of technology is an essential part of the Plan. Progress in implementation to-date is described in this paper.]

FINE STRUCTURE OF THE TURBULENT BOUNDARY LAYERS

M. A. V. DEVANATHAN

(Tea Research Institute of Ceylon)

and

VINODHINI GURUSWAMY

(Ceylon Institute of Scientific and Industrial Research)

Using simple electrochemical reactions as tracers, it has been possible to study the mass transfer hydrodynamics of liquids. The mode of damping is established as gradual according to the model advocated by Vielstich, Lin and Putnam.

By using a symmetrical cell design it has been possible to evaluate U_i the minimum velocity for the inception of turbulence. And hence, using these values at various temperature 'a' ($a = \frac{\delta_0 \nu_0}{\nu}$) the Reynolds number for the turbulent eddies towards the wall has been evaluated as a finite value. Previous workers have assigned a ~ 10 by *assuming* the $U^{\frac{7}{8}}$ distribution law within the viscous sublayer. Now it is possible to give a quantitative model of the Universal velocity profile since 'a' is defined uniquely.

HIGHWAY PLANNING AND DESIGN METHODS NECESSARY TO IMPROVE ITS PERFORMANCE IN RELATION TO EXISTING LAND USE PATTERN IN ASSISTING DEVELOPMENT ACTIVITY IN CEYLON

P. THIRUMAN

(Department of Highways, Colombo)

The object of this paper is to study the pattern, changes and trends of land use in Ceylon in relation to Highways, the causes of traffic congestion, and the design and planning methods necessary to tackle them.

Ceylon is primarily an agricultural economy, with reasonable tourist potential. Both agricultural and tourist development is directly linked to land-use. Therefore, traffic represents development activity and the Highway performance shows the degree of impedence to that activity. The lower the level of service at which congestion takes place, the lower the rate of development. Hence, highways need positive planning and improvement to assist Ceylon's development.

What are the conditions prevailing on our highways? Traffic congestion, which is a feature of peak hour traffic, has now become more the rule, than the exception. It is more so on sections of roads approaching provincial and principal towns, where land use activity is more pronounced.

What caused this problem? The main reason is that, the same network of narrow-ways, which once served the pedestrians, bullock carts and horse carriages satisfactorily, is expected, with minor adjustments, to serve the needs of the fast motor traffic in developing Ceylon. Can this thinking go on for ever? Is there a solution, and if so what is it? The solution lies in understanding the nature and seriousness of the problem, quickly adopting drastic planning and design methods, however unpleasant they may be, and eventually make our highways give the healthy performance required.

FAILURE OF RAILWAY DRAWBAR HOOKS

A. R. T. DE SILVA

(Metallurgy Laboratory, Faculty of Engineering, Peradeniya Campus, University of Ceylon)

The carriages of a train are pulled along by a hook and link arrangement, the former being termed a drawbar hook. In the Ceylon Government Railway these hooks are made by hot-forging from imported steel bar stock. The hooks are subject to periodic sudden failure and are a source of inconvenience and danger. The failure is either of two types:

(i) Normally, fracture occurs across a vertical section situated close to the lowest point of the hook.

(ii) Sometimes, due to chance positioning of the link on the hook, traction is applied at a point on the hook higher than usual. In this case, fracture may occur on a plane passing through the region normally occupied by the link.

The fracture surface was of the cleavage type throughout indicating that the material was embrittled. Metallographic examination and testing showed this to be due to coarse – grained ferrite, a Widemanstätten distribution of pearlite and lack of stress – relief after the hot - forging operation.

The first type of failure has been initiated by overloading, assisted by large oxide inclusions forged into the surface. Owing to the embrittled condition of the metal, the crack formed propagates across with little resistance. The second type of failure is initiated by the presence of a work-hardened layer caused by rubbing of the link against the hook; this is followed by rapid crack propagation as before.

In this paper, the analysis leading to the detection of these failure modes will be outlined and it will be shown how a simple heat-treatment can greatly reduce the susceptibility to this sort of failure.

Acknowledgement

Work supported by a grant from the National Science Council.

STUDIES OF RATE OF ION EXCHANGE IN 'ORGANICALLY FOULED' RESINS

S. PERASIRIYAN

(Ceylon Electricity Board)

The symptoms of organic fouling and the methods to alleviate the problem have been reported.

It has also been noted that the reduction of flow rate improved the quality of treated water in the filter plant, indicating that the effect of organic fouling is mainly due to a reduction in the rate of ion exchange rather than a reduction in the overall capacity of the resins.

It is recognised that the rate of ion exchange is controlled by the diffusion across the thin layer which surrounds the gel of resin and the diffusion of particle through the net work of polymeric structure. Further, the rate of ion exchange in an organically fouled resin is affected by 'steric' and 'concentration' effects.

An attempt was made to measure the rate of ion exchange of three different resins taken from mixed-bed deioniser plants at the Thermal Power Station, Colombo. An absorptiometric method was adopted and the rate of ion exchange in the fouled resins is compared with that of fresh resins of the same batch. The results indicated the extent of 'fouling' and treatment has been carried out in the field plants accordingly, to improve the performances.

The studies of rate of ion exchange as a useful method to solve the problem of 'organic fouling' are discussed.

Reference

Perasiriyan, S. (1971) Proc. Ceylon Assoc. Advmt. Sci., **1**, 98.

THE FATIGUE RESISTANCE OF ROTATING SHAFTS

A. DE S. JAYATILEKA *and* A. R. T. DE SILVA

(Metallurgy Laboratory, Faculty of Engineering, Peradeniya Campus)

Imported 'jumper' steel and locally hot-rolled mild steel are the common alloys used for the manufacture of small rotating shaft in Ceylon. From the service failures received in this laboratory for examination it was observed that most were due to poor design against fatigue. This investigation was carried out to determine the fatigue behaviour of these alloys under rotating beam conditions and to observe the effect of production variables which could be controlled locally.

In the 'as received' normalised condition, both jumper steel and mild steel have comparable fatigue limits, these being 38,500 psi and 48,500 psi maximum alternating bending stress, respectively.

Using a factor

$$\emptyset = \left(\frac{\text{(fatigue limit} \times \text{wear resistance}}{\text{cost}} \right)$$

as a basis for comparison, it was found that as received, local mild steel ($\emptyset = 3.08$) is superior to jumper steel ($\emptyset = 2.77$). Unfortunately, it is in this state that the latter steel is used locally. However, when jumper steel was heat-treated to a tempered martensitic structure it was observed that both the fatigue limit and wear resistance improved considerably producing a $\emptyset$ factor of 8.14. The new fatigue limit was 73,000 psi maximum alternating bending stress.

Tests were also conducted at fixed stress levels with different surface conditions; it was observed that bad filleting can reduce the fatigue life by about a factor of 10 and rough machining by about a factor of 100.

Acknowledgement

Work supported by a grant from the National Science Council.

TRAFFIC TRENDS IN COLOMBO AND SUBURBS

M. K. X. SABAR *and* M. D. C. GUNATILAKE

(Department of Highways, Colombo)

The paper discusses a study of the traffic position within Colombo and suburbs in relation to traffic data that have been collected for purposes of a proposed UNDP study involving the planning of a Greater Colombo for a 2¾ million population. A comprehensive plan in accordance with best concepts of town planning is being envisaged, and the Department of Highways has been involved with the collection of data in relation to the transportation aspect.

Transport is an economic overhead, the weightage of which could be considerable in terms of economic investment. The passenger car cannot be considered, for future purposes, as a permanent solution to the nation's transport problems. Good planning concepts, an intelligent diversification of traffic generating centres, adoption of the neighbourhood concept and the 'environmental area' type of living must necessarily be a more lasting solution. Environmental factors such as accidents and pollution must be given due consideration. A fundamental requirement is the

proper collection and analysis of traffic data in relation to the existing network, and poperly classified in terms of the various type of vehicles.

Significant trends in traffic growth in relation to specific areas are discussed in the background of both fast and slow traffic. Peak Hour Volumes and Capacity consideration have been analysed in relation to accepted standards in traffic engineering practice. Future forecasts have been made in relation to past trends, and emphasis laid on those aspects that must be kept under review in order to see that the future assignment of traffic would not only be viewed from an intelligent approach but also from a point of view of the need to avoid for all time undesirable environmental hazards.

MODEL TESTS ON REINFORCED CONCRETE PILES

M. W. D. C. S. GUNASEKERA

(Soil Mechanics Laboratory, Faculty of Engineering, University of Ceylon, Peradeniya)

This paper describes the apparatus and summarises the results obtained from model piles tested in fine sand. A unique load-settlement envelope corresponding to any particular length of pile is established. Recovery of settlement is found to take place during cyclic leading at working load.

The skin friction and point bearing load are expressed as functions of the length of the pile.

Reference

Gunasekera, M. W. D. C. S. (1972) "Model Pile Tests in Fine Sand". M.Sc. Project Report, University of Ceylon, Peradeniya.

LANDSLIDE ON RATTOTA GAMMADUWA ROAD

J. B. DISSANAYAKE

(Soil Mechanics Laboratory, University of Ceylon, Peradeniya Campus)

In January 1971, a landslide occurred on the Rattota Gammaduwa Road, destroying nearly seventy-five meters of the highway, and involving a large quantity of soil material. Fortunately, no damage to structures had resulted from the slide and no lives were lost.

An investigation was carried out at the Soil Mechanics Laboratory of the University of Ceylon, Peradeniya Campus, for the purpose of identifying the type of the slide, and the possible causes that led to it.

The paper discusses in brief the various types of landslides classified on the basis of the shape of the moving soil mass during and after failure and the distinguishing features of the more common types. The various mechanical, physico-chemical and geological factors that generally cause or influence landslides are also discussed in brief.

The investigation has revealed that this particular landslide could be classified as a 'Slump Mudflow' and the characteristic features of this type are discussed. It can also be concluded that the presence of mica in the slope-forming clayey soil may have played a significant role as a contributory cause.

SECTION D: NATURAL SCIENCES

(Biology Theatre)

Wednesday, 13th December:

8.00 .. Histology and Histochemistry of the Uterus of *Achatina fulica* (Gastropoda: Pulmonata, Stylommatophora) – S. F. M. Fallil and W. R. Breckenridge.

8.30 .. The Development of the Ovary in the Adult *Sitophilus zeamais* Motsch. (Coleoptera, Curculionidae) – V. K. Ganesalingam.

9.00 .. Mutants of *Excherichia coli* which are defective in DNA synthesis – H. G. Nandadasa.

9.30 .. Chromosome replication of *Escherichia coli* under the control of the sex factor F. – H. G. Nandadasa.

10.00 .. The Effect of Different Types of Paper on Feeding and Growth in the Silverfish, *Ctenolepisma longicaudatum* Escherich and *Acrotelsa collaris* (F.) (Thysanura: Lepismatidae) – W. W. D. Modder.

10.30 .. Chromosome Studies on the Ceylon Liliaceae, Amaryllidaceae and Hypoxidaceae – Seetha Kulatunga, M. D. Dassanayake and K. Theivendirarajah.

1.00 .. Predators of Flying Fish *Hirundichthys coromandelensis* Hornell and its suitability as a Bait Fish – J. Jinadasa.

1.30 .. Natural Hazards in Ceylon – A Geographical point of view – K. U. Sirinanda.

2.00 .. Some Aspects of Graphite Prospecting in Sri Lanka – V. V. C. Ranasinghe and D. B. Pattiaratchi.

Thursday, 14th December:

8.00 .. Germination and seedling structure in *Borassus flabellifer* and other palms – M. D. Dassanayake and B. Sivakadachcham.

8.30 .. Flora of the Thondaimannar Lagoon – K. S. Kugathasan, K. Ratnasabapathipillai and V. Ponnampalam.

9.00 .. Report on the comparison of the flora of an undisturbed and a burnt area – K. S. Kugathasan, K. Ratnasabapathipillai and V. Ponnampalam.

9.30 .. Oceanographic factors of the coastal waters off Trincomalee – J. Jinadasa.

10.00 .. MICRO-ORGANISMS AS CO-ORDINATION CHEMISTS – A. W. Johnson (Jointly with Section E) *(Chemistry Theatre)*.

11.00 .. Presidential Address: "Industrial Clays of Sri Lanka" – J. W. Herath *(Physics Theatre)*.

1.00 .. The Drought in Yala and its effect on Wild Life Distribution – Dodwell P. de Silva.

1.30 .. A Method of Evaluating and Mapping the Topographical Variation of Solar Radiation and its application to Ceylon – B. K. Basnayake.

2.00 .. Granulities of Ceylon – Metamorphic Temperatures – D. J. A. C. Hapuarachchi.

2.30 .. A Classification of the Northern (Jaffna) Coasts – P. Puvanarajan.

3.00 .. Business Meeting.

Friday, 15th December:

8.00 .. Drainage Basin Clusters in the Central Highlands of Sri Lanka – C. M. Madduma Bandara.

8.30 .. Effective Precipitation and Drainage Density – C. M. Madduma Bandara.

9.00 .. Some Techniques adaptable for application in Hydro-Geological Investigations in Ceylon – K. Kularatnam.

9.30 .. Intensity, duration and period of occurrence of water deficit (drought) conditions in some dry zone stations – K. U. Sirinanda.

10.00 .. The Talagoda Pegmatite – D. B. Pattiaratchi.

1.30 .. Socio-Economic study of some *Purana* Villages in the Kala Oya Basin, Anuradhapura District – H. N. C. Fonseka (Jointly with Section F) *(New Lecture Hall)*.

2.00 .. A study on the grey discolouration in sliced cooked ham – P. E. Dias and K. S. Kularatne (Jointly with Section A) *(Physics Theatre)*.

2.30 .. GEOLOGY IN GOVERNMENT: ITS GROWING RESPONSIBILITIES UNDER ENVIRONMENTAL STRESS – A. W. WOODLAND (Jointly with Section C) *(Biology Theatre)*.

Saturday, 16th December:

8.30 .. Seminar on the Mahaweli Development Project (Jointly with Section B, C and F) *(K. G. Hall)*.

HISTOLOGY AND HISTOCHEMISTRY OF THE UTERUS OF *ACHATINA FULICA* (GASTROPODA: PULMONATA, STYLOMMATOPHORA)

S. F. M. Fallil

and

W. R. Breckenridge

(Department of Zoology, University of Ceylon, Peradeniya Campus)

Achatina fulica is a hermaphrodite, and an individual snail may lay as much as 150 – 200 eggs at a time. The eggs are elaborated and stored in the uterus prior to being deposited in the soil.

The uterus forms a part of the sperm oviduct – prostate gland complex, and its wall is made up of logitudinal and circular muscles, a layer of connective tissue, and an epithelium of cuboidal ciliated cells lining the lumen. The folded wall of the uterus and the well developed musculature permit its expansion to accommodate the large number of eggs produced. Numerous unicellular gland cells are found in the connective tissue and these are not clearly seen with routine histological stains like haematoxylin and eosin and azan, but stand out vividly with a variety of histochemical stains. Each gland is elongate – oval in shape and empties its secretion into the lumen of the uterus through a narrow neck which lies between the epithelial cells.

Histochemical tests show that the following components are present in the secretion of these glands: protein, acid mucosubstances and carbohydrate, glycogen being absent. Calcium could not be determined by routine histochemical tests, although incineration of uterine tissue and subsequent testing of the ash for calcium gave a strong positive result.

The following functions are attributed to the secretion: formation of egg membranes, egg-shell, and a thick mucus which bathes the eggs.

THE DEVELOPMENT OF THE OVARY IN THE ADULT *SITOPHILUS ZEAMAIS* MOTSCH. (COLEOPTERA, CURCULIONIDAE)

V. K. GANESALINGAM

(Department of Zoology, University Campus, Peradeniya)

Sitophilus zeamais Motschulsky is an important pest of stored cereal grains, specially rice in Sri Lanka. The development of the ovary in the adult weevils, which were reared on rice grain under laboratory conditions, was studied by making whole mount preparations and microtome sections of the ovaries from weevils of known age.

At the time when the adult weevil is hatched, the ovary consists of 2 pairs of ovarioles, each of which is differentiated into terminal filament, germarium, vitellarium and pedicel. Each pair of the ovarioles is connected proximally to the oviducts on either side, and both the oviducts join to form a common oviduct.

The follicles begin to form posterior to the vitellarium about the 4th day after hatching. Thereafter more follicles are added distally. The yolky egg with a chorion is formed in the most proximal follicles by the 6th day, and subsequently passed into the oviduct.

The ovary is of acrotrophic type, and usually 5 follicles are formed in each ovariole. The number of the follicles does not increase with age of the weevil, but is formed in the early stages of the adult.

Both the developing eggs and the fully formed eggs are found even in the old weevil, but as the weevil grows still older, the follicles of the distal region undergo disintegration.

It may be concluded that the ovary is functional for the most part of the adult life of the weevil.

MUTANTS OF *ESCHERICHIA COLI* WHICH ARE DEFECTIVE IN DNA SYNTHESIS

H. G. NANDADASA

(Department of Biology, Vidyodaya Campus, University of Ceylon)

A large number of mutants of *E. coli* has been isolated, using different techniques, which show conditional DNA synthesis. Most of these mutants synthesise DNA normally at 30°C but not at 40°C. They appear to be defective, at the high temperature in different processes involved in the replication and segregation of the chromosome.

These mutants can be classified into several groups according to the abberations they show at high temperature and according to the map positions of the mutated loci in the chromosome.

Some mutants when shifted from 30°C to 40°C, stops DNA synthesis immediately, while others show some residual synthesis before the DNA synthesis comes to a halt. There is sufficient evidence to show that some mutants of the latter type are defective in the initiation of DNA replication although they can complete already initiated cycles of DNA replication.

In temperature-sensitive DNA mutants the increase in cell mass is not accompanied by formation of septa, at the restrictive temperature. Consequently these cells form snake like filaments. However, in some of these mutants, a second mutation can occur leading to the resumption of septum formation. Since in these cells DNA synthesis does not occur at high temperature, cellular division results in the production of DNA less bacteria.

CHROMOSOME REPLICATION OF *ESCHERICHIA COLI* UNDER THE CONTROL OF THE SEX FACTOR F.

H. G. NANDADASA

(Department of Biology, Vidyodaya Campus, University of Ceylon)

The sex factor F of *E. coli* is an extrachromosomal DNA ring of about 1/50th the size of the chromosome. In the cell division cycle the sex factor also replicates and segregates like the chromosome.

However, the, replication of the chromosome and the F factor appear to be controlled independently since replication of either the chromosome or the sex factor can occur in the absence of the replication of the other.

In some strains, the F factor can intergrate into the chromosome as a result of a recombinational event, to form stable unions (Hfr cells). In these cells the autonomous replication of the F factor is lost; which now replicates passively as a part of the chromosome.

In temperature sensitive mutants which are defective in initiation of the chromosome replication, the F factor replication takes place normally even at high temperature. In these mutants, integration of the F factor into the chromosome can suppress the mutant phenotype. Cells of such integrated srains can replicate the chromosome and grow at 40°C even though they still carry the initiation defective mutation.

It is believed that in these Hfr strains the initiation system of the chromosome is still defective at 40°C while that of the F factor is normal. Since the chromosome is attached to the F factor, the whole chromosome now replicates as a part of the F factor.

THE EFFECT OF DIFFERENT TYPES OF PAPER ON FEEDING AND GROWTH IN THE SILVERFISH, *CTENOLEPISMA LONGICAUDATUM* ESCHERICH AND *ACROTELSA COLLARIS* (F.) (THYSANURA: LEPISMATIDAE)

W. W. D. MODDER

(Department of Zoology, University of Ceylon, Peradeniya)

Pre-starved and freshly moulted silverfish were confined singly on representative paper samples (filter, tissue, writing, drawing, cartridge, ledger, art, glassine) and on filter paper impregnated with a commercial milk food. Every two days the weights of the live silverfish, paper eaten, and faeces, were obtained using a micro-balance. Control paper, and faecal, samples were weighed concurrently.

No significant differences in the quantitative aspects of feeding and moulting were observed between the species or sexes.

Each stadium was found to consist of a feeding period followed by a non-feeding period. Feeding periods, but not non-feeding periods, were related to stadial duration. Stadial and feeding durations (42 ± 1 and 29 ± 1 days) were not statistically different on any of the untreated papers. However, on the milk food these were significantly shorter (27 ± 2 and 18 ± 2 days). More frequent moulting on milk food paper indicates its nutritional superiority to the untreated papers.

In contrast, non-feeding periods were not significantly different on any of the papers including milk food (12.0 ± 0.4 days). The non-feeding period apparently constitutes a physiological preparation for the moult, which is independent of feeding regime.

The weights of the different papers ingested per unit body weight were not statistically different, except that significantly more art and milk food paper were eaten. These coated papers are probably more easily scraped by the insects' mouth parts.

The mean coefficients of digestibility for the papers used were in the range 63 – 75%.

The silverfish lost weight on all the papers, including milk food paper.

CHROMOSOME STUDIES ON THE CEYLON LILIACEAE, AMARYLLIDACEAE AND HYPOXIDACEAE

SEETHA KULATUNGA, M. D. DASSANAYAKE

and

K. THEIVENDIRARAJAH

(Department of Botany, University of Ceylon, Peradeniya)

The chromosome numbers of 28 of the 31 Ceylon species of these families were determined. 17 of these appear to be new records. *Urginea rupicola,* the only endemic species, *Ophiopogon intermedius* and *Scilla hyacinthina* are tetraploids, while *Crinum latifolium* is triploid. *Allium hookeri* (2n = 22) has a chromosome number which sets it apart from other *Allium* species, which have 7, 8 or 9 as the basic number. *Gloriosa superba* and *Chlorophytum-laxum* are reported to have 2n = 22 or 88 and 14 respectively,

but the specimens examined had 2n = 24 and 16 respectively. In the latter species chromosome abnormalities were observed in the pollen mother cells at meiosis. At diakinesis and metaphase I most pollen mother cells had 8 II, but some had 7 II and 2 I, and at anaphase I chromosome bridges were observed in a few pollen mother cells. These abnormalities may be related to the fact that the basic number for the genus *Chlorophytum* is 2n = 14.

PREDATORS OF FLYING FISH *HIRUNDICHTHYS CORO-MANDELENSIS* HORNELL AND ITS SUITABILITY AS A BAIT FISH

J. JINADASA

(Forest Department, Colombo 2)

Local flying fish fishery of the east coast of Ceylon, around Trincomalee operates from May to July. During this period a very high concentration of other varieties of fish like the Yellow fintuna *(Thunnus albacares)*, Skipjack *(Katsuwonus pelamis)*, Mackeral tuna *(Euthunnus affinis)*, Frigate mackeral *(Auxis thazard)*, Sier *(Scomberomorus sp)*, Dolphin fish *(Coryphaena hippurus)*, and Sharks *(Carcharhinus sp)* are a common occurrence. Some of these varieties trace the fishing boats operated for flying fish and prey on spawning flying fish. The analysis of the stomach contents of these fish showed a large numbers of flying fish eaten as food. Bait trials carried out on surface trolling, tuna long-lines showed good results. The foreign exchange that could be saved by utilizing local flying fish as a bait fish instead of imported bait fish Saury *(Colalabes saira)*, economics of the local flying fish fishery are also considered.

NATURAL HAZARDS IN CEYLON A GEOGRAPHICAL POINT OF VIEW

K. U. SIRINANDA

(Department of Geography, University of Ceylon, Colombo)

Investigations into natural hazards in Ceylon are few and far between and have taken a simplistic view of human behaviour in situations of stress, the wide interest in mitigating damage and disruption caused by natural hazards notwithstanding. Almost

every year one natural hazard or another strike one part of Ceylon or another; among them weather induced phenomena are particularly damaging. A basic pre-requisite for the minimization of the impact of adverse environmental conditions on the economy and society is a proper understanding of these hazards. This in turn presupposes the availability of more and better information on the spatial pattern of their incidence, frequency and magnitude, on the one hand and the human perception of and adjustment to these hazards, on the other.

In this paper an attempt is made to (a) outline the broad spatial pattern of natural hazards in Ceylon, and (b) evaluate the perception of and human adjustment to drought conditions.

SOME ASPECTS OF GRAPHITE PROSPECTING IN SRI LANKA

V. V. C. RANASINGHE

and

D. B. PATTIARATCHI

(Geological Survey, Colombo 2)

Mining of graphite in Sri Lanka has been going on over the last 150 years or so and up to recently prospecting was largely by the 'hit and miss' method. In this paper the prospecting methods now been used by the Geological Survey Department are presented and the case histories of those investigated at Siyambalawela, Pinnalanda and other areas are discussed. The future programme of prospecting for graphite is outlined.

GERMINATION AND SEEDLING STRUCTURE IN *BORASTUS FIABELLIFER* AND OTHER PALMS

M. D. DASSANAYAKE

and

B. SIVAKADACHCHAM

(Department of Botany, University of Ceylon, Peradeniya)

The cotyledon forms the bulk of the mature embryo of *B. flabellifer*, and the plumule and radicle are situated distally in the axis of the embryo. Germination is of the type known as 'remotive'.

The cotyledonary stalk elongates and grows downwards into the soil to a depth of 20 -- 40 cm., carrying the plumule and radicle at its tip, and burying the seedling at this depth. The first leaf is a scale leaf, which forms the edible part of the seedling, known as "panang kelangoo". The remotive type of germination occurs in a number of palm genera mostly belonging to the sub-families Borassoideae and Coryphoideae, and there appears to be a relation between this type of germination and the structure of the embryo.

FLORA OF THE THONDAIMANNAR LAGOON

K. S. KUGATHASAN, K. RATNASABAPATHIPILLAI

and

V. PONNAMPALAM

(Hydro-Biological Survey Research Council, Karaveddy)

A survey of the flora along the lagoon was made and species catalogued. The general nature of the flora (vegetation) is discussed.

REPORT ON THE COMPARISON OF THE FLORA OF AN UNDISTURBED AND A BURNT AREA

K. S. KUGATHASAN, K. RATNASABAPATHIPILLAI

and

V. PONNAMPALAM

(Hydro-Biological Survey Research Council, Karaveddy)

The effect of fire on vegetation, colonization by new plants, succession of plants were observed over a period of one year and recorded. Our observations strongly suggest that the scrub jungles of Jaffna would yield more grazing grounds through controlled burning and could be maintained for long periods through controlled grazing.

OCEANOGRAPHIC FACTORS OF THE COASTAL WATERS OFF TRINCOMALEE

J. JINADASA

(Forest Department, Colombo 2)

The surface temperatures of coastal waters showed an increase towards off shore area, throughout the year. The temperature reaches a peak in April/May and in November. The low temperature was observed in February and August/September. The salinity of the surface waters showed a declining trend towards the off shore waters, throughout the year. The peak salinity was observed in August/September only. The rainfall over the coastal belt in this area is generally poor until about July after which there is a rapid increase until the end of the year. The wind speed, air temperature of this particular coastal belt, recorded high values from May to July. The turbidity of the coastal waters showed a rapid decline towards the off shore waters. The plankton production appears to become high during the period June to October.

THE DROUGHT IN YALA AND ITS EFFECT ON WILD LIFE DISTRIBUTION

DODWELL P. DE SILVA

(Cement Paints (Ceylon) Ltd., Ratmalana)

The Yala National Park, which lies in the Southern dry zone receives only about 30 to 40 inches of rain every year. This monsoonal rain is not uniformally distributed throughout the year and long spells of drought are regular occurrences. During the drought water is scarce and thereby becomes the limiting factor governing the pattern of wild life distribution.

The clayey soil type found in Yala favours lateral drainage and the rain-water collects in water holes which range in type and size from small rock pools to large tanks. The smaller pools dry up during the drought and only the larger tanks are able to retain water throughout the year. Some of these large tanks are situated very close to the sea and their water is brackish.

Samples of water were collected during the drought and the monsoon season from all the water holes and tanks and chemically analysed for their salinity.

The results showed that the brackishness of water increased with the progress of the drought. At the peak of the drought the water became distinctly saline and unpalatable. A condition of "physiological drought" is therefore reached long before the tanks are completely dry. This triggers off the early migration of animals away from the park towards the river basin areas.

The results also established that the water from these brackish tanks became palatable only after heavy rainwater dilution.

A METHOD OF EVALUATING AND MAPPING THE TOPOGRAPHICAL VARIATION OF SOLAR RADIATION AND ITS APPLICATION TO CEYLON

B. K. Basnayake

(Geography Department, University of Ceylon, Peradeniya)

It is standard meteorological practice to measure solar radiation on the horizontal, although it is well known that the solar radiation received on a neighbouring slope can be very different in amount. Recently, practical methods for calculating and mapping the variability of solar radiation on different slopes have been developed and successfully applied (Garnier, B. J. & Ohmura, A., 1970).

While it is a commonplace that the aspect of a slope is an important consideration in the climatology of polar and mid-latitude lands, the importance of this factor in tropical countries has only recently been investigated (Geiger, R., 1969). The author's work in Barbados (Basnayake, B. K., 1972) has demonstrated that existing topographical variability of solar radiation in low-latitudes is large enough to be of possible significance to meteorology, and to other relevant applied fields such as biology and agriculture.

The methodology of the calculation and mapping of the topographical variability of solar radiation is discussed, together with the relevant mathematical equations. A computer programme in FORTRAN, which may be used to perform the required calculations, is presented. Examples of completed maps of a selected area of the Ceylon hill-country are given.

References

Basnayake, B. K. (1972) Topography and solar radiation in Barbados. McGill University Ph.D. Thesis (Unpublished).

Garnier, B. J. and Ohmura, A. (1970) The evaluation of surface variations in solar radiation income. *Solar Energy*, **13**, 21–34.

Geiger, R. (1969) Topoclimates. World Survey in Climatology (H. E. Landsberg, ed.) **2**, 105–138.

GRANULITES OF CEYLON – METAMORPHIC TEMPERATURES

D. J. A. C. Hapuarachchi

(Geological Survey Department, Colombo)

Possible metamorphic temperature limits for hornblende and biotite-bearing granulites (garnet-biotite and cordierite divisions of the bornblende-granulite subfacies) and for hornblende and biotit-free granulites (pyroxene-granulite and garnet-diopside-quartz subfacies) are inferred from the distribution of magnesium and ferrous iron in coexisting clino – and orthopyrosenes in a method given by Kretz, 1963. The distribution coefficient with reference to Mg – Fe^{2+} exchange is defined and its values for pyroxene-pairs from different Ceylon rock types are given and the temperatures are deduced from those values. For the former rocks the temperature range is 620° C to 725°C and for the latter temperatures range from 700°C to 840°C.

For the hornblende-granulite subfacies in the Adirondacks, Buddington has estimated possible metamorphic temperature limits, deduced from compositions of coexisting iron-titanium oxide phases, as 600°C to 665°C (Turner, 1968, p. 330). For the Indian charnockite series, R. A. Howie has estimated temperatures of 650°C and 750°C (Kretz, 1963).

References

Kretz, R. (1963) Distribution of magnesium and iron between orthopyroxene and calcie pyroxene in natural assemblages, *J. Geol.*, **71**, 773 – 785.

Turner, F. J. (1968) Metamorphic Petrology, McGraw-Hill, New York.

A CLASSIFICATION OF THE NORTHERN (JAFFNA) COASTS

P. PUVANARAJAN

(Department of Geography, University of Ceylon, Colombo Campus)

The Jaffna Peninsula has an extensive coast running to about 140 miles, facing the Palk Strait, Bay of Bengal and the Jaffna Lagoon. The coast is remarkably uniform and straight with the general absence of deep indentations. The absence of indentations together with recent sands, spits, mudflats and corals has, in addition to providing variety to its coasts, has impeded the formation of natural harbours. However, there are spots on the northern coastal stretch at Kankesanturai, Valvettiturai and Point Pedro which are used as harbours of a limited nature.

Within this 140 miles of coastal stretch there appears to be a variety of coastal types which could be attributed to the geological history, the different processes in operation and thus to the resultant coastal forms.

Based on detailed field observations an attempt is made in this paper to classify the northern coasts and show the contrasts among the types found.

DRAINAGE BASIN CLUSTERS IN THE CENTRAL HIGHLANDS OF SRI LANKA

C. M. MADDUMA BANDARA

(Department of Geography, University Campus, Peradeniya)

Dissection characteristics of a sample of 84, fourth-order drainage basins, selected from the south central parts of the highlands of Sri Lanka, were analysed with the aid of some multivariate statistical methods.

The choice of these localities was based on several considerations:

(a) they provide a representative cross section of the regional hydrometeorological continuum,

(b) availability of recently published Ceylon Five Inch Maps,

(c) availability of a dense network of rain gauges and the existence of a fairly uniform vegetative cover, i.e. tea plantations.

All the morphometric parameters were derived from Ceylon Five Inch Maps. The reliability of these maps for this purpose was checked by Air Photographs and field investigations.

Three statistical methods proved to be especially useful in the analysis of morphometric data: (1) Principal Component Analysis (2) Cluster Analysis (3) Multiple Discriminant Analysis. Since the 2nd and 3rd methods are more widely used in biological sciences than in earth sciences, for purposes of these tests, drainage basins are viewed as individuals or 'species' possessing distinct morphological characteristics, in terms of which similarities and grouping tendencies among them could be studied.

Results of these tests strongly suggest the existence of three distinct clusters of drainage basins in the study area, named by the writer as 'Watawala genera', 'Kotagala genera' and 'Welimada genera'. It is believed that this grouping tendency reflects some form of adaptation to the environment in which they are found. Thus, a hypothesis is proposed to explain the spatial distribution of these clusters in terms of the regional distribution of rainfall intensity characteristics.

EFFECTIVE PRECIPITATION AND DRAINAGE DENSITY

C. M. MADDUMA BANDARA

(Department of Geography, University of Ceylon, Peradeniya Campus)

Drainage density, defined as the ratio of cumulative channel segment lengths within a drainage basin to the basin area, is considered by most geomorphologists as an important diagnostic characteristic of landscapes developed under fluvial climatic conditions. Since the work of Horton in 1945, several geomorphologists have made attempts to explain the factors controlling this complex geohydrologic phenomenon. One of the most important findings was made by Melton (1958) who demonstrated that drainage density has a significantly high *negative correlation* with Thornthwaite's (1931) P/E Index. Melton (1958) interpreted this as a result which shows the efficacy of the natural vegetative cover in controlling the erosional processes.

Recently, the writer has made a similar attempt to study this relationship between effective precipitation and drainage density in the central hills of Sri Lanka. Thus drainage density measurements were made in 24 drainage basins, and P/E Indices were computed for all rain gauging stations located in the immediate vicinity of these basins. When these values were plotted on log-paper they exhibited a highly significant *positive relationship*.

This result when considered in combination with Melton's finding, clearly indicates that above a certain critical level of effective precipitation the relationship between drainage density and P/E Index becomes positive. This conclusion is in agreement with the results of recent work by Langbein and Schumm (1958) and Hadley and Schumm (1961), who demonstrated that sediment yield reaches a maximum under grassland conditions, and possibly reach another peak where the impeding effect of vegetation cannot be increased by further increase of precipitation.

SOME TECHNIQUES ADAPTABLE FOR APPLICATION IN HYDRO-GEOLOGICAL INVESTIGATIONS IN CEYLON

K. KULARATNAM

(Department of Geography, University of Ceylon, Colombo Campus)

This Paper is the result of studies of techniques described at various I.H.D, I.A.S.H. and other conferences abroad, attended recently by the present writer. It highlights some inexpensive, but efficient methods and instrumentation suitable for use in Ceylon.

Reference is made to the following in particular:

1. Observations on river basins in relation to river regimes and man-made cultural changes due to deforestation, agriculture, industry, human settlement planning, chena (slash and burn) etc.

2. How to handle problems due to variables in precipitation intensity changes in time and space, methods of interpolation and extrapolation, the required precautions, problems of heat balance, heat exchange and evaporation, problems of infiltration due to geological and pedological characteristics of the terrain, slope exposure and reflecting capacity of different lithological surfaces, etc.

3. The instrumental corrections for the inaccuracy of precipitation measurements, pluviographs and telemetric instruments for continuous records.

4. Various types of evaporometers and evaporotranspirometers.

5. Self-regulating infiltrometers for ground water discharge perfected in India.

6. For the estimation of soil moisture and soil moisture movement, the thermogravimetric method has now been superceded by such techniques as electrometric, neutron-scattering, radiometric, tensiometric etc.

7. The electrical water-table probe, piezo-meters and pneumatic gauges for ground water studies are also described.

8. As regards run-off, new types of current meters and hydrometric structures are considered.

9. For discharge measurements new methods and improvements in the use of tracer salts, dyes and radio-isotopes are discussed. Others are ultrasonic and compressed air methods, thermal methods, geomagnetic, perforated tube and air bubbles, electromotive force measurement, etc. The graduated rod used in India for low discharges in small rivers commends itself for use in Ceylon. Other more sophisticated instruments becoming useful are analogue to digital water-level recorders, binary decimal transmitter, etc. but Sri Lanka's foreign exchange position stands in the way of their importation, except as gifts.

10. Sediment measurements, both for studying erosion as well as evaluation of, duration of and silting in reservoirs, also receives some attention in relation to local conditions.

INTENSITY, DURATION AND PERIOD OF OCCURRENCE OF WATER DEFICIT (DROUGHT) CONDITIONS IN SOME DRY ZONE STATIONS

K. U. SIRINANDA

(Department of Geography, University of Ceylon, Colombo Campus)

Drought or water deficit conditions afflict a large part of Ceylon, especially those areas traditionally referred to as the dry zone of Ceylon. The water deficit conditions in the dry zone can be evaluated in terms of several parameters, viz., the duration, intensity, period of occurrence and their spatial and temporal variations.

In this paper an attempt is made to identify regional variations of the period of water deficiency and to examine the relationship between the duration and intensity of water deficiency conditions in several dry zone stations. It is apparent from the spatial patterns that there is a general tendency for both the intensity and the duration of water deficiency to increase away from the area of water surplus in the south-central region. This feature is discussed at length.

THE TALAGODA PEGMATITE

D. B. PATTIARATCHI

(Geological Survey, Colombo 2)

The Talagoda deposits of felspar occur in a pegmatite cutting across Precambrian rocks which include crystalline limestones and charnockites. The pegmatite is zoned and has a core of vein quartz bordered by a felspar and mica bearing zone; and the margins with the bedrock are graphic granite. Allanite occurs on the margins of the vein and it has been formed by the interaction of the fegmatite material with the country rocks. The Talagoda pegmatite is of the 'intrusive' type and the shape of the pegmatite body is a large 'boudin' and the problems involved in prospecting this type of deposit are discussed.

SOCIO - ECONOMIC STUDY OF SOME *PURANA* VILLAGES IN THE KALA OYA BASIN, ANURADHAPURA DISTRICT

H. N. C. FONSEKA

(Department of Geography, University of Ceylon, Colombo Campus)

A socio-economic survey was undertaken during the past few months to ascertain the present agrarian situation and problems and peasant attitude to cultural change in two groups of *purana* villages on the right bank of the Kala Oya: (i) Palugaswewa – Kele Amunukole (ii) Ihala Hammillewa – Ipalogama – Pahala Hammillewa.

Information was sought on farm size, land tenure and fragmentation; irrigation and land use; cultural practices and farm labour force; production and income; credit and indebtedness; expenditure and consumption patterns and service institutions.

Certain trends and problems which have emerged from the analysis of the data collected will be discussed in the paper.

SECTION E : PHYSICAL SCIENCES

(Chemistry Lecture Theatre)

Wednesday, 13th December:

8.00 .. Properties of tea polyphenoloxidase – K. P. W. C. Perera and R. L. Wickremasinghe.

8.20 .. Tracer studies on the biosynthesis of theanine in the tea plant – K. Sivapalan.

8.40 .. Polar lipids of the leaves and seeds from the tea plant *(Camellia sinensis L.)* – G. R. Roberts.

9.00 .. Some observations on the nature of catechol oxidase in tea leaves – G. R. Roberts.

9.20 .. The effect of ultraviolet radiations on yeasts isolated from fermented saps of Palmyrah (Py) *(Borassus flabellifer)*, Coconut (Cy) *(Cocos nucifera)* and Kitul (Ky) *(Karyota urens)* – P. Jayatilake and S. Sentheshanmuganathan.

9.40 .. Calculation of activation energy of movement of point defects in CaF_2 – K. Tharmalingam.

10.15 .. Extraction constant of the pyridine adduct of titanylsalicylate in chloroform – R. S. Ramakrishna and H. D. Gunawardena.

10.35 .. The Vanadium (IV) – Citric acid system and its reaction with Al^{3+} and $Cr.^{3+}$ – R. S. Ramakrishna, T. P. Wijesekera and M. Kanagaratnam.

1.30 .. A portable laboratory thermal neutron facility: construction, calibration and uses – Dhammika de Silva, K. G. Dharmawardena, P. P. G. L. Siriwardena and K. Svoboda.

1.50 .. Use of Mossbauer effect to study kinetics of solid state reactions – K. G. Dharmawardena.

2.10 .. Dispersion of electro-magnetic waves in a plasma – M. W. C. Dharmawardana.

2.30 .. A Quantum mechanical method to calculate potential energy of π–electrons in conjugated polyenes – W. Mallawaarachchi and D. S. Jayasuriya.

3.30 .. PRESIDENTIAL ADDRESS: A CHEMIST'S TALE OF SPICE AND FLAVOUR – R. O. B. WIJESEKERA *(Physics Theatre)*.

4.15 .. BUSINESS MEETING.

Thursday, 14th December:

8.00 .. Some observations on post-prune growth of the tea plant – K. Sivapalan (Jointly with Section B) *(Chemistry Theatre)*.

8.20 .. The feasibility of producing oil and saponins from tea seeds on a commercial scale – U. L. L. de Silva and G. R. Roberts (Jointly with Section B) *(Chemistry Theatre)*.

8.40 .. Physico-chemical data on some Ceylon fruit juices (Part II) – P. E. Dias and K. S. Kularatne.

9.00 .. Some effects of tea and coffee on the serum lipid levels of rat – C. C. Mahendra, S. Sentheshanmuganathan, W. P. A. Perera and R. L. Wickremasinghe (Jointly with Section A) *(Physics Theatre)*.

9.00 .. Studies on Ceylon essential oils and spices (Part V) The constituents of cinnamon bark oil – R. O. B. Wijesekera and A. L. Jayewardene.

9.20 .. Studies on Ceylon essential oils and spices (Part VI) Preliminary studies on the 'Chemical races' of citronella by gas liquid chromatographic analysis – S. Ponnuchamy, A. L. Jayewardene and R. O. B. Wijesekera.

10.00 .. MICRO-ORGANISMS AS CO-ORDINATION CHEMISTS – A. W. JOHNSON (Jointly with Section D) *(Chemistry Theatre)*.

1.30 .. Isolation and partial structures of six new triterpenoids from *Trichadenia zeylanica* Thw. (S. Tolol, Titta) Flacourtiaceae – S. P. Gunasekera and M. U. S. Sultanbawa.

1.50 .. Extractives of *Hydnocarpus venenata* Gaertn. (S. Makulu) Flacourtiaceae – S. P. Gunasekera and M. U. S. Sultanbawa.

2.10 .. Extractives of *Calophyllum cuneifolium* Thw. Guttiferae – S. S. Selliah and M. U. S. Sultanbawa.

2.15 .. Fine structure of the turbulent boundary layers – M. A. V. Devanathan and Vinodhini Guruswamy (Jointly with Section C) *(King George's Hall)*.

2.30 .. Extractives of *Artocarpus nobilis* Thw. (S. Wal del) Moraceae – G. Subramaniam and M. U. S. Sultanbawa.

2.50 .. The effect of dolomite on compressive strength and sulphate resistance of Portland cement – R. B. Elkaduwa and H. W. Dias.

Friday, 15th December:

8.00 .. Isolation and characterization of some triterpenoid acids from the resins of *Dipterocarpus hispidus* Thw. (S. Buhora) *Dipterocarpus zeylanicus* Thw. (S. Galhora) and *Doona congestiflora* Thw. (S. Tiniya) – S. P. Gunasekera, S. Sotheeswaran and M. U. S. Sultanbawa.

8.20 .. Extractives of *Garcinia echinocarpa* Thw. (S. Madol) Guttiferae – S. S. Selliah, M. U. S. Sultanbawa and W. D. Ollis.

8.40 .. Extractives of *Madhuca nerrifolia* (Thw.) H. J. Lam (S. Ganmi) Sapotaceae – P. A. Gunatillake and M. U. S. Sultanbawa.

9.00 .. Faradaic rectification at radio frequencies (Part I) Instrumentation for Faradaic rectification studies in the frequency range 100 KHz to 15 MHz – I. F. Le Mercier, Susima Abeyagunawardene and M. A. V. Devanathan.

(9.15) .. Studies on rate of ion exchange in 'organically fouled' resins – S. Perasiriyan (Jointly with Section C) *(King George's Hall)*.

9.20 .. Faradaic rectification at radio frequencies (Part II) Determination of the rate constants of (1) Ferricyanide ferrocyanide *and* (2) Ferric ferrous redox reactions – Susima Abeyagunawardene and M. A. V. Devanathan.

9.40 .. Development of a new analytical instrument; the Votator electrode system – M. A. V. Devanathan and Vinodhini Guruswamy.

(10.00) .. Ribosuria in viral diseases – J. E. J. Aiyathurai, Shiransi Thalgahagoda, D. F. Kuruppu and S. Sentheshanmuganathan (Jointly with Section A) *(Physics Theatre)*.

10.15 .. Strictavine: a new alkaloid from *Rhazya stricta* – K. T. D. de Silva and G. N. Smith.

(10.20) .. Methods for estimation of aflatoxins in coconut products – U. Samarajeewa and S. N. Arseculeratne (Jointly with Section A) *(Physics Theatre)*.

10.35 .. Screening of some indole alkaloid producing plants for the occurrence of biogenetically significant compounds – K. T. D. de Silva and Sunethra Kaluarachchi.

1.30 .. Extractives of *Calophyllum walkeri* Wight and *Calophyllum pulcherrimum* Wall, Guttiferae – M. Dahanayake, R. Somanathan and M. U. S. Sultanbawa.

1.50 .. Extractives of *Mesua ferrea* L. (Form. *M. Salicina* Pl. & Tri) Guttiferae – S. Ramachandran, S. S. Selliah and M. U. S. Sultanbawa.

2.10 .. Preparation of N-acetyl – trans – 1 – R, 3-methoxy-carbonyl 1,2,3,4, tetrahydro – β – carbolines – K. T. D. de Silva.

2.30 .. Development of natural rubber – Portland cement mixes for practical applications – M. Nadarajah and Hemal Pieris.

2.50 .. Use of natural rubber latex – urea formaldehyde resin blends as adhesives for plywood – W. G. Weeraratne, D. A. R. Eliyatamby, U. P. P. Amarasinghe, N. Liyanage and M. Nadarajah.

Saturday, 16th December:

8.00 .. The quality of the X-ray image in diagnostic radiology – P. L. T. Fernando.

8.20 .. Recovery of alkali from black liquor by electrolysis – Vinodhini Guruswamy.

8.40 .. A quality control technique for boron treated wood – K. G. Dharmawardena, P. P. G. L. Siriwardena, K. Svoboda and L. K. G. Wickramasinghe.

9.00 .. Isolation of magnesium salts from sea-water as preliminary step of the metallurgy of magnesium – H. W. Goonatillake and H. W. Dias.

9.20 .. A method for the extraction of titanium dioxide from ilmenite – W. M. D. Wijekoon and H. W. Dias.

9.40 .. An inexpensive water clock – G. P. P. Gunaratne

10.00 .. Acoustic measurements to determine the percentage composition of fluid milk – M. P. Wesenti-Pulle.

PROPERTIES OF TEA POLYPHENOLOXIDASE

K. P. W. C. Perera *and* R. L. Wickremasinghe

(Tea Research Institute, Mid-Country Station, Kandy)

Polyphenoloxidase plays an important role in black tea manufacture, and the properties of this enzyme in relation to tea manufacture are described. The enzyme shows optimal activity in the range pH 5.6 to 6.2 (Gregory & Bendall, 1966). The molarity of the reaction medium affects polyphenoloxidase activity, and was found to be optimal at 0.05 to 0.1. The period of withering has no effect on enzyme activity, but there is a progressive fall as the period of fermentation is extended. The latter effect is due partly to inhibition of the enzyme by the products of oxidation, and partly to the decrease in pH. The products of oxidation of individual and mixed flavanols isolated from tea leaves are described. The addition of amino-acids to the flavanol mixtures exerted a profound effect on the formation of theaflavins and thearubigins. Studies of the effect of substrate concentration showed that there was an optimal level for theaflavin production.

Reference

Gregory, R. P. F. and Bendall, D. S. (1966) The purification and some properties of the polyphenol oxidase from tea *(Camellia sinensis* L.). *Biochem. J.*, **101**, 569 – 574.

TRACER STUDIES ON THE BIOSYNTHESIS OF THEANINE IN THE TEA PLANT

K. Sivapalan

(Tea Research Institute, Talawakele)

Theanine (γ glutamyl ethylamide) is the most predominent amino acid in the tea plant, and can be extracted from the non-protein fraction of leaves and roots in large amounts. The biosynthesis of theanine in tea seedlings has been reported (Sasaoka *et al.*, 1962) and an enzyme which catalyses the synthesis of theanine from L-glutamic acid and ethyl amine in the presence of ATP has been isolated (Sasaoka & Kito, 1964). Studies on the incorporation

of $14CO_2$ into theanine in tea plants suggested that the site of biosynthesis of this amino acid was in the roots (Perera & Wickremasinghe, 1971).

The present investigation was undertaken to confirm the exact site of synthesis of theanine and to determine the relative contribution of other sites if any. Labelled L-glutamic acid was fed to excised parts of the tea plant, and samples were processed after three days. Autoradiography of the amino acid fraction and determinations of total and specific activities revealed that

(1) Feeder root is the preferred site of theanine synthesis;

(2) Theanine synthesis could take place in the large roots to about 25 per cent of that in feeder roots;

(3) Other parts of the plant do not appear to be capable of synthesizing theanine.

References

Perera, K. P. W. C. and Wickremasinghe, R. L. (1971) Role of theanine in tea manufacture, *Proc. Cey. Ass. Adv. Sci.*, **(1)**, 80.

Sasaoka, K. and Kito, M. (1964) Biosynthesis of theanine by tea seedling homogenate, *Agr. Biol. Chem.*, **28,** 313–17.

Sasaoka, K., Konishi, S. and Inagaki, H. (1962) Biosynthesis of theanine in tea seedlings, *Agr. Biol. Chem.*, **26,** 265–6.

POLAR LIPIDS OF THE LEAVES AND SEEDS FROM THE TEA PLANT (CAMELLIA SINENSIS L)

G. R. Roberts

(Tea Research Institute, Low Country Station, Ratnapura)

Polar lipids have been reported to play a role in regulating the membrane activity of plants. The lipids of tea leaves and seeds were extracted with iso-propanol. The extract was concentrated and partitioned with chloroform: Methanol (2:1) (Folch *et al.*, 1957) and purified on silicic acid columns. The extract was separated into individual compounds on thin layer plates coated with silica. Eight polar lipids were separated and two of them identified by

their colour reactions. Comparative semi-quantitative estimation of the lipid content of young leaves, mature leaves and seeds has been carried out.

Reference

Folch-Pi, J., Lees, M. and Stanley, G. H. S. (1957) A simple method for the isolation and purification of total lipids from animal tissues, *J. Biol. Chem.*, **226,** 497–509.

SOME OBSERVATIONS ON THE NATURE OF CATECHOL OXIDASE IN TEA LEAVES

G. R. Roberts

(Tea Research Institute, Low Country Station, Ratnapura)

The catechol oxidase enzyme system plays a vital role in the oxidation reactions taking place during tea manufacture. The enzyme was assumed to be insoluble or particle bound until Sanderson (1964) found that catechol oxidase was, in reality, a soluble enzyme that was readily precipitated by polyphenols. The enzyme activity can be solubilised even from acetone powders if sufficient polyclar AT is added to remove the polyphenols. Treatment with lipid solvents and detergents is used to show that unlike some other polyphenol oxidases, tea catechol oxidase is not latent or lipid bound and thus freely available for the reactions taking place during tea manufacture.

Reference

Sanderson, G. W. (1964) Extraction of soluble catechol oxidase from tea shoot tips. *Biochemi. Biophys. Acta.*, **92,** 622–624.

THE EFFECT OF ULTRAVIOLET RADIATIONS ON YEASTS ISOLATED FROM FERMENTED SAPS OF PALMYRAH(Py) *(BORASSUS FLABELLIFER)*, COCONUT (Cy) *(COCOS NUCIFERA)* AND KITUL (Ky) *(KARYOTA URENS)*

P. JAYATILAKE

(Department of Biological Sciences, University of Ceylon, Vidyodaya Campus, Nugegoda)

and

S. SENTHESHANMUGANATHAN

(Department of Biochemistry, Medical Research Institute, Colombo 8)

Ultra-violet radiations (from 200 mμ to 400 mμ) have a profound effect on micro-organisms (Rose, 1961). The effect is either lethal or mutagenic.

Experiments were carried out with the yeasts isolated from the fermented saps of Palmyrah, Coconut and Kitul (Liyanage & Senthe Shanmuganathan, 1970), in order to obtain a strain which would give a higher yield of alcohol or cells than the unirradiated strain with the same substrate concentration.

Cells from 24 h. old cultures were irradiated for 10 min. The source of irradiation was a 125 watt Gallenkamp UV light. The dose was measured as time of exposure at a standard distance from the UV source. To measure the effect of different doses of UV radiation, separate samples of the suspensions were irradiated for increasing lengths of time.

Microscopic examination of the irradiated cells revealed that there was no change in their morphology. An increase in the production of alcohol was observed with Py cells incubated in light for 72 h. in fresh growth media; but Cy cells gave an increase when incubation was carried out in the dark. Irradiation however inhibited the production of alcohol with Ky. No appreciable change was noted in growth in all three strains tested.

Investigations are under way to study the mechanisms involved in this type of behaviour.

References

Liyanage, A. W. and Sentheshanmuganthan, S. (1970) Comparative studies of yeasts isolated from fermented saps of palms in Ceylon. *Proc. Cey. Ass. Advmt. Sci.*, (1), 96–97.

Rose, A. H. (1961) *Chemical microbiology*, 2nd ed. London: Butterworths.

CALCULATION OF ACTIVATION ENERGY OF MOVEMENT OF POINT DEFECTS IN CaF_2

K. THARMALINGAM

(Department of Mathematics, University of Ceylon, Colombo Campus)

The Born model of the ionic crystal is used to calculate the activation energy of movement of interstitials and vacancies in CaF_2. We have used the Mott–Littleton (1938) method as developed by Boswarva and Lidiard (1967) to evaluate the energy of the defect crystal. The ground state energies of the defect crystal have been previously calculated by the author. The calculations of the excited state reveal that the activation energy of movement of anion interstitial in CaF_2 is 2.1. e.v. This is in reasonable agreement with the experimental value for this quantity which lies in the range 1 to 2 e.v. A similar calculation reveals that the activation energy of cation interstitials in CaF_2 is 9.7 e.v., but no experimental values are available for this quantity.

The results of calculation of the energy of movement of anion vacancies in this system indicate a very low value (0.26 e.v. in the zero order and – 0.1 e.v. in the first order). The experimental value of this quantity is however in the range 0.5 to 0.9 e.v. Hence, though we have poor quantitative agreement for the energy of movement of anion vacancies, the overall conclusion is that the theory predicts the anion vacancies to be more mobile than the anion interstitials and this is in qualitative agreement with the experimental results.

References

Boswarva, I. M. and Lidiard, A. B. (1967) The energy of formation of Schottky defects in ionic crystals, *Phil. Mag.*, **16**, 107.

Mott, N. F. and Littleton, M. J. (1938) Conduction in polar crystals. *Trans. Faraday Soc.*, **34**, 485–499.

EXTRACTION CONSTANT OF THE PYRIDINE ADDUCT OF TITANYLSALICYLATE IN CHLOROFORM

R. S. RAMAKRISHNA *and* H. D. GUNAWARDENA

(Department of Chemistry, University of Ceylon, Colombo Campus)

Although details of the conditions necessary for the quantitative extraction of TiO^{2+} into chloroform by pyridine in the presence of salicylic acid were reported (Ramakrishna & Gunawardena, 1972), the nature of the extracted species was not precisely determined. This report investigates the role of both pyridine and salicylic acid in the extraction process.

At pyridine concentrations between 10^{-1} M and 1 M the extracted species is shown to have the composition (TiO. SA). py/2. The partition data give a value of 2.05×10^{-8} for K extraction in $CHCl_3$.

Reference

Ramakrishna, R. S. and Gunawardena, H. D. (1972) Use of the titanium (IV) chelate of salicylic acid for a selective absorptiometric determination of titanium. *Talanta (in press)*.

THE VANADIUM (IV) – CITRIC ACID SYSTEM AND ITS REACTION WITH Al^{3+} AND Cr^{3+}

R. S. RAMAKRISHNA, T. P. WIJESEKERA *and* M. KANAGARATNAM

(Department of Chemistry, University of Ceylon, Colombo Campus)

This paper describes a reinvestigation of the behaviour of citric acid as a tridentate ligand with V (IV). The Stoichiometry of this vanadyl chelate has been determined and its U.V. and I.R. spectral data discussed. A high intensity charge transfer band identified at 305 nm has hitherto not been reported.

The change in spectra of vanadyl citrate on reaction with Al^{3+} is shown to be due to ternary complex formation. The decreased reactivity of Cr^{3+} under the same conditions is ascribed to the kinetic inertness of Cr (III).

The significance of the results obtained is discussed with reference to the reported ternary complex formation with other oxometal ions.

A PORTABLE LABORATORY THERMAL NEUTRON FACILITY: CONSTRUCTION, CALIBRATION AND USES

DHAMMIKA DE SILVA, K. G. DHARMAWARDENA, P. P. G. L. SIRIWARDENA *and* K. SVOBODA

(Radioisotope Centre, University of Ceylon, Colombo Campus)

In small laboratories it is impracticable to have a Nuclear Reactor or a Cyclotron as a Neutron Facility. A Portable Thermal Neutron Facility suitable for laboratory experiments such as, Neutron Cross Section Measurements, neutron activation analysis, neutron absorption analysis, production of radioisotopes, hot atom chemistry studies, moisture determination etc. has been designed, constructed and calibrated in our laboratory. Neutrons are produced by a mixture of 5 curies of Plutonium–239 with Beryllium. Pu^{239} emits α – particles which hit the Be^{9} nuclei causing a nuclear reaction during which neutrons are released. These neutrons are thermalized by using paraffin wax moderator which also acts as the biological shield.

The facility consists of two separable parts, the storage unit and the irradiation unit. The source stored in the storage unit when not in use is lowered into the irradiation chamber when necessary. The irradiation chamber is in a paraffin wax drawer which could be pulled out for introducing and removal of the samples. Different paraffin drawers are designed to suit different uses.

The calibration of the neutron facility was done by activating Standard gold foils supplied by the IAEA. The activities of these gold foils were measured against a standard Sn^{113} source provided by the IAEA.

The construction, uses etc. will be discussed with the aid of diagrams.

USE OF MOSSBAUER EFFECT TO STUDY KINETICS OF SOLID STATE REACTIONS

K. G. DHARMAWARDENA *

(Cambridge University Chemical Laboratories)

Mossbauer spectroscopy of iron compounds is based on the resonance absorption of γ – radiation by Fe^{57} nuclei. The presence of impurities does not affect the spectra which are obtained from solid samples and the area under the peaks can be accepted as a measure of the concentration of the corresponding species. This can be used to study the kinetics of solid state reactions specially where the reactants and/or products are unstable towards solution. Some aspects of the kinetics of the solid state reaction;

$$2\,K_2\left[Fe\,(C_2O_4)\,2\,(H_2O)_2\right] + K_2C_2O_4 \rightarrow K_6\left[Fe_2\,(C_2O_4)_5\right]$$

have been studied using this method. The reactant $K_2\left[Fe_2\,(C_3O_4)_2\,(H_2O)_2\right]$ is not available free from $K_2C_5O_4$ and the product is unstable towards solution. The areas under the peaks corresponding to the two species have been used to measure the concentration of each species.

DISPERSION OF ELECTRO-MAGNETIC WAVES IN A PLASMA†

M. W. C. DHARMAWARDANA

(University of Ceylon, Vidyodaya Campus, Nugegoda)

A satisfactory theory of the dispersion and scattering of electromagnetic waves in a plasma is of importance in astrophysics, geophysics, physics of thermonuclear processes as well as in studies on laboratory plasmas. The absorption line profiles and peaks are used to deduce the temperature, composition, etc., of the plasma under study. The existing theory treats the problem

* Present Address: Radioisotope Centre, University of Ceylon, Colombo Campus.

† Supported by the Centre Europeen des calcules atomique et moleculaires, Campus, d'Orsay France.

semi-classically, with various drastic assumptions: the particles in the plasma are assumed to follow classical paths in collision processes; the interaction potentials used are asymptotic approximations to the coulomb potential; exchange scattering and such quantum features are ignored; heavy particles (e.g. protons) are often treated as static.

We make none of these assumptions; a fully quantum statistical approach is developed for a completely general plasma consisting of ions, electrons and neutral species in local thermodynamic equilibrium. By developing a convenient field quantisation procedure we calculate the temperature dependant photon – photon propagator and the two particle density fluctuation propagator. Free – free processes, free-bound and bound-free processes (i.e., photo-absorption and photo-emission), as well as bound – bound processes are taken into account. These include exchange scattering. The calculation of the propagators involves an approximation to the polarisation operator.

The complex refractive index and the generalised susceptibility contain all the relevant physics of the system. An analysis of the expression for the imaginary part of the complex refractive index brings out line broadening due to Doppler, Stark and pressure effects, all coming within the frame work of a single unified theory of the dispersion and scattering of photons by a plasma. Numerical computation using a form of this theory to predict the Lyman – α line profile is being undertaken by Michel Penicaud* at Orsay, France.

A QUANTUM MECHANICAL METHOD TO CALCULATE POTENTIAL ENERGY OF π-ELECTRONS IN CONJUGATED POLYENES

W. MALLAWARACHCHI *and* D. S. JAYASURIYA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

The variation of the potential energy along the length of a polyene chain, according to spectroscopic data, is a periodic curve with the following characteristics:

* In partial fulfilment of doctoral thesis requirement in theoretical physics. University of Paris, South France.

(a) Has two types of maxima, one ($=V_D$) within the double bond, and the other ($=V_S$) within the single bond. ($V_S > V_D$)

(b) Has a period of two C–C bond lengths.

This potential variation has earlier been approximated to a sine curve (Labhart, 1957).

In this method, the potential variation is approximated to a curve of the form;

$Z = A \cos 2X + B \cos X + C$

Z = Potential V_P above $V = O$

$X = n/L.x$, A, B & C are constants.

L = Total length of molecule, n = number of bonds.

x = Co-ordinate along the molecule with one end as the origin.

This approximation is better than a sine curve, because

(a) It represents the exact nature of the potential variation.

(b) It accounts for the difference in C–C bond lengths along the chain.

The energy levels of the systems were derived from E_j° using the elements H_{ij} of the permutation matrix.

Where $H_{ij} = \int_0^L \phi_i \; V_P \phi_j \; dx$

Derivation of ΔE_j where $\Delta E_j = E_j - E_j^\circ$ imposes restrictions to mixing up of quantum numbers. Then an expression for total ground state energy of π electrons of a conjugated polyene, containing bonds was worked out. This expression has additional terms to the one obtained from sine curve approximation. Finally, a few experimental checks will be discussed.

Reference

Labhart, H. (1957) Spectra and bond lengths in long polyenes. *J. chem. Phys.*, **27**, 957–962.

SOME OBSERVATIONS ON POST-PRUNE GROWTH OF THE TEA PLANT

K. Sivapalan

(Tea Research Institute, Talawakele)

In a perennial crop like tea which is subjected to a regular cycle of pruning, the problem of post-prune growth becomes an important consideration. The factors contributing to recovery from pruning therefore deserve special attention. It has been shown that starch, stored in the roots, is the main polysaccharide of the tea plant and that recovery from pruning was accompanied by a decrease in this starch content (Selvendran & Selvendran, 1972).

In the present work, the relative contribution of the stem to recovery from pruning was studied. The fixation of $^{14}CO_2$ by mature brown stems and the conversion to labelled starch is demonstrated. The distribution of activity in the different compounds and the possible movement of label to other parts of the plant were also examined. After bud-break, the young shoots on the stem were seen to carry a fair amount of label. It appears that stem reserves may also be utilized to initiate and support growth of new shoots.

The role of lung-branches during post-prune growth was also investigated. It was seen that the lung supplies labelled substrates to the developing shoots in some of the pruned branches. The movement of labelled assimilates to these side branches was studied more closely.

Reference

Selvendran, R. R. and Selvendran, S. (1972) Changes in the polysaccharides of the tea plant during post-prune growth. *Phytochem.* (In press).

THE FEASIBILITY OF PRODUCING OIL AND SAPONINS FROM TEA SEEDS ON A COMMERCIAL SCALE

U. L. L. DE SILVA *and* G. R. ROBERTS

(Tea Research Institute, Low Country Station, Ratnapura)

The laboratory extraction and properties of tea seed oil and saponins have been described (de Silva & Roberts, 1971). The process of extraction has been studied in greater detail to evaluate the possibility of preparing these products on a commercial scale. It has been found that – (a) Tea seeds may be grown on a commercial scale on abandoned tea lands; (b) the process can be carried out with industrial solvents, and (c) the market for the final products is very restricted but setting up of a small plant will be justifiable if abandoned tea land can be used even to yield a small profit.

Reference

de Silva, U. L. L. and Roberts, G. R. (1971) Extraction and properties of oil and saponins from tea seeds. *Proc. Cey. Advmt., Sci.*, **(1)**, 77.

PHYSICO-CHEMICAL DATA ON SOME CEYLON FRUIT JUICES (PART II)

P. E. DIAS *and* K. S. KULARATNE

(Ceylon Cold Stores Ltd., Colombo 2)

An earlier communication (Kularatne & Dias, 1971) discussed certain physico-chemical properties of Lime, Grapefruit, Passionfruit and Pineapple. This study is extended to Orange *(Citrus sinensis)*, Mandarin *(Citrus nobilis)*, Woodapple *(Feronia elephantum)* and Mango *(Mangifera indica)*.

Physico-chemical properties obtained by analysis were used as parameters to evaluate the fruit content. Variations in fruit contents were calculated as coefficients of variation. The higher the coefficient of variation, the less accurate the parameter as a means of fruit evaluation.

Orange: Variations are lowest for dissolved solids (10.2) and dry matter (11.0) and highest for phosphorus (47.2).

Mandarin: Variations are lowest for dissolved solids (10.9) and dry matter (10.8) and highest for acidity (61.1).

Woodapple: Variations are lowest for dry matter (2.0) and dissolved solids (11.8) and highest for Phosphorus (40.9).

Mango: The variation is lowest for ash (20.0) and highest for acidity (117.7).

Fruits which occur in several varieties exhibit large variations in physico-chemical properties.

Considerable variations occur in the physico-chemical properties of fruits. Hence, no single property could be used as a satisfactory parameter to evaluate the fruit content accurately.

Reference

Kularatne, K. S. and Dias, P. E. (1971) Physico-chemical data on some Ceylon fruit juices. *Proc. Cey. Ass. Advmt. Sci.* **(1)**, 97–98.

STUDIES ON CEYLON ESSENTIAL OILS AND SPICES. PART V: THE CONSTITUENTS OF CINNAMON BARK OIL

R. O. B. WIJESEKERA *and* A. L. JAYEWARDENE

(Section of Natural Products, Ceylon Institute of Scientific and Industrial Research, Colombo 7)

Cinnamon *(Cinnamomum zeylanicum)* bark oil is important in the pharmaceutical and food industries. Its main constituents are cinnamaldehyde (75–85%) and eugenol (15–25%). The other constituents are comparatively minor ones but play an important role in the overall flavour of natural Ceylon cinnamon. There are over 50 compounds present in the oil of which as many as 30 different compounds have been identified by gas liquid chromatography of the oil. These are as follows:

Terpenoids: Hydrocarbons:

α-pinene, camphene, β-pinene, sabinene, Δ^3-carene, myrcene, α-terpinene, α-phellandrene, limonene, γ-terpinene p-cymene, β-caryophyllene, humulene.

Terpenoids: Oxygenated compounds:

α-terpeneol, borneol.

Non terpenoid compounds:

Cinnamaldehyde, eugenol, methyleugenol, cinnamyl alcohol, safrole, benzaldehyde, benzyl benzoate, cinnamyl acetate, cuminaldehyde. Retention data, peak enrichment techniques, using three different stationary phases; and in many cases infrared spectroscopy have been used in these identifications.

The oil of *Cinnamomum zeylanicum* is clearly very different from *Cinnamomum cassia*, a cheaper substitute with which Ceylon cinnamon is often adulterated. (Stahl, 1965). GLC affords a ready means of detecting such adulteration.

Reference

Stahl, W. H. (1965) Critical review of methods for analysis of oleoresins. *J. Ass. Off. Agr. Chem.*, **48**, 515.

STUDIES ON ESSENTIAL OILS AND SPICES. PART VI: PRELIMINARY STUDIES ON THE "CHEMICAL RACES" OF CITRONELLA BY GAS LIQUID CHROMATOGRAPHIC ANALYSIS

S. PONNUCHAMY, A. L. JAYEWARDENE *and* R. O. B. WIJESEKERA

(Section of Natural Products, Ceylon Institute of Scientific and Industrial Research, Colombo 7)

Two species of citronella grass are cultivated for the distillation of citronella oil. In Ceylon, the species *Cymbopogon nardus* (Sinh. Lenabatu) predominates while the species *Cymbopogon winterianus* (Sinh. Maha pengiri) is cultivated in Java, Formosa, China and other countries. It was believed for a long time that the oils derived from a particular botanical species had a similar chemical composition. But G. L. C. studies reveal that oils distilled from one lot to another of the same species vary in chemical composition.

We have examined over a thousand plants belonging to the species *Cymbopogon nardus* and found that they could be further divided into seven groups on the basis of morphological features only. However, on the basis of their chemical composition we can identify five distinct "chemical races." Further, we examined the species *Cymbopogon winterianus* existing in Ceylon. We found the chemical composition of this varied to a great extent when compared to the oil distilled from *Cymbopogon winterianus* growing in other citronella producing countries. It is interesting to note that Ceylon was the only citronella oil producing country till 1890 and planting material of *Cymbopogon winterianus* was taken from Ceylon to other countries. The chemical constituents of citronella oil identified previously (Wijesekera & Fonseka, 1970) were taken into consideration for our study. The quantitative variations among the chemical constituents forms the basis for the division into different "chemical races".

Reference

Wijesekera, R. O. B. and Fonseka, B. D. (1970) G. L. C. studies on citronella oil. *Proc. Cey. Ass. Advmt. Sci.*, **(1)**, 81.

ISOLATION AND PARTIAL STRUCTURES OF SIX NEW TRITERPENOIDS FROM *TRICHADENIA ZEYLANICA* THW. (S. TOLOL, TITTA) FLACOURTIACEAE

S. P. GUNASEKERA *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

The hot light petroleum extract of the bark of *Trichadenia zeylanica* Thw. has given, in addition to friedelinol acetate mp. 316–7°, six new triterpenoids.

Compound	*M. P.*	*Rotation* $[\alpha]_D^{26}$ *($CHCl_3$)*
(1) 3β – Acetoxy triterpenoid acid* (SP 4) $C_{32}H_{52}O_4$	267°	+56.0°
(2) 3α – Hydroxy triterpenoid acid* (SP 2) $C_{30}H_{50}O_3$)	294°	+25.0°

(3) 3α – Acetoxy triterpenoid acid (TB 1) $C_{32}H_{52}O_4$	242–4°	+27.5°
(4) 3 Keto triterpenoid acid (TB 3) $C_{30}H_{48}O_3$	245–6°	+ 3.1°
(5) Keto triterpenoid acetate (TB 4) $C_{32}H_{52}O_3$	246–7°	+13.0°
(6) Keto hydroxy triterpenoid (TB 4H) $C_{30}H_{50}O_3$	300-1°	+ 8.1°

The inter-relationship among the first four compounds and that between the last two compounds have been established. The partial structures of the above will be discussed with the help of chemical and spectral data.

Reference

*Gunasekera, S. P. and Sultanbawa, M. U. S. (1971) Extractives of *Trichadenia zeylanica* Thw. (S. Tolol, Titta), Flacourtiaceae. *Proc. Cey. Ass. Advmt. Sci.*, **(1)**, 72.

EXTRACTIVES OF *HYDNOCARPUS VENENATA* GAERTN. (S. MAKULU), FLACOURTIACEAE

S. P. GUNASEKERA *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

In addition to the isolation of mangostin (Balasubramaniam *et al.*, 1972) the following compounds have been isolated from the hot light petroleum extract of the bark of *Hydnocarpus venenata* Gaertn.

Compound	*M. P.*	*rotation* $[\alpha]_D^{26}$ *(CHCl₃)*
(1) β–sitosterol	136–7°C	–36.4°
(2) Ursolic acid	283–5°C	67.3°
(3) Acetoxyursolic acid	288–90°C	65.1°
(4) Betulinic acid	3 00–2°C	9.5°
(5) Acetoxybetulinic acid	289–90°C	22.6°
(6) Betulonic acid	257-9°C	14.1°

The methods of isolation and the spectral data of the above compounds are discussed.

Reference

Balasubramaniam, S., Gunasekera, S. P. and Sultanbawa, M. U. S., *Phytochemistry*, (1972), (in press).

EXTRACTIVES OF *CALOPHYLLUM CUNEIFOLIUM* THW. GUTTIFERAE

S. S. SELLIAH *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

The extractives of the timber of *Calophyllum cuneifolium* Thw. were obtained with benzene, and chloroform. From the benzene extract, β-sitosterol, guanandin, euxanthone, scriblitifolic acid, 6–deoxyjacareubin and buchanoxanthone were isolated. A new xanthone 2–(3–Methylbut–2–enyl)–1, 3, 5–trihydroxyxanthone and jacareubin were isolated from the chloroform extract.

The light petroleum extract of the bark gave a new dihydrocoumarinic acid–cuneifolic acid, in addition to β–sitosterol, friedelin, taraxerol, simiarenol, 2,2– dimethyl–5–hydroxy–8–methoxy–7– (2–methylbut–2–enyl) –2H, 6H– pyrano– [3, 2–b] xanthen–6–one (calabaxanthone) and 13– hydroxy–3, 10– tetramethyl –3H, 10H, 14H–dipyrano– [3, 2a: 2′, 3′ –i]– xanthen–14–one (thwaitesixanthone).

The spectral data of these compounds and the biogenetic considerations on the co-occurrence of these metabolites are discussed.

EXTRACTIVES OF *ARTOCARPUS NOBILIS* THW. (S. WALDEL) MORACEAE

G. SUBRAMANIAM *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

Six pyrano-flavanoids have been isolated from the benzene extract of the bark of the above:

	M. P.		*M. P.*
NBB_1	244°C	NBB_4	148°C
NBB_2	135°C	NBB_5	180°C
NBB_3	145°C	NBB_6	150°C

From the ethylacetate extract of the timber, the following six hygroscopic polyhydroxy compounds have been isolated:

NTW_1	198°C (softens at 100°C)	NTW_4	145°C
NTW_2	180 C	NTW_5	190°C
NTW_3	175°C	NTW_6	200°C

The structures of the above compounds will be discussed with the aid of chemical and spectral data.

THE EFFECT OF DOLOMITE ON COMPRESSIVE STRENGTH AND SULPHATE RESISTANCE OF PORTLAND CEMENT

R. B. ELKADUWA *and* H. W. DIAS

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

To study the effect of dolomite on compressive strength of cement, mortar cubes were prepared using dolomite from Digana (below sieve No. 52) and sand (below sieve No. 7) as aggregates. The ratio of water: cement: aggregate was 0.56:1:5. Keeping the cement aggregate ratio constant, sand was replaced by dolomite. These mortar cubes were cured under water and the compressive strength was determined. The results showed that when cement: sand: dolomite = 1: (4.5 – 4): (0.5 – 1) the strength is a maximum (4900 p. s. i. after 28 days.)

The sulphate susceptibility of the cement dolomite mixture was determined by obtaining a measure of the amount of $3\,CaO.\,Al_2O_3.\,CaSO_4.y\,H_2O$ formed as a result of the interaction between SO_3 and reactive alumina phase. The procedure was to shake for 6 hours, a mixture of saturated $Ca(OH)_2$ (100 ml.), standard Ottawa sand (about 30 gr.) and cement $\left(\text{wt. of cement used} = \frac{5.4}{\%SO_3 \text{ in the cement}}\right)$ and to determine the amount of unreacted SO_3 in the mixture (Bogue, 1955). The results showed that maximum resistance could be obtained by mixing dolomite and cement in the ratio (1–2):1 by weight.

Reference

Bogue, R. H. (1955) *Chemistry of Portland Cement*, 2nd ed. NewYork. Reinhold Publishing Corporation.

ISOLATION AND CHARACTERISATION OF SOME TRITERPENOID ACIDS FROM THE RESINS OF *DIPTEROCARPUS HISPIDUS* THW. (S. BUHORA), *DIPTEROCARPUS ZEYLANICUS* THW. (S. GALHORA) AND *DOONA CONGESTIFLORA* THW. (S. TINIYA)

S. P. GUNASEKERA, S. SOTHEESWARAN *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

The resins of *Dipterocarpus hispidus* Thw. and *Dipterocarpus zeylanicus* Thw. (Gunasekera *et al.*, 1970) were shown to contain asiatic acid, characterised as methyl ester m.p. 216-7°, $[\alpha]_D^{26}$ + 54.8° (chloroform) and 2α, 3β dihydroxyurs–12–ene-28–oic acid m.p. 253–4°, $[\alpha]_D^{26}$ + 44.2° (pyridine). Similarly, the resin of *Doona congestiflora* Thw. was shown to contain ursolic acid m.p. 283–4°, $[\alpha]_D^{26}$ + 66.1° (pyridine), 2β, 3β dihydroxyolean-12–ene–28–oic acid m.p. 294–5°, $[\alpha]_D^{26}$ + 81.3° (methanol) and asiatic acid.

2α, 3β Dihydroxyurs–12–ene–28–oic acid (Glen *et al.*, 1965) is being reported for the first time from the Dipterocarpaceae. 2β, 3β dihydroxyolean–12–ene–28–oic acid (Cheung and Young, 1970) is being isolated for the first time from a natural source.

References

Gunasekera, S. P., Sotheeswaran, S. and Sultanbawa, M. U. S. (1970), *Proc. Cey. Ass. Advmt. Sci.*, (1), 78.

Glen, A. T. *et al.*, (1965) Isolation of a new triterpenoid from Rose-bay Willow-Herb. *Chem. and Ind.*, 1908.

Cheung, H. T. and Yan, T. C. (1970) 2 α, 3α and 2β, 3β dihydroxyolean–12–ene–28–oic acids. *Chem. Comm.*, 369.

EXTRACTIVES OF *GARCINIA ECHINOCARPA* THW. (S. MADOL), GUTTIFERAE

S. S. SELLIAH *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

and

W. D. OLLIS

(Department of Chemistry, University of Sheffield)

The timber and the bark of *G. echinocarpa* Thw. were extracted with light petroleum and methanol. The methanol extracts were further extracted with diethylether to give a yellow mixture. The mixture from both timber and bark was separated by washing with aqueous borax. The borax insoluble fraction on chromatographic separation on polyamide gave I–4′, II–4′, I–5, II–5, I–7, II–7–hexahydroxy flavanone [I–3, II–8] flavone (volkensiflavone). The borax soluble fraction gave on polyamide chromatographic separation two yellow pigments one of which was identified as II–3′, I–4′, II–4′, I–5, II–5, I–7, II–7–heptahydroxy flavanone [I–3, II–8] flavone (morelloflavone) and the second one is tentatively identified as 1,3,7,8–tetrahydroxyxanthone.

The mass spectral fragmentation pattern and the chemotaxonomic significance of the biflavanoids are discussed.

The light petroleum extract of the timber in addition gave 1,5–dihydroxyxanthone and β–sitosterol.

EXTRACTIVES OF *MADHUCA NERIIFOLIA* (THW.) H. J. LAM (S. GANMI), SAPOTACEAE

P. A. GUNATILLAKE *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

From the benzene extract of the bark of *Madhuca neriifolia* (Thw.) H. J. Lam, four terpenoid compounds have been isolated: 1) Friedelin, m.p. 263–64°, $[\alpha]_D^{26}$ – 29.4° ($CHCl_3$), 2) β–Amyrin acetate, m.p. 238–40 , $[\alpha]_D^{26}$ + 78.5° ($CHCl_3$), 3) a Hydroxy triterpenoid compound (GBP 1), m.p. 278–80°, $[\alpha]_D^{26}$ + 60° ($CHCl_3$) and 4) a triterpenoid acetate (GBP VI), m.p. 96–8°, $[\alpha]_D^{26}$ + 52.1° ($CHCl_3$).

The chemical and spectral data of the compounds will be discussed.

FARADAIC RECTIFICATION AT RADIO FREQUENCIES

PART I – INSTRUMENTATION FOR FARADAIC RECTIFICATION STUDIES IN THE FREQUENCY RANGE 100 KHz TO 15 MHz

I. F. LE MERCIER, SUSIMA ABEYAGUNAWARDENE *and* M. A. V. DEVANATHAN*

(Ceylon Institute of Scientific and Industrial Research, Colombo)

A simple method has been devised to investigate the phenomenon of faradaic rectification in the frequency range 100 KHz to 15 MHz at a solid liquid interface.

The equipment used for these investigations consisted of a Marconi Standard Signal Generator TF 144H, a power amplifier built in these laboratories, a Tektronix oscilloscope type 531A with a type CA plug-in-unit and a Sargent recorder model MR3 – 72150 – 02.

The oscilloscope measured the a.c. voltage across the cell system while the Sargent recorder was used to record the faradaic rectification voltage at the interface, on a chart running at 0.5 inches per minute.

Working with one system – pure gold electrodes and a solution 0.1M ferric ammonium sulphate/0.1M ferrous ammonium sulphate/ 1M sulphuric acid, the results obtained have conformed to existing theory, i.e. the faradaic rectification voltage ψ is proportional to v^2 where v is the amplitude of the a.c. voltage across the solid-liquid interface.

The rectification ratio $\frac{\psi}{V^2}$ is found to be proportional to $\frac{1}{\sqrt{f}}$ (where f is the frequency of the applied a.c.) in the frequency range 100 KHz to 1 MHz. Above 2 MHx the rectification ratio deviates from the straight line and tends to zero as $f \rightarrow 15$ MHz.

*Present Address: Tea Research Institute, Talawakelle.

FARADAIC RECTIFICATION AT RADIO FREQUENCIES

PART II – DETERMINATION OF THE RATE CONSTANTS OF

(1) Ferricyanide ferrocyanide, and

(2) Ferric ferrous redox reactions

SUSIMA ABEYAGUNAWARDENE *and* M. A. V. DEVANATHAN

(Physical Chemistry Section, Ceylon Institute of Scientific and Industrial Research, Colombo)

The faradaic rectification voltage at high frequencies is given by the equation

$$\frac{\psi}{v^2} \simeq \frac{nF}{RT}\left(\frac{2\alpha-1}{4}\right)\left[1+\frac{1}{\frac{R_r}{\sigma}\sqrt{2\pi}} \times \frac{1}{\sqrt{f}}\right]$$

for equal bulk concentrations of the oxidant and the reductant. In deriving this equation the diffusion coefficients of the oxidant and the reductant were also assumed to be equal.

Using concentrations of 0.002M, 0.004M, 0.006M, 0.008M and 0.01M $K_3Fe(CN)_6$ $K_4Fe(CN)_6$ solution with 0.02M, 0.04M, 0.06M 0.08M, 0.1M KCl respectively, as supporting electrolyte, and Au electrodes, ψ is found to be proportional to v^2. The curve obtained by plotting $\frac{\psi}{V^2}$ vs. $\frac{1}{\sqrt{f}}$ is linear in the range 100 to 200 KHz. Using these linear portions of the curves, the rate constants of the reactions, were 3.78, 4.00, 3.89, 3.34, 3.78 cms./sec. for the above concentrations respectively, giving a mean value 3.76, with standard deviation 0.224.

Preliminary experiments were carried out with a solution of 0.1M ferrous ammonium sulphate/0.1M ferric ammonium sulphate/1M sulphuric acid. Using pure gold electrodes the rate constants were 5.24, 6.85 and 8.41 cms./sec. The variation in the values of the rate constant may be partly due to the ageing of the solution. It is proposed to carry out this experiment using freshly prepared solutions of ferric ammonium sulphate/ferrous ammonium sulphate/sulphuric acid, of various concentrations.

The rate constants obtained for these two redox reactions, are much higher than those reported by other research workers.

DEVELOPMENT OF A NEW ANALYTICAL INSTRUMENT – THE VOTATOR ELECTRODE SYSTEM

M. A. V. DEVANATHAN* *and* VINODHINI GURUSWAMY

(Physical Chemistry Section, Ceylon Institute of Scientific and Industrial Research, Colombo)

A new type of cell with a fixed area, a renewable surface and streaming electrolyte by votator action is designed for electroanalytical work.

The votator action increases the limiting current by two orders of magnitude, hence increasing the range of simple polarography from 10^{-4} gm. mols./1. to 10^{-6} gm. mols./1.

The characteristics of the electrode is worked out and it has been found that under turbulent flow conditions $i \propto U^{\frac{7}{8}}$ as has been derived by Levich (1962) for streaming solutions.

The range and applicability for polarography seems promising for further research and development.

Reference

Levich, V. G. (1962) *Physicochemical hydrodynamics,* N. J. Prentice, Hall.

STRICTAVINE; A NEW ALKALOID FROM *RHAZYA STRICTA*

K. T. D. DE SILVA† *and* G. N. SMITH

(Department of Chemistry, University of Manchester, U. K.)

Rhazya stricta (Decaisne) is a common shrub indigenous to Western Asia, with a history of use in the indigenous system of medicine. A new 2-methylene-indoline alkaloid, Strictavine was isolated from the light petroleum insoluble bases of its leaves. The elucidation of the structure of this alkaloid is presented, with particular reference to the use of spectroscopic methods.

---

* Present address: Tea Research Institute, Talawakelle.

† Present address: Department of Chemistry, Vidyodaya Campus, University of Ceylon, Nugegoda.

SCREENING OF SOME INDOLE ALKALOID PRODUCING PLANTS FOR THE OCCURRENCE OF BIOGENETICALLY SIGNIFICANT COMPOUNDS

K. T. D. DE SILVA *and* SUNETHRA KALUARACHCHI

(Department of Chemistry, University of Ceylon, Vidyodaya Campus, Nugegoda)

The natural occurrence of strictosidine or vincoside together with secologanin has upto now been shown in *Vinca rosea* and *Rhazya* sp. (Smith, 1968) both of the family apocynaceae. Although vincoside and secologanin have been shown to be specific precursors of indole alkaloids in *Vinca rosea* (Battersby *et al.*, 1969) recent work has shown the absence of vincoside in *Rhazya orientalis*. 5 α carboxystrictosidine has been proposed as an alternative biosynthetic precursor (de Silva, 1971; de Silva, King & Smith, 1971). As an important requirement for an authentic precursor is its presence in the living system, a number of indole alkaloid producing plants were screened for these important biogenetic compounds. The results of a preliminary screening method, using TLC and specific colour reactions of these compounds and their derivatives, are presented.

References

Battersby, A. R., Burnett, A. R. and Parsons, P. G. (1969) Alkaloid biosynthesis, Parts XIV & XV, *Journal of the Chemical Society*, **(C)**, 1187–1200.

De Silva, K. T. D., Ph. D. Thesis Manchester (1971).

De Silva, K. T. D., King, D. and Smith, G. N. (1971) "5α carboxystrictosidine", *Chemical Communications*, 908–910.

Smith, G. N. (1968) "Strictosidine" *Chemical Communications*, 912–913.

EXTRACTIVES OF *CALOPHYLLUM WALKERI* WIGHT AND *CALOPHYLLUM PULCHERRIMUM* WALL., GUTTIFERAE

M. DAHANAYAKE, R. SOMANATHAN *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

Extractives of the timber and bark of *Calophyllum walkeri* Wight and *Calophyllum pulcherrimum* Wall were obtained with light petroleum, benzene and chloroform. The chromatographic separation of the light petroleum extract of the bark of *C. walkeri* Wight gave taraxerol, taraxerone and calabaxanthone. The light petroleum extract of the bark of *C. pulcherrimum* Wall gave in addition to the above compounds friedelin, simiaren-3β–ol and β–sitosterol.

The benzene extract of timber of *C. walkeri* Wight on chromatographic separation gave 1,5–dihydroxyxanthone, 1,7–dihydroxyxanthone, jacareubin and β–sitosterol. The chloroform extract gave 1,5–dihydroxyxanthone, 1,7–dihydroxyxanthone and three additional pigments the structures of which are under investigation. The benzene extract of the timber of *C. pulcherrimum* Wall gave 3 pigments of which two have been identified as 1,5–dihydroxyxanthone and 1,7–dihydroxyxanthone. The structure of the other pigment is under investigation. The chloroform extract of the timber gave in addition to the pigments found in the benzene extract, a fourth pigment whose structure is under investigation.

The chemical and spectral data of all compounds are discussed.

EXTRACTIVES OF *MESUA FERREA* L. (FORM. *M. SALICINA* PL. & TRI.) GUTTIFERAE

S. RAMACHANDRAN, S. S. SELLIAH *and* M. U. S. SULTANBAWA

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

The timber of *Mesua ferrea* L. (form. *M. salicina* Pl. & Tri.) was extracted with light petroleum, benzene and chloroform. From the petroleum extract β–sitosterol and 6 yellow pigments were isolated of which three have been identified as 1,7–dihydroxyxanthone, 1,5–dihydroxyxanthone and 2–methoxyxanthone. The fourth has been tentatively identified as 4–hydroxyxanthone.

The benzene extract gave 2–hydroxyxanthone and 1,5,6–trihydroxyxanthone in addition to the pigments isolated from the petroleum extract.

The chloroform extract provided 2–hydroxyxanthone, in addition to three other yellow pigments whose structures are being investigated.

The spectral data of these metabolites and their chemotaxonomic significance are discussed.

PREPARATION OF N–ACETYL – *trans* – 1 – R. 3 – METHOXYCARBONYL 1,2,3,4 TETRAHYDRO – β – CARBOLINES

K. T. D. DE SILVA*

(Department of Chemistry, University of Ceylon, Vidyodaya Campus, Nugegoda)

A new general method, incorporating a pyridine-acetic anhydride catalysed epimerisation, for the synthesis of the above compounds is discussed.

DEVELOPMENT OF NATURAL RUBBER – PORTLAND CEMENT MIXES FOR PRACTICAL APPLICATIONS

M. NADARAJAH

(Rubber Research Institute of Ceylon)

and

HEMAL PIERIS

(State Engineering Corporation)

The basis of this work was the patent on Stabilising of Natural Rubber Latex for mixing with Portland cement (Nadarajah *et al.*, 1972).

Though cement is alkaline (pH 12), field latex which is also negatively charged coagulates when added to cement. The stabilisers added to NR latex should be such that the latex coagulates during the hydration and setting of cement products. Cement – NR latex mixes should remain in the workable condition for ½ to 1 hour and they should set hard within 2 or 3 days.

A suitable stabiliser for field latex is 0.3% formaldehyde added as a 30% solution. The field latex is used as such or after centrifuging. Sodium carbonate is added as a 25% solution at 1% on the formaldehyde stabilised field latex or as a 10% solution at 1% on the formaldehyde stabilised centrifuged latex, to enable it to be sufficiently stable for mixing with Portland cement.

This paper discusses the possibilities of the uses of NR latex – Portland cement mixes in flooring, in roads and in repair of old cement constructions.

Reference

Nadarajah, M., De Silva, K. P. N. and Goonasena, G. W. (1972) Stabilising of natural rubber latex for mixing with portland cement. *Ceylon Patent*, No. 6938 filed.

THE USE OF NATURAL RUBBER LATEX–UREA FORMALDEHYDE RESIN BLENDS AS ADHESIVES FOR PLYWOOD

W. G. WEERARATNE, D. A. R. ELIYATAMBY, U. P. P. AMARASINGHE *and* N. LIYANAGE

(Ceylon Plywoods Corporation)

and

M. NADARAJAH

(Rubber Research Institute)

The basis of this work is the use of natural rubber (NR) field latex – UF resin blends or of NR concentrated latex – UF resin blends as the adhesive for plywood (Eliyatamby *et al.*, 1972).

China clay is used as the extender and a minimum adhesive total solid content of 55% is necessary to obtain minimum plywood bond strength specifications. Formaldehyde is used as the stabiliser for NR latex as its use enables the blending of UF resin with NR latex without any coagulation of the latex and gives an acidic pH

* Research was carried out by the author at the Department of Chemistry, University of Manchester.

which is necessary to cause polymerisation of the UF resin. If a small amount of the UF resin (approximately 25%) is replaced by melamine, then a higher bond strength is obtained.

Approximately, 1,400 tons of urea formaldehyde (UF) resin involving a foreign exchange of $2\frac{1}{2}$ million rupees are imported annually for bonding plywood.

Using NR latex – UF resin blends, it should be possible to satisfactorily substitute 2/3rds of the imported UF resin by NR.

Reference

Eliyatamby, D. A. R., Nadarajah, M., Amarasinghe, U. P. P. and Liyanage, N. (1972) The use of natural rubber – resin blends as an adhesive for plywood. *Ceylon Prov. Patent* filed.

THE QUALITY OF THE X-RAY IMAGE IN DIAGNOSTIC RADIOLOGY

P. L. T. Fernando

(Government Cancer Institute, Maharagama)

The Primary X-Ray Image is the distribution of X-Ray Quanta/sq./ cm./sec. across the field of view and this can be registered by –

(a) X-Ray Film,

(b) X-Ray Film sandwiched between two intensifying screens (Ca WO4 blue region of visible spectrum) for radiography,

(c) Fluoroscopy using Zn. CdS. screens in the yellowish-green region of the visible spectrum for the continuous viewing of the X-Ray Image thus giving the movement of the organ under examination.

The Luminous Flux/MR/Sec. at different monochromatic X-Ray Energy (KeV) and the quantum efficiency (the number of light photons emitted per absorbed X-Ray quantum) are presented for each of these fluorescent screens.

The factors involved in the registration of each absorbed quantum of X-Rays in the fluoroscent screen so that it may be registered in the brain are discussed.

The Electronic Intensification of Fluoroscopic Images using the (1) Image Intensifier, and (2) Image Orthicon with Mirror/Lens optics and Television Monitors are indicated.

The Geometrical (Ug) and movement-blurring (Um) can be expressed as a sine wave response (S) as

$$Sm = \frac{\lambda}{\pi Um} \quad Sin: \quad \frac{\pi Um}{\lambda} \quad — \quad (1)$$

$$Sg = \frac{\lambda}{\pi Ug} \quad Sin: \quad \frac{\pi Ug}{\lambda} \quad — \quad (2)$$

The total sine wave response (S_t) is given by the product of the sine wave responses of each constituent element.

$St = Sg \times Sm \times$ ..... etc. and in the case of $\lambda \geq 2\,Um$ and $\lambda \geq 2Ug$.

$$Sm = 1 - \frac{\pi^2}{6}\left(\frac{\pi U_m}{\lambda}\right) \quad \text{and} \quad Sg = 1 \quad \frac{\pi^2}{6}\left(\frac{\pi U_g}{\lambda}\right)^2$$

in which case $U_t = U_g^2 + U_m^2$.

The experimental determination of the sine wave response of the fluorescent screen is indicated together with that of the Image Intensifier, and Image Orthicon coupled to a Television Monitor.

RECOVERY OF ALKALI FROM BLACK LIQUOR BY ELECTROLYSIS

Vinodhini Guruswamy

(Physical Chemistry Section, Ceylon Institute of Scientific and Industrial Research, Colombo)

Black liquor from the Eastern Paper Mills was subjected to electrolytic treatment. Sodium hydroxide was isolated at the cathode while a concentration of sulphuric acid was found at the anode. A large percentage of the lignin was deposited at the bottom of the anode chamber.

The energy consumption was in the range of 0.5 – 2.5 KWh./lb. of NaOH recovered and this compared favourably with the energy required in the sodium chloride diaphragm cell which is 1.4 KWh./lb. of NaOH.

The advantages of setting up an electrolytic recovery plant for black liquor are:

(1) Removal of environmental pollution by the black liquor.

(2) Availability of electrical power and local materials for cell construction.

(3) Saving by the reuse of NaOH in the digester.

(4) Low grade uses of sulphuric acid as in fertilisers.

(5) Saving on fuel by burning of the deposited lignin in the driers or using them as fillers in the Kraft paper process etc.

This method of treatment could be extended to other industrial effluents.

A QUALITY CONTROL TECHNIQUE FOR BORON TREATED WOOD

K. G. Dharmawardena, P. P. G. L. Siriwardena, K. Svoboda

and

L. K. G. Wickramasinghe

(Radioisotope Centre, University of Ceylon, Colombo Campus)

Boron is used as a preservative for wood and in the proposed rubber-wood factory, borax and boric acid are the main preservatives that would be used. Thus, a rapid method for the determination of boron in wood is an essential quality control technique in this industry. The methods presently available involve grinding, or ashing followed by leaching out the boron as preliminary steps, before chemical analysis and each sample needs several hours of careful manipulation.

A rapid technique has been developed in this laboratory for this purpose using the high thermal neutron cross-section of boron–10 isotope and each determination by this technique takes about two minutes.

The thermal neutron cross-section of boron–10 isotope is much higher than all other elements present in wood. Percentage transmission of thermal neutrons through aqueous solutions and rubber-wood samples with different boron concentration were examined and was found to lie on a smooth curve when plotted versus boron content. The curves can be used to determine the boron content in unknown samples.

This technique is rapid, performed on solid samples, requires very little space for installation, does not require any consumable supplies such as chemicals, can be performed by a Laboratory assistant and is more reliable than the chemical methods presently used.

ISOLATION OF MAGNESIUM SALTS FROM SEA-WATER AS A PRELIMINARY STEP OF THE METALLURGY OF MAGNESIUM

H. W. Goonatillake *and* H. W. Dias

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

The important sources of magnesium are the minerals carnallite, magnesite, dolomite and sea-water. Of these, dolomite and sea-water are available in Sri Lanka.

Magnesium is precipitated as $Mg(OH)_2$ by adding burnt lime (or burnt dolomite) to sea-water (Navratil, 1971).

In this study, samples of filtered sea-water were stirred with CaO and the effects of certain variables on the extent of precipitation of $Mg(OH)_2$ was determined.

The results indicated that,

(i) The optimum time of stirring was 2 – 4 hours.

(ii) In the range of 10% – 80% more than the theoretical quantity of CaO, yields of $Mg(OH)_2$ were 77–93%.

(iii) Optimum temperature was 30°C.

(iv) Yield of $Mg(OH)_2$ was independent of the magnitude of the sample.

The use of this method on an industrial scale is considered possible. The industry is best sited close to a saltern which has accessible limestone deposits because the mother liquor from saltern rich in magnesium salts also can be used and the problem of humus might also be reduced.

Reference

Navratil, J. D. (1971) *Chemistry*, **44**, pp. 6 – 10.

A METHOD FOR THE EXTRACTION OF TITANIUM DIOXIDE FROM ILMENITE

W. M. D. WIJEKOON *and* H. W. DIAS

(Department of Chemistry, University of Ceylon, Peradeniya Campus)

When ilmenite was treated with concentrated hydrochloric acid at 90–100°C for two days, a 70% decomposition occurred forming the chlorides of iron and $TiCl_4$. On a ten-fold dilution with water, $TiCl_4$ hydrolysed almost completely forming nydrated $Ti0_2$ while the iron compounds remained in solution. Heavier unreacted ilmenite was removed by gravity separation. Hydrated $Ti0_2$ was then isolated by filtration or sedimentation. This product was yellow due to contamination by iron oxides. Yield of $Ti0_2$ was 70%.

To remove iron oxides, the following leaching conditions were tried separately:

(i) 4M, (ii) 5.5M, and (iii) concentrated; hydrochloric acid solutions, for one day in each case at 90 – 100°C.

(iv) Concentrated hydrochloric acid, three times for one day each, at 90 – 100°C followed by a reduction with aluminium powder (1% W/W) and 8M hydrochloric acid (20. ml/20g. of $Ti0_2$) at 50°C until all ferric ions were reduced.

The products were washed with water and ignited for ½ – 1h. at 400°C. Condition (iv) gave the maximum whiteness of $Ti0_2$ with overall yield of 40%.

AN INEXPENSIVE WATER CLOCK

G. P. P. GUNARATNE

(Department of Physics, University of Ceylon, Peradeniya Campus)

The paper describes an inexpensive device for measuring time tnat uses water as a driving force. The main feature is a specially designed constant pressure arrangement that requires only a limited amount (one or two litres) of water per day. The necessary

apparatus is readily constructed with available material in a school, or household, and the assembled device is capable of sufficient accuracy to be used as a clock.

The constant pressure arrangement has wide applications of its own, and may be used with advantage for laboratory experiments in schools.

ACOUSTIC MEASUREMENTS TO DETERMINE THE PERCENTAGE COMPOSITION OF FLUID MILK

M. P. WESENTI-PULLE

(Faculty of Agriculture, University of Ceylon, Peradeniya Campus)

A sonar principle has been utilized to simultaneously determine fat, protein, solids–non-fat and total solids content of fluid milk. The results were accurate and precise.

SECTION F: SOCIAL SCIENCES

(New Lecture Hall adjoining K. G. Hall)

Wednesday, 13th December:

8.30 .. ඌණ සංවර්ධන රටක නොදියුණු ශිල්පී ක්‍රම ගැන හැඳින්වීමක්. (ලංකාවේ උදැල්ල භාවිතය සම්බන්ධයෙනි) ඇන්. ජී. ගුණසේකර
(Jointly with Section C) *(K. G. Hall)*.

9.30 .. Southern Area Development Plan – D. L. O. Mendis and M. S. M. de Silva (Jointly with Section C) *(K. G. Hall)*.

2.30 .. Agro-based Industrial Potential in the Jaffna Peninsula – P. Puvanarajan.

Thursday, 14th December:

9.00 .. New Cropping Systems in areas of Chena Cultivation – W. P. T. Silva.

1.30 .. ග්‍රාමීය කුඩා පරිමාණ අංශය මගින් ශ්‍රී ලංකා ලුහු ඉංජිනේරු කර්මාන්ත සංවර්ධනය -- ඩබ්ලිව්. ඒ ජයසිංහ සහ ඩී. ඇල්. ඕ. මෙන්ඩිස්.
(Jointly with Section C) *(New Lecture Hall)*.

2.30 .. Regionalism in the context of Development Planning with reference to Sri Lanka – M. W. J. G. Mendis.

Friday, 15th December:

9.30 .. A New Look at an Old Crop – S. Ponnuchamy (Jointly with Section B) *(New Lecture Hall)*.

1.30 .. Socio-Economic study of some *Purana* Villages in the Kala Oya Basin, Anuradhapura District – H. N. C. Fonseka (Jointly with Section D) *(New Lecture Hall)*.

3.30 .. Presidential Address: "The Unified Approach Development – The Experience in Sri Lanka" – Godfrey Gunatilaka *(Physics Theatre)*.

Saturday, 16th December:

8.30 .. Seminar on the Mahaweli Development Project (Jointly with Section B, C and D) *(K. G. Hall)*.

11.45 .. Business Meeting.

ඌන සංවර්ධන රටක "නොදියුණු" ශිල්පීක්‍රම ගැන හැඳින්වීමක් (ලංකාවේ උදැල්ල භාවිතය සම්බන්ධයෙනි)

එන්. ජී. ගුණසේකර

(ක්‍රම සම්පාදන හා රැකීරක්ෂා අමාත්‍යාංශය)

1. කාර්මික විප්ලවයක් සිදු නොවුනු රටක එම රටේ ඉපැරනි එමෙන්ම නොදියුණු වශයෙන් සලකෙන ශිල්පීක්‍රම පලාත්බද වෙනස්වීම් වලින් යුක්තව භාවිතා වේ. විශේෂයෙන් දියුණු යයි විශ්වාස කරන රටවල පවා ගොවිතැන විශයයෙහි පැරනි ක්‍රම භාවිතාවීම දක්නට ලැබෙනවා.
2. උදැල්ල භාවිතා කරන අන්දම
3. ලංකාවේ ගොවිතැනේ සම්බන්ධය හා පසේ ස්වභාවය
4. පලාත්බද වෙනස්කම් වලින් යුක්තව උදැල්ල භාවිතා වීම
5. ගොවිතැන සඳහා උදලුතල ආනයනය
6. සමාජ ආර්ථිකය කෘෂි දේශගුණයක වාතාවරනයක් සඳහා ගොවි උපකරන නිශ්පාදනය සමග උදැල්ලේ සම්බන්ධය.
7. පැරණි සමාජ ක්‍රමයට හා ශිල්පිය අංශයන්ට අදල ක්‍රම භාවිතය මත උදැල්ල සම්බන්ධ වන ආකාරය සහ එමගින් ස්වයංපෝෂිත ආර්ථික සමාජයක් සඳහා පැරණි ශිල්පී ක්‍රම දියුණු කිරීම.

[The introduction of a primitive technology in a developing country: use of the traditional mammoty in Sri Lanka].

AGRO BASED INDUSTRIAL POTENTIAL IN THE JAFFNA PENINSULA

P. PUVANARAJAN

(Department of Geography, University of Ceylon, Colombo Campus)

The economy of the Jaffna Peninsula has been dominated by agricultural activities, but tnere is state sponsored large scale industry e.g. Cement, using local mineral raw material and others of a smaller scale using essentially agricultural raw material like tobacco and Palmyrah.

Recent studies of the resource base of the Jaffna Peninsula has revealed that there is a large potential for industrial development based on many other local agricultural raw materials (Jeyasingham & Puvanarajan, 1971).

This paper attempts to examine the agricultural raw material resources available in the Jaffna Peninsula for industry. Attention will be focussed firstly on those raw materials that are now produced on a small scale and whose production could be increased considerably with the creation of an industrial demand, and secondly, on those based on either altogether new crops or the expansion of the acreage under crops which have an agro-industrial potential, but have not been properly appreciated hitherto. An attempt will also be made to analyse the required scale of production, the potential in terms of employment and foreign exchange earnings of such agro-based industries.

Reference

Jeyasingham, W. L. and Puvanarajan, P. (1971) *Report of the Survey of some major Raw materials of Jaffna District,* Submitted to the IDB.

NEW CROPPING SYSTEMS IN AREAS OF CHENA CULTIVATION

W. P. T. SILVA

(Department of Geography, University of Ceylon, Colombo Campus)

Chena cultivation has been the major form of land use on the unirrigable slopes in the Dry Zone. Although the villagers grew a variety of crops on their chena holdings these only provided them with a low level of income. In recent years, however, the situation has changed in some areas, with the introduction of new crops and the increasing commercial importance of certain traditional crops. This paper attempts to examine the conditions under which the changes in the traditional cropping patterns have taken place.

REGIONALISM IN THE CONTEXT OF DEVELOPMENT PLANNING – WITH REFERENCE TO SRI LANKA

M. W. J. G. MENDIS

(Department of Town and Country Planning, Colombo 10*)*

In Sri Lanka, development planning is concerned exclusively with economic and social development at the national level and has mainly concentrated on the choice of sectors to develop and on individual large projects. This has resulted in the inadequacy of indices such as national averages for income, for standards of living, for productivity, and for health, education and welfare. Consequently, it is now considered necessary to recognise that different geographical areas of the country vary with respect to economic, technological and human resources, the rates of productivity, standards of living and their endowment with the essential physical and social infra-structure.

It is therefore necessary for the identification of spatial units which are individually homogenous but collectively heterogenous within such a context. A convenient size of such a spatial unit is the REGION. It embraces a sufficiently large geographical area and comprises an adequate population size, a reasonable degree of economic activity and a manageable scale of administration. It therefore represents a scale of planning which links "national development" with the "efforts of local communities".

Regionalism has been the means whereby developed areas were balanced by a deliberate programme of investment and incentives in other areas. Thus by regional planning techniques it is possible to stimulate growth in the less developed regions of the country and to ensure the orderly growth of the developed areas from an otherwise cancerous spread leading to continuous singular organisms.

This paper concludes that a regional planning framework is essential towards the balanced development of the different areas of the country.

A NEW LOOK AT AN OLD CROP

S. PONNUCHAMY

(166/32, *Kolonnawa, Road, Colombo* 9)

Citronella grass is one of the oldest of the industrial crops cultivated in Ceylon and can be traced to the latter part of tne 18th century. Ceylon remained the sole supplier of citronella oil to the world market till 1890. Java started growing citronella in 1890 from the planting materials supplied by Ceylon and replaced Ceylon's position as the chief supplier. Today, Ceylon produces only 6% of the citronella oil produced in the world. The acreage under citronella cultivation has been reduced from 50,000 acres to 10,000 acres and the production of citronella oil has dropped from 800 tons to 200 tons a year and the foreign exchange earnings has been reduced to 2 million rupees a year.

The investigations carried out by the author in the citronella growing areas reveals that if steps are not taken to rehabilitate this agro industry the present production of 200 tons will be reduced in the future.

A detailed rehabilitation programme is also discussed under the following headings:

(a) Setting up of a rehabilitation committee

(b) Replanting subsidy scheme

(c) Fertilizer subsidy scheme

(d) Setting up of a purchasing board

(e) Setting up of a Research and Quality control unit.

As this is a foreign exchange spinner it should be fostered well to the maximum level. If the required consideration is given for the rehabilitation of the existing plantations an additional foreign exchange of 3 million rupees an year will accrue to Ceylon.

Printed by Kularatne & Co. Ltd., 732, Maradana Road, Colombo 10 and Published by the Ceylon Association for the Advancement of Science, 381/50, Bauddhaloka Mawatha, Colombo 7. 3361/72.