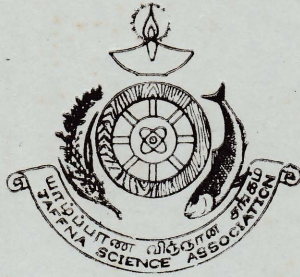


Abstracts



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A PRELIMINARY INVESTIGATION ON THE ANTIBACTERIAL
PROPERTIES OF SOME PLANTS
USED IN INDIGENOUS MEDICINE

K. Theivendirajah and K. Pathmanathan.

Department of Botany, University of Jaffna.

Antibacterial activity of leaf extracts of *Lawsonia alba* (Maruthondy-T) *Lantana camara* (Nayunni-T) and *Indigofera aspalathoides* (Sivanar vembu - T) against seven bacteria *E. Coli*, *Pseudomonas* sp., *Staphylococcus aureus*, *Klebsiella* sp, *Proteus* sp. and two different *Bacillus* sp. were evaluated under laboratory conditions. Disc diffusion method was employed for testing antibacterial activity. Two antibiotics (Streptomycin and Chloramphenicol - 1000 ppm) were used to compare the activity as standards. Both the aqueous and alcoholic extracts of the leaves were tested for their activity against the test organisms.

Lantana camara and *Lawsonia alba* showed suppressive activity against *Stap aureus*, *Klebsiella*, and *Bacillus* sp. II. While *Indigofera* failed to show any activity against the tested microorganisms. *Pseudomonas* strain was inhibited by both the aqueous and alcoholic extracts of *Lawsonia*, while it was not inhibited by streptomycin and chloramphenicol even at the concentration of 1000 ppm. Antibacterial activity of *Lawsonia* was more marked than *Lantana*. Generally alcoholic extracts were found to be more effective than water extracts. The effectiveness increased with increasing concentration of the extract.

A STUDY OF THE INTERACTION BETWEEN
RHIZOBIUM SPECIES AND SOIL FUNGI

K. Theivendirarajah, Arulvathani P. Arudchandran and Inthumathy Nalliah.

Department of Botany, University of Jaffna

Legumes are symbiotically associated with *Rhizobium* sp. As a result of this association nodules are formed on the root system of leguminous plants. The symbiotic association between these organisms plays a very important role in agriculture by converting atmospheric nitrogen into the available form of combined nitrogen.

The effects of a few soil inhabiting fungi *Fusarium* sp., *Trichoderma* sp., *Penicillium* sp. and *Aspergillus* sp. on the growth and nodulation of the test plant *Crotalaria juncea* of a few rhizobial strains - viz. UJB Rh01 (*Crotalaria juncea*) UJB Rh02 (*Vigna cylindrica*), UJB Rh03 (*Phaseolus mungo*), and UJB Rh04 (*Psophocarpus tetragonolobus*), were investigated.

Growth of Rh03 strain was suppressed by the filtrate of *Fusarium* sp. and growth of Rh03 and Rh04 was reduced by the filtrate of *Trichoderma* sp. in YMA medium. The nodulation by Rh02 and Rh03 strains was reduced by the filtrate of *Fusarium* sp. in seedling agar medium, and the nodulation by Rh01, Rh02, and Rh03 was promoted by *Fusarium* sp. while *Penicillium* sp. promoted the nodulation only in Rh01 strain in polythene bags under glass house conditions.

SOME ASPECTS OF SEED GERMINATION AND SEEDLING GROWTH ON PALMYRAH PALM

Nirmala Selvaratnam and S. Kandiah

Department of Botany, University of Jaffna

The changes which occur during the germination of Palmyrah seed were studied. The Palmyrah palm is dioecious. Pollination occurs chiefly by wind. Double fertilization takes place. The endosperm is triploid.

The endosperm of different stages in fruit development was analysed by paper chromatography. Initially there is sugar in the endosperm of young fruit. When the fruit matures sugar is converted into polysaccharides other than starch. During germination of the seed, there is conversion of polysaccharides into sugar which subsequently occurs in the form of starch in the Palmyrah tuber.

The tubers obtained from N, P and K treatments were analysed. The coefficient of variability of the dry weight of tubers was obtained. There was no indication of the effect of fertilizer on tuber size. The analysis of CV values of endosperm size and tuber size also showed that there is no correlation between these two.

Locally they were found to attack various plants such as Guava, Jack, Temple tree, Syzygium cumini, Citron, Hibiscus and vegetable crops. The biology, egg and larval stages have variations in species especially in *Sarothamnus*, *Coccus hesperidum* and *Sarothamnus*. A life cycle pattern has been prepared for each species collected.

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A STUDY OF SYSTEMATICS, MORPHOLOGY, ECOLOGY
AND BIOLOGY OF SCALE INSECTS (Homoptera : Coccoidea)
COLLECTED FROM JAFFNA PENINSULA.

Rajendramani Gnanaswaran and V. K. Ganesalingam

Department of Zoology, University of Jaffna

The scale insects are of considerable importance to agriculture as they cause damage to plants by sucking the juice. They occur on all kind of plants - ornamental cultivated, and wild. A study of Coccoidea was carried out in some parts of Sri Lanka by Rutherford (1915) and Green (1937). In this investigation a study was carried out on the systematics, morphology ecology and biology of Coccoidea in Jaffna peninsula.

The scale insects were collected from various plants in Jaffna peninsula and permanent preparations on slides made. The insects were identified by the morphological features and the life cycle in some selected species studied in the laboratory.

The genera identified are *Pseudococcus*, *Phenacoccus*, *Ferrisia*, *Aonidiella*, *Pinaspis*, *Ceroplastes*, *Saissetia*, *Coccus*, *Pulvinaria* and *Lepidosaphes*. Their morphological features were studied in detail with measurement of various parts of the body.

Locally, they were found to attack various plants such as Guava, Jak, Temple tree, *Syzigium cumini*, *Croton*, *Hibiscus* and vegetable crops.

The biology, egg and larval stages have variations in species specially in *Saissetia oleae*, *Coccus hesperidum* and *Saissetia nigra*. A life cycle pattern has been prepared for each species collected.

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A STUDY ON REPRODUCTION OF RICE WEEVIL (*SITOPHILUS* SP.) ON LOCAL VARIETIES OF RICE GRAIN

K. Jeyasingham and V. K. Ganesalingam

Department of Zoology, University of Jaffna

Reproduction of rice weevil, *Sitophilus* sp. fed on locally cultivated varieties of rice which were treated in different ways, was studied in the laboratory with a view to determining the suitable variety and treatment for long term storage of rice grain.

The following varieties were used in the experiment :

- (1) H₄, (2) 501, (3) Black, (4) Big young,
(5) Pachchaipperumal, (6) Murungan.

Each of the varieties was treated in the following ways :

- (a) Rough paddy (husk intact), (b) Rice with husk removed (unpolished), (c) Rice with husk and bran removed (polished),
(d) Processed rice (parboiled).

Ten pairs of recently emerged male and female weevils were introduced into forty grams of rice variety of various treatments in individual containers. F₁ progeny was determined in each experimental set up after 10 weeks.

It was observed that the reproduction of *Sitophilus* sp. was nil in rough paddy. There was no significant difference in reproduction when provided with different varieties of rice. But there was a significant difference in reproduction when provided with rice treated in different ways. Reproduction was highest in weevils of unpolished rice and polished rice but was least in weevils of parboiled rice.

It was concluded that rice may be stored against *Sitophilus* sp. as rough paddy or as parboiled rice.

A SURVEY OF THE AMPHISTOMES (PLATYHELMINTHES) PARASITIC ON CATTLE AND GOATS IN JAFFNA PENINSULA

Rajini Rajeswaran and N. Selvarajah

Department of Zoology, University of Jaffna.

In Sri Lanka, Amphistomes have been recorded in the stomach of ruminants such as cattle, goats and buffaloes (Crusz 1952). Infection by *Cotylophoron* sp have also been reported by Dewan (1966) and Eduardo (1985). The present study reports the findings of a systematic survey of Amphistomes occurring in the alimentary canal of cattle and goats in Jaffna Peninsula.

Sample collections were made from slaughter houses from sixteen locations. An examination of the stomach of cattle and goats was done in the laboratory in order to collect Amphistomes.

Five species of Amphistomes were collected and identified from the rumen and reticulum of cattle - *Calicophoron calicophorum* Nasmark, *Cotylophoron cotylophorum* Stiles and Goldberger, *Gastrothylax crumenifer* (Creplin), *Orthocoelium streptocoelium* Yamaguti and *Paramphistomum gracile* Fischeoeder. Only one representative of the genus *Paramphistomum* Fischeoeder was recorded from goats.

C. cotylophorum was the most common Amphistome in cattle from September 1989 to December 1991. But in 1992, *C. calicophorum* was the most abundant with *G. crumenifer* occurring next in density in the population. *O. streptocoelium* has been observed occasionally since January 1990 and *P. gracile* also occasionally since October 1989.

Amphistomes infested 85.21% male and 77.34% female cattle. *Paramphistomum* sp. infested 7.52% male and 5.88% female goats. Amphistomes occurred in 44.65% of all cattle and goats examined of which 81.82% of the cattle and 6.85% of the goats were infested.

This study indicates the pattern of distribution of various Amphistomes in Jaffna Peninsula, which will also be helpful in studies towards the location and discovery of the proper secondary hosts such as snails, involved in the transmission of such Amphistomes.

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STATUS OF CRAB FISHERY IN THE JAFFNA LAGOON

K. Chitravadivelu

Department of Zoology, University of Jaffna

The Jaffna lagoon is a shallow water body located in the Northern part of Sri Lanka. Crabs form an important source of income to the fishermen of Jaffna and therefore have been assuming commercial importance since long. The present investigation was carried out over a period of two years from January 1991 to identify the crab species and evaluate the state of the crab fishery in the Jaffna lagoon.

Weekly samples were obtained from collections made at four landing centres at Araly, Kakaitivu, Colombuthurai and Ariyatal. Over 70% of crabs are caught by Parik Koodu - baited trap which is the main gear used in crab fishery. Each Parik koodu Unit (PKU) consists of twenty traps which are taken in a boat manned by two. Two hundred and forty eight samples in all, comprising 31,834 specimens of crabs were analysed during the investigation.

Neptunus pelagicus (Linnaeus), *Charybdis annulata* (Fabricius) and *Scylla serrata* (Forskale) are three species of edible crabs recorded in the Jaffna lagoon.

N. pelagicus is the dominant species with an average species composition of 79.5% in 1991 and 60.0% in 1992, followed by *C. annulata* with 18.6% and 38.6% during the corresponding period. *S. serrata* though the most popular species has a species composition of only 1.9% and 1.4%.

During 1991 CPUE varied from 3.5 Kg PKU⁻¹ day⁻¹ to 17.5 Kg PKU⁻¹ day⁻¹ giving an average of 8.7 Kg PKU⁻¹ day⁻¹ while in 1992 the value varied from 3.9 Kg PKU⁻¹ day⁻¹ to 14.6 Kg PKU⁻¹ day⁻¹ with an average of 7.8 Kg PKU⁻¹ day⁻¹.

The main season for crab fishery extends from June to December with peak catches.

The sizes of *N. pelagicus*, *C. annulata* and *S. serrata* ranged from 52 mm to 150 mm, 41 mm to 85 mm and 63 mm to 190 mm in carapace width, respectively.

This research was funded by the University of Jaffna, Sri Lanka.

SOME OBSERVATIONS ON THE BIOLOGY OF *NEPTUNUS PELAGICUS* (LINNAEUS) (PORTUNIDAE) FROM THE JAFFNA LAGOON

K. Chitravadivelu and K. Somasundaram

Department of Zoology, University of Jaffna.

Neptunus pelagicus (Linnaeus) a valuable and widespread food reserve in the Northern part of Sri Lanka, is an important component of the crab fishery in the Jaffna lagoon. The Jaffna lagoon is the largest water body situated in the Northern part of Sri Lanka with an area of approximately 421 Km². The present investigation carried out during January 1991 to December 1992, elucidates some information on the biology of *N. pelagicus*.

Weekly samples from collections made at four landing centres at Araly, Kakaitivu, Columbuthurai and Ariyalai, by Parik koodu, Sirahu valai, Drag net Kandi, Hoop net and Tramel net were used to study morphometrics, length-weight relationships, fecundity and rate of growth. The significant morphometric differences between sexes confirm the sexual differences indicated by colour. Male crab is blue in colour while the female is reddish orange.

The calculated carapace width-weight relationships of $W=0.0383cw^{3.322}$ for male and $W=0.0946 cw^{3.332}$ for female reflect an almost isometric growth.

The rate of growth ascertained from the monthly progression of modal carapace widths indicated an average of 10.0 mm month⁻¹, irrespective of the Sex.

There was a noticeable preponderance of females throughout 1991 and 1992. Fecundity was estimated to be in the range of 1.40×10^6 to 2.75×10^6 with a mean value of 1.93×10^6 .

The carapace width of *N. pelagicus* caught in the Jaffna lagoon ranged from 5.2 cm to 15.0 cm, weighing 14.1 gm to 215.0 gm respectively. The largest crab recorded was a female.

This research was funded by the University of Jaffna, Sri Lanka

THE DISTRIBUTION OF MICRO-CRUSTACEANS IN A POND AND THE
INFLUENCE OF PHYSICO-CHEMICAL FACTORS OF THE
POND WATER ON THEM

Chandrakathy Rajendram and N. Selvarajah

Department of Zoology, University of Jaffna

Micro-crustaceans are primary consumers in the ecosystem of fresh water pond and their distribution varies from month to month. The present work was undertaken to study the monthly distribution and abundance of various species of micro-crustaceans in a pond.

Micro-crustaceans were surveyed in a temporary pond of Sivankovil at Thirunelveli Jaffna for a period of one year from January to December 1991, with a view to studying the different species and their abundance in relation to the physico-chemical factors of the pond water.

This was done by obtaining random samples of the pond water once a week, examining and quantifying the fauna by numerical assessment using the drop method, and determining the major chemical components of the water samples collected.

The micro-crustacean population consisted mainly of Cladocera, Copepoda and Ostracoda. The peak density of the population of these micro-crustaceans was in June, and their population density was significantly higher than that of other orders. Fourteen species of micro-crustacea were listed and identified from the pond. The population density of a copepod, namely *Phyllodiaptomus annae*, an ostracod, *Cypris* sp and naupili of crustacea were found to be influenced by the combined effects of physico-chemical factors as seen from the analysis of multiple correlation coefficient. The individual species showed a significant difference in population with seasons. *Phyllodiaptomus annae* was abundant when there was little water. Another Copepod *Mesocyclops leuckarti*, Cladoceran, *Ceriodaphnia cornuta* and an Ostracod, *Cypris* sp were favoured by less sunny months of January, February and March.

ABUNDANCE OF ROTIFERS IN TWO PONDS IN JAFFNA PENINSULA

Chandrakanthy Rajendram and N. Selvarajah

Department of Zoology, University of Jaffna

Rotifers are important members of zooplankton which play a vital role in an aquatic ecosystem. In Sri Lanka the Rotifers have received some attention in recent years. The present investigation was carried out to study the abundance of Rotifers in Northern Sri Lanka.

Studies on monthly abundance of Rotifer population in relation to physico-chemical factors of water were made in two ponds, one at Nallur and another at Chundikuli, Jaffna, for ten months during the period March 1991 to March 1992. It was not possible to collect samples for 2 months due to the drying up of the pond.

The analysis was done after collecting random samples of plankton and water from the ponds once a month, and determining the density of Rotifer population in relation to the physico-chemical factors of the sample.

A total of twelve different species were recorded in the pond at Chundikuli, and eight species in the pond at Nallur. *Asplanchna brightwelli*, *Brachionis falcatus*, *Brachionis forficula*, *Brachionis rubens*, *Conochilus unicornis* and *Keiratella tropica* were identified in both ponds, of which *Asplanchna brightwelli* was the most dominant.

It was observed that the total densities of Rotifers showed a peak population in both ponds in the rainy months of November and December. However, individual species showed no significant differences in population between the ponds. The population density of Rotifers showed an inverse correlation with salinity, pH and dissolved ammonium concentration of the water. But the population density of individual species showed significant variation with physico-chemical factors.

DESIGN OF A METAL DETECTOR AND INVESTIGATION OF ITS PERFORMANCE

S. Gnanarajan

Department of Physics, University of Jaffna

The design of a metal detector based on the frequency shift of an oscillator when the inductance of its resonance circuit is changed is described. The detector is made up of two oscillators. One oscillator is used as a reference oscillator and it is made to oscillate at a fixed frequency of 788 kHz. The second is a tunable oscillator and a search coil with a diameter of 30 cm is included in the resonance circuit. When this search coil is taken near a metal, the frequency of oscillation of the second oscillator changes. This change is due to the change in effective inductance of the coil. Initially the tunable oscillator is tuned to 788 kHz. The change in frequency at detection is recognised from the beat produced by the signals of the two oscillators. When both signals are fed through a mixer, the output signal is like an amplitude modulated signal with the envelope having the beat frequency. The beat signal is separated using a demodulator (peak voltage detector) and amplified by an audio amplifier. The amplified signal is heard as a whistle in a headphone. The search coil is covered with a metal shield to reduce capacitance effects.

For detailed study in the laboratory the beat signal was analysed with an oscilloscope. The performance of the metal detector was tested for metal objects of different shapes and sizes and found to be satisfactory. The beat frequency is a measure of the sensitivity of the detector. It is observed that the beat frequency depends mainly on the cross-sectional area of the metal object normal to the axis of the search coil. The sensitivity is observed to be higher for ferromagnetic materials than for ordinary metals. That beat frequency is observed to be nearly the same for circular metal discs and circular loops of the same diameter. For the detection of a circular metal loop of 6 cm diameter, the range of detection is about 30 cm. For loops, that have the diameter of the wire greater than 0.1 mm, the sensitivity is nearly independent of the diameter of the wire.

A theory is proposed for the frequency shift when the object to be detected is a circular loop. The agreement between the theory and experiment is satisfactory.

RESISTIVITY VARIATION DURING HYDROGEN ABSORPTION IN PALLADIUM AND ITS ALLOYS

K. Kandasamy

Department of Physics, University of Jaffna

Palladium - hydrogen system is an ideal metal hydrogen system to investigate the origin of the processes that are responsible for the changes in physical properties during the formation of solid state hydrides (Mueller *et al.* 1968). The influence of alloying elements on the changes in physical properties provide further information for this investigation (Kandasamy *et al.* 1989). In palladium and its alloys the dissolved hydrogen occupies octahedral interstitial sites of the F.C.C lattice of the metal. The occupation by hydrogen atoms of the interstitial spaces causes a small expansion of the lattice without changing its crystallographic nature. At very low hydrogen to metal atomic ratios the dissolved hydrogen in the metal lattice exists as a solid solution. At hydrogen concentrations which correspond to an atomic ratio closer to 1 dissolved hydrogen forms a distinct hydride phase. Over a long range of atomic ratio between these two phases it exists as a characteristic mixed phase. The phase diagrams of these metal hydrogen systems show topologically greater similarity to those phase diagrams of one component systems which exhibit gas-liquid-solid phase transitions (Alefeld 1972).

In this study, phenomenological model for the variation of resistivity during absorption of hydrogen in Pd and its alloys is presented. The model explains the changes in the contribution to the resistivity of the host metal by various scattering mechanisms such as scattering of conduction of electrons by impurities, vacancies, zone boundaries, acoustic phonons and optical phonons. A comparison between the predictions of the model and published experimental results is given. It agrees reasonably well with the experimental results. The possible extension of the model to group III and group IV metal hydrides is also discussed.

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UPHILL DIFFUSION OF HYDROGEN IN METALLIC MEMBRANES

K. Ahilan and K. Kandasamy,

Department of Physics, University of Jaffna

The inclusion of hydrogen in a metal lattice expands the lattice and creates a stress around the inclusion sites. The effect of the stress is not only limited to the region around the inclusion sites but also propagates elastically to a long range in the metal lattice. The diffusion of hydrogen in a metal lattice is controlled by the gradient of chemical potential and since the chemical of hydrogen in a metal lattice is a function of stress the diffusion can be modified by the stress that is created due to the presence of hydrogen in the lattice (Kandasamy 1990).

Recently such modification in the hydrogen diffusion process was observed by Lewis *et al.* (1987), Kandasamy *et al.* (1989), Tong *et al.* (1990) in their investigation of hydrogen diffusion in metallic membranes by electrochemical and gaseous experimental methods. The modified diffusion is not Fickian and at present no complete theory is available to describe the non-Fickian nature of the diffusion processes.

In this study an attempt is made to understand the effect of stress on the factors controlling the diffusion processes and the nature of non-Fickian diffusion. The diffusion of hydrogen through a thin slab metallic membrane is investigated using (a) the Fick's equation and (b) a modified Fick's equation for the effect of internal stresses. A comparison of the study with the published experimental results is presented. It agrees reasonably well with experimental results. The possible sources for differences between the experimental and theoretical results are identified.

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A CLUSTER ANALYSIS OF JAFFNA - VALIKAMAM GROUND WATER RESOURCE

C. Elankumaran

Department of Mathematics and Statistics, University of Jaffna

Cluster Analysis has been applied to widely differing sets of ground water hydro-chemical data. Sixty eight spatially distributed random wells of the Water Resources Board of Jaffna were utilized for data collection from Jaffna-Valikamam region. Data for the year 1979, 1981 and 1983 were available for this study.

A hierarchical agglomerative clustering procedure applied revealed the development of ground water clusters in relation to Mahalanobis distance measure. The ideal cluster on ground water source area of the region appeared single in 1979, segregated into two clusters with three portions in 1981 and further segregated into six identified clusters in 1983. None of the clusters met the drinking water standard recommended by WHO. Four of them had fair quality and the remaining two had poor quality drinking water.

In this study an attempt is made to understand the effect of stress on the factors controlling the diffusion processes and the nature of non-Fickian diffusion. The diffusion of hydrogen through a thin slab metallic membrane is investigated using (a) the Fick's equation and (b) a modified Fick's equation for the effect of internal stresses. A comparison of the study with the published experimental results is presented. It agrees reasonably well with experimental results. The possible sources for differences between the experimental and theoretical results are identified.

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A PRELIMINARY STUDY ON THE USE OF NEEM, AZADIRACHTA INDICA (L) SEED KERNEL EXTRACT AS AN INSECT PEST CONTROL AGENT

Nithiagowry Ratnasabapathy, and V. K. Ganesalingam
Department of Zoology University of Jaffna

The neem tree (*Margosa*), *Azadirachta indica* has long been known to contain chemicals that affect the physiology and behaviour of insects, causing mortality. However there is little work done in the field in Jaffna to determine its efficacy. The present study was undertaken to determine the effect of neem seed kernel extract on insect pests of vegetable crops in the laboratory and in the field.

In the laboratory 100 g of neem kernel was powdered and mixed with 3 l water and sprayed on 25 plants against the whitefly, *Bemisia tabaci* and Jassids, *Empoasca* sp. The population of these pests was determined before and after spraying. In order to compare the effect of neem, a synthetic insecticide, "Penthoate" (2.1 ml in 3 l of water) was sprayed concurrently on plants against these pests.

For field work neem kernel was ground into fine powder, mixed with water, 500 g in 20 l of water and soap solution (7% of 200 ml) and left to soak for 24 h. It was sprayed with a knapsac sprayer on crop plants at the rate of 20 l for 500 plants once a week, against *Spodoptera exigua*, *Empoasca* sp. locust and grasshopper. The samples of affected plants were determined before and after the application.

The laboratory studies showed that the population of whiteflies was significantly reduced with neem kernel extract as well as "penthoate", but both had almost the same effect. In the field it was found that there was a significant decrease in pest damage in onion, greengram and *Amaranthus* grown in the different locations under normal cultivation. It was also observed that the plants which were sprayed with neem extract had a better yield and better market than the control.

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HEAT FLOW OUT OF REGIONS IN R^n

S. Srisatkunarajah

Department of Mathematics, University of Jaffna

Let D be an open set in R^n and let $H \geq 0$ be the operator $-\Delta$ on $L^2(D)$ subject to Dirichlet boundary condition, (Dirichlet Laplacian). The heat kernel $P(x, y; t)$ of e^{-Ht} is a positive C^∞ function on $D \times D \times (0, \infty)$.

Necessary and sufficient conditions for

$Z_D(t) = \text{trace}(e^{-Ht}) = \int_D P_D(x, x, t)$ to be finite for some $t > 0$ are provided in [1], [2].

In this paper we shall provide a necessary condition on D for a closely related function $Q_D(t)$ to be finite for some $t \geq 0$. Here $Q_D(t)$ is defined by

$$Q_D(t) = \int_D dx \int_D dy P_D(x, y; t)$$

$Q_D(t)$ represents the amount of heat contained in D at time t when D has temperature 1 at $t=0$ and the boundary ∂D of D is kept at temperature 0 for all $t > 0$.

Result :

$$Q_D(t) < \infty \iff \int_D dx e^{-n^2 \pi^2 t / 4d^2(x)} < \infty$$

$$\text{where } d(x) = \min \{ |x-y| : y \in D \}$$

The main tool of our investigation relies on the representation of $\int_D dy P_D(x, y; t)$ as a Wiener probability $P_X[T > t]$ that a Brownian motion $B(\cdot)$ with $B(0) = X$ does not leave D until t :

$$P_X[T > t] = \int_D dy P_D(x, y; t). \quad [3]$$

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RESPONSE OF GREEN MANURE ON GROWTH AND YIELD OF RICE

S. Mohanadas & N. Gnanavelrajah

Faculty of Agriculture, University of Jaffna

A field experiment was conducted at Kilinochchi to study the effect of inorganic fertilizers, compost, green manure - glycidia and the combined use of organic fertilizers on growth and yield of rice.

All three fertilizers namely inorganic fertilizer, compost and green manure significantly increased the grain yield. However, glycidia has a marked effect on growth and yield of rice compared to inorganic fertilizer or compost. The highest grain yield was recorded for the treatment of green manure 15 mt/ha used in combination with 25% of the recommended inorganic fertilizer (85 kg N/ha; 55 Kg P₂O₅/ha; 45 Kg K₂O/ha). There was no significant difference in yield among treatments of 100% inorganic fertilizer, 10 mt/ha compost in combination with 50% inorganic fertilizer and 15 mt/ha compost in combination with 25% inorganic fertilizer. Number of tillers/m² was also significantly affected by the treatments. However 1000 grain weight was not significantly affected by treatments.

EFFECT OF ORAL CONTRACEPTIVES AND INJECTABLE CONTRACEPTIVES ON VARIOUS BIOCHEMICAL PARAMETERS

S. Ahilan, V. Balasinhham, S. Mahendran, V. Arasaratnam,
and K. Balasubramaniam,

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

This study was carried out to determine the biochemical effects of oral contraceptive (OC) and the injectable contraceptive (IC) on the users. These two routes of administration are more commonly used in our country. For this experiment three groups each consisting of twenty (20) subjects were selected from Jaffna Municipality area. Tests were done in all three groups (OC users, IC users and non users). Serum ascorbic acid levels were significantly decreased in both the OC and IC users compared with the controls. Catecholamine excretion was determined by the amount of VMA excreted in 24 h urine sample. There was a significant increase in OC users. Serum protein, iron, iron binding capacity, triacylglycerol and uric acid levels were significantly increased in both the OC and IC users. There was no significant difference between both types of contraceptive users and non-users in serum bilirubin, calcium, free fatty acids, glutamate oxaloacetate transaminase, glutamate pyruvate transaminase, blood glucose, and glucose tolerance. These results indicate that the use of contraceptives oral or injectable, had significantly increased serum protein, triacylglycerol, iron, iron binding capacity levels and nucleic acid metabolism.

PRILIMINARY STUDIES ON THE ANTIBACTERIAL ACTIVITY OF
SELECTED PLANT EXTRACTS USED BY AYURVEDIC PHYSICIANS
IN JAFFNA

C. Soloman, S. Mahendran, V. Arasaratnam, and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

Antibacterial action of eight common plants which are used in indigenous medicine in Jaffna were tested using disc diffusion method. Standard antibiotics such as Cefuroxime, Ampicillin and Penicillin were used as control. Crude extracts of five plants such as *Azadirachta indica* (Vempu), *Coriandrum sativum* (Kothamali), *Ctenolepis garcini* (Musumusukai), *Hibiscus rosasinensis* (Sevarathai), *Zingiber officinale* (Inchi) showed very high antibacterial activity against *Staphylococcus aureus*, which commonly causes superficial and deep seated pyogenic infection and was Penicillin resistant. Extract of *C. sativum* showed high antibacterial activity while four plants such as *A. indica*, *Phyllanthus emblica* (Nelli), *H. rosasinensis* and *Z. officinale* showed moderate antibacterial activity against *Klebsiella* which commonly causes pneumonia, and was Penicillin resistant. Extract of the other two *Loranthus* (Kuruvichai) and *C. Sativum* showed antibacterial activity against *Pseudomonas* which commonly causes endogenous urinary tract infection and was Cefuroxime and Penicillin resistant. Extract of *A. indica*, *C. sativum*, *C. garcini*, *H. rosasinensis* and *Z. officinale* were highly effective against *Escherichia coli* which commonly causes infantile diarrhoea and urinary tract infection and was Penicillin resistant. These results show that the locally available natural resources could be developed into newer antibiotics.

QUALITY CONTROL OF PROCESSED FOODS

K. Sritharan, P. Thevathapam, G. R. P. Kulasingham,
K. Balasubramaniam, S. Mahendran and V. Arasaratnam

Department of Biochemistry, Faculty of Medicine, University of Jaffna

Quality control analysis of foods is important to protect the consumer and to help the producer to improve the processing and quality of the processed foods. Jams, cordials and beverages produced and marketed in Jaffna peninsula were analysed. Analytical methods adopted were those recommended by the Sri Lanka BUREAU and British standards. Total sugar, reducing sugar and acidity of the tomato jam were 64.7% (W/W), 14.9% (W/W) and 0.874% (W/W), respectively, while the recommended values were 65.0% (W/W) 20-40% (W/W) and 1% (W/W) respectively. Total sugar, acidity, benzoic acid, ascorbic acid and sulphurdioxide of grape cordial manufactured locally were 50% (W/W), 1.628% (W/W) and 732 mg kg⁻¹, whereas ascorbic acid, and sulphurdioxide were absent. Recommended values of the first three are 45-55% (W/W), 1.6% (W/W) and 800 mg kg⁻¹ (max) respectively. Benzoic acid level in nelli crush was within the recommended level (398.4 mg kg⁻¹ 800 < mg kg⁻¹) while in cream soda it was above the level (272 mg kg⁻¹ > 120 mg kg⁻¹). Some soft drinks marketed in Jaffna had high values of saccharin such as 168 mg kg⁻¹ and 322.4 mg kg⁻¹, whereas the recommended amount is 80 mg kg⁻¹. Average values of pH, % Brix (total solids) total sugar and acidity of many beverages were determined and were within the range of the recommended values. Microbial count in soft drinks was estimated by pour plate technique. Number of colonies present in the soft drinks (7 samples) was in the range of 3.6 x 10² - 9.6 x 10⁴ colonies ml⁻¹. According to Sri Lanka BUREAU standards permitted microbial count for soft drinks is 100 colonies ml⁻¹ (max) Presence of coliform bacteria was tested in those drinks using Lactose broth and Eosin Methylene blue (ENB) agar plates. Coliform bacteria was not present in the tested soft drinks. Our results indicate that the consumers especially children, have to be protected from the harmful effects of saccharin found in beverages.

EFFECT OF ROASTED PLANTAIN FLOWER ON BLOOD LIPIDS, PROTEINS AND IORN

M. Thirukumar, V. Balasingam, S. Mahendran,
V. Arasaratnam, and K. Balasubramanian

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

Plantain flower is used by the population of Sri Lanka in their normal diet. Hence the effect of Plantain flower on the metabolism of lipids, proteins and iron was studied in a group of healthy individuals at the ages of 20–25 years. Roasted Plantain flower "varai" (60 g wet weight) was administered with their normal mid-day meal for six consecutive days and various parameters were measured on 0 and 7th day of administration of the food. Cholesterol, triacylglycerol, free fatty acids and iron were measured on a group of 40 healthy subjects, while the protein and bilirubin trials were made on different groups of 20 people. Fasting blood samples were taken for all analysis. Mean blood glucose levels before and after the administration of Plantain flower were 79.7 mg dl^{-1} ($+/- 13.18$) and 72.4 mg dl^{-1} ($+/- 12.37$) respectively. The difference was statistically significant. Mean serum triacylglycerol levels before and after the administration of the food were $0.99 \text{ m mole l}^{-1}$ ($+/- 0.44$) and $0.68 \text{ m mole l}^{-1}$ ($+/- 0.36$) respectively. The decrease in serum triacylglycerol level was also statistically significant. Mean serum total protein level before and after the administration of Plantain flower was 6.38 g dl^{-1} ($+/- 0.83$) and 6.21 g dl^{-1} ($+/- 0.79$) respectively. Difference in serum protein after the administration of the diet was not significant. Mean serum iron before and after the administration of Plantain flower was $166.4 \text{ } \mu\text{g dl}^{-1}$ ($+/- 45.6$) and $124.5 \text{ } \mu\text{g dl}^{-1}$ ($+/- 38.1$) respectively. The results show that the decrease in serum iron level is significant. Mean serum cholesterol level before and after the administration of the food was 196.4 mg dl^{-1} ($+/- 48.9$) and 171.8 mg dl^{-1} ($+/- 18.3$) respectively. Thus the food has not significantly reduced the serum cholesterol level. Mean serum bilirubin level before and after the administration of Plantain flower curry was 0.58 mg dl^{-1} ($+/- 0.1$) and 0.33 mg dl^{-1} ($+/- 0.8$) respectively. Thus serum bilirubin was not significantly altered by the intake of Plantain flower. Mean serum free fatty acid levels before and after the administration of plantain flower were 751.6 ($+/- 117.5$) and 654.3 ($+/- 97.4$) respectively and no significant reduction was observed. These results indicate that blood glucose, serum triacylglycerol and iron are significantly reduced while the cholesterol, free fatty acid and bilirubin changes are insignificant.

ETHANOL PRODUCTION FROM MALTED PADDY

K. Sivaganeshan, S. Mahendran and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine, University of Jaffna

Paddy was steeped in water for 24 h and allowed to germinate in dark for 5 days. The germination was arrested on the 6th day by drying the paddy in hot sun and husk was removed manually. Malted rice was powdered in a grinding mill. Moisture content, reducing sugar, total carbohydrate content and endogenous amylase activity of malt powder were 97.5 g kg⁻¹, 97.2 g kg⁻¹, 720 g kg⁻¹ and 488.3 μ mol min⁻¹ g⁻¹ malt powder respectively. Optimum endogenous amylase activity was observed at pH 4.5 and 50°C. By the action of endogenous amylase activity at 50°C and pH 4.5, about 50% of starch present in malt powder was hydrolysed in 5 h. The simultaneous saccharification by endogenous amylases and fermentation by a yeast strain isolated locally from toddy produced 275.3 g ethanol from one kg malt powder at room temperature in 120 h. In this research we have achieved an efficient saccharification and fermentation process (76.5%) in which the malted paddy was hydrolysed by its endogenous amylases with concomitant conversion of the sugars to ethanol by yeast fermentation.

USE OF CALCIUM CARBONATE IN BATCHWISE PROCESS FOR LACTIC ACID PRODUCTION BY *LACTOBACILLUS DELBRUECKII*

A. Senthuran, V. Arasaratnam and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

The influence of pH on lactic acid production and glucose consumption by *Lactobacillus delbrueckii* and on its growth was studied with two different glucose concentrations in shake-flasks at 42°C and 120 rpm. Continuous control of pH led to increased yields (70%) and rates of lactic acid production ($2 \text{ gl}^{-1} \text{ h}^{-1}$). However when pH of the medium (containing 50 gl^{-1} glucose) was not maintained, glucose consumption decreased to 58% and lactic acid production was 40% of the theoretical yield. Both glucose consumption and lactic acid production were increased by 30% and 24% respectively, when the pH was manually adjusted to 6.5 two hourly using 4N NaOH under these conditions OD, a measure of growth increased from 3.1 to 8.2. The maintenance of pH is vital for growth of *Lactobacillus delbrueckii* and for fermentation of lactic acid. When CaCO_3 was used as neutralizing agent, further increase in glucose consumption and lactic acid production by 16% and 8% respectively was observed. But at 150 gl^{-1} glucose concentration the manual addition of 4N NaOH two hourly was not effective. The glucose consumption dropped from 84% (50 gl^{-1} glucose) to 50% (150 gl^{-1} glucose) and the growth of *Lactobacillus delbrueckii* decreased from 8.2 to 4.6 (OD). Higher initial glucose concentration increased the lag phase and decreased the growth rate. Although the cell growth and theoretical yield of lactic acid decreased at 150 gl^{-1} , the amount of lactic acid production increased. Addition of CaCO_3 intermittently throughout the experiment gave better yields of lactic acid (90 gl^{-1}) rather than adding all at once at the beginning of the experiment (83 gl^{-1}). These results indicate that lactic acid could be produced efficiently in batchwise process by adding CaCO_3 without continuous pH adjustment.

PREPARATION AND CHARACTERIZATION OF DEAE-CELLULOSE IMMOBILIZED AMYLOGUCOSIDASE

T. Murugapopathy, V. Arasaratnam, and K. Balasubramaniam

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

In the industrial production of dextrose syrups, immobilized amyloglucosidase offers an advantage over the soluble enzyme as immobilized enzyme can be recovered for reuse. Since physical immobilization is the simplest and most preferred method, amyloglucosidase was physically immobilized on DEAE-cellulose.

In a comparative study of equal amounts (0.172 mg protein) of soluble amyloglucosidase and DEAE-cellulose immobilized amyloglucosidase, activities of soluble and immobilized enzyme on the hydrolysis of soluble starch at pH 4.5 and at 57°C were 1.76 and 1 units (1 unit produces 1 mg glucose min⁻¹ respectively under zero order kinetics. DEAE-cellulose immobilized amyloglucosidase showed optimal activity when agitated at 120 rpm.

Conditions for physical immobilization of amyloglucosidase on DEAE-cellulose and hydrolytic actions of the immobilized enzymes were optimized. Optimum pH value for immobilization of amyloglucosidase was pH 7.0 at which 86% of added enzyme protein was immobilized. Despite the fact that ion-exchange process is instantaneous, time is required to reach an equilibrium when using a porous carrier due to diffusional problems. Thus, the equilibrium time required for physical immobilization of amyloglucosidase was 4 h. With increasing concentrations of soluble amyloglucosidase in the reaction mixture for immobilization, activity of DEAE-cellulose immobilized amyloglucosidase increased whereas its specific activity decreased. When the soluble amyloglucosidase in the immobilization medium was 62.2 U ml⁻¹ per ml carrier, the optimum activity of DEAE-cellulose immobilized amyloglucosidase was 45 U ml⁻¹ and its specific activity was 3.6 U mg⁻¹ protein. As starch (7% W/V) at 95°C is not readily soluble a dextrinized starch (20% W/V) of DE 36 was prepared by incubating starch 20% (W/V) with heat stable amylase at 95°C for 1 h. Activity of DEAE-cellulose immobilized amyloglucosidase was enhanced by 2.7 fold when dextrinized starch was used as substrate instead of normal starch. Immobilized enzyme preparation (11.3 mg protein, 1 ml) hydrolyzed dextrinized starch DE 36 (16% W/V) to 98% in 90 min which was comparable to the activity of soluble enzyme at pH 4.5 and at 57°C. DEAE-cellulose immobilized amyloglucosidase showed optimal activity at 52°C.

EFFECT OF PLANTAIN FLOWER AND LEAVES OF GYMNEMA

SYLVESTRE ON BLOOD GLUCOSE LEVEL

S. K. Arulmoli, S. Kumaravel, V. Balasingam,

V. Arasaratnam and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,

University of Jaffna

Effect of temperal Plantain flower (*Valaipoo*) and temperal leaves of *Gymnema sylvestre* (*Sirukurunga*) on the blood glucose levels of 19 healthy volunteers were studied. The food ("varai") was prepared by the addition of scraped coconut, coconut oil, onions and chillies to a fixed weight of Plantain or *G. sylvestre*. The subjects were administered with 50g of fibrous food and 75g of glucose orally after over night fasting. Blood glucose levels were estimated before and 1 h administration. The same individuals were subjected to both the *Valaipoo varai* with glucose and *Sirukurunga varai* with glucose at 1 week interval. As a control glucose was administered alone to these subjects and the blood glucose levels were determined. The blood glucose levels at fasting and 1 h after the administration of glucose were 65.1 mg dl^{-1} (± 10.1) and 96.1 mg dl^{-1} (± 12.8) respectively. When *Valaipoo varai* and glucose and *Sirukurunga varai* and glucose were administered, the blood glucose levels at fasting and 1 h after the administration was 65.5 mg dl^{-1} (± 8.5) and 75.0 mg dl^{-1} (± 10.8) and 64.5 mg dl^{-1} (± 9.3) and 82.71 mg dl^{-1} (± 10.2) respectively. The result of paired "t" test for *Valaipoo varai* was 7.2 and for *Sirukurunga varai* was 4.3 and in both cases the "P" values were less than 0.01. These results indicate that Plantain and *G. sylvestre* which are fibre rich had a significant effect on the reduction of blood glucose level. This effect could have been brought about by the interference of insoluble carbohydrate fibres on glucose absorption. The increase in blood glucose level in control subjects was 30 mg dl^{-1} while after the administration of glucose and *Valaipoo varai* was 10.5 mg dl^{-1} (± 11.6) and for *Sirukurunga varai* and glucose was 18.2 mg dl^{-1} (± 6.0). The result of paired "t" test was 2.6 and "p" value was less than 0.05 ($p < 0.05$). Hence the result was statistically significant. The amount of fibre in *Valaipoo varai* was $3.01\text{g}/50\text{g}$ while in *Sirukurunga varai* was $1.22\text{g}/50\text{g}$. In the food preparations sugar content was $1.22\text{g}/50\text{g}$ *Valaipoo varai* and $1.39\text{g}/50\text{g}$ *Sirukurunga varai*. The decrease in blood glucose level for Plantain and *G. sylvestre*, 3.01g and 1.22g fibre were 20.5 mg dl^{-1} and 12.8 mg dl^{-1} indicates that the amount of decrease in blood glucose is directly proportional to the fibre content of the diets.

PREPARATION OF SUGAR SYRUP (DE 50-70) FROM CORN FLOUR

K. Thayananthan, V. Arasaratnam, S. Mahendran and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

Sugar syrup obtained by dextrinization of starch in corn flour (22% solids W/W) by α -amylase at concentration of 12 KNU and 24 KNU for 100 g suspension had 56 and 61 DE respectively. As the corn flour was suspended in tap water containing Ca, addition of calcium acetate to the corn flour suspension did not improve the hydrolysis of starch. As total solid suspension of 22% (W/W) was very viscous, no further increase in dry solids was possible without decreasing its viscosity. Hence the addition of corn flour (dry) or corn flour suspension to increase the total solids from 22% (W/W) to final concentrations ranging from 25 to 30% (W/W) was only done as the liquefaction proceeded with the concomitant decrease in viscosity. When corn flour (10 g) corn flour suspension (30g of 33% W/W) or corn flour suspension (40g of 66% W/W) was added to the liquefying starch (22% W/W), sugar syrup obtained at 3h had 50, 60 and 36 DE respectively and the percentage of starch hydrolysed was 72.4, 80.5 and 48.4% respectively. As α -amylase cannot completely hydrolyse starch to glucose or maltose, malt extract rich in β -amylases was added to convert dextrins to maltose. Addition of corn malt extract to the liquefied starch preparations supplemented with either dry corn flour (10 g) or corn flour suspension (33% W/W) increased the DE from 50 and 60 to 62.2 in both respectively. In the next experiment malt powder suspension (25% W/W) equivalent to the malt extract of the previous experiment was added directly and the DE obtained were 57 and 55.2 respectively. These results indicate that glucose syrups of 50 to 70 DE can be prepared using α -amylase alone without the help of malt amylases.

MALT AMYLASES AND EXOGENOUS AMYLASE IN THE PREPARATION OF MALT EXTRACT

K. Mylvaganam, S. Mahendran, V. Arasaratnam and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

Malted corn grains (5th day) were dried in hot sun and powdered in a grinding mill. Moisture content, total carbohydrate, total protein and the endogenous amylase activity of corn malt powder were 100g kg^{-1} , 660g kg^{-1} , 90g kg^{-1} and $30.4\ \mu\text{mol glucose g}^{-1}\text{ malt powder min}^{-1}$ respectively. The endogenous amylase activity was optimum at 60°C . When endogenous amylases were supplemented with increasing concentration of α -amylase, 95% of the endogenous starch was hydrolysed in 2 h by 5g kg^{-1} α -amylase. From one kg corn malt powder about 3.5 l clear malt extract was obtained. The colour substance in the malt extract had a maximum absorbance at 740 nm . Total carbohydrate, dextrose equivalent (DE), Ca^{++} , and total protein content of the malt extract were 150g l^{-1} , 60, 0.14g l^{-1} and 5.0g l^{-1} respectively. These results indicate that a good nutrititious malt extract could be prepared from corn.

PRODUCTION AND KINETIC STUDIES OF α -AMYLASE FROM
Bacillus licheniformis 6346
IN SOLID STATE FERMENTATION

W. S. Tambyrajah, S. Mahendran V. Arasaratnam and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

Optimization of α -amylase production by *Bacillus licheniformis* 6346 was done in basal rice bran medium. Maximum enzyme was produced in solid state fermentation (SSF) medium at 144 h (6th day). During SSF, viable cell count, pH and moisture content of the fermentation medium were monitored from the time of inoculation. The cells reached log phase at 96 h and stationary phase at 144 h. Moisture content of the fermentation medium varied within a narrow range during enzyme production (66.7%—71% (W/W) from 0h to 168h). The pH of fermentation medium increased gradually during enzyme production. Kinetic properties of the enzyme were studied. The enzyme was assayed in starch 1% (W/W)-0.01M phosphate buffer (pH 7) at 85°C for 5 minutes. Optimum temperature for amylase activity was 85°C. The pH activity curve showed two peaks at 6.6 and 8.3. The K_m and V_{max} of the enzyme were determined. Stability of the enzyme was more when stored as dried bacterial bran (retained 44.6% activity at 105th day) than as extract (retained 4.6% activity at 92nd day).

BIOCONVERSION OF GLUCOSE TO CITRIC ACID USING A STRAIN OF *ASPERGILLUS SP.*

P. Navaratnam, S. Mahendran and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

A local isolate of *Aspergillus sp.* strain P_1 from decaying lime fruit was used in the bioconversion of glucose to citric acid. When this strain was cultivated in surface culture of a liquid medium containing glucose 50 gl^{-1} , peptone 7 gl^{-1} and salt mixture consisting of (gl^{-1}) NH_4NO_3 , 0.5; K_2PO_4 , 0.5; $MgSO_4$, 0.1; ferrous ammonium sulphate, 0.1×10^{-3} ; $CuSO_4 \cdot 5H_2O$, 0.06×10^{-3} ; and $ZnSO_4$, 0.1×10^{-3} ; maximum citric acid obtained was 1.0 gl^{-1} at 90 h and at room temperature. By single spore culture in a medium containing indicator bromocresol green, a strain P_2 was isolated. Maximum citric acid produced by this strain was 2.5 gl^{-1} in 122 h. By UV radiation (254 nm, 10 min) of spores of *Aspergillus sp.* P_2 , a mutant UV_1 was isolated. It produced 4.6 gl^{-1} of citric acid from 50 gl^{-1} glucose in liquid culture medium at 91 h and at room temperature. Supplementation of liquid culture medium with methanol (3%, V/V) and gingilly oil (0.2%, V/V) increased citric acid production from 4.6 gl^{-1} to 12.4 gl^{-1} , an increase of 170%. Another cycle of UV radiation of spores from *Aspergillus sp.* UV_1 strain and isolation of mutants on bromocresol green gave a strain UV_2 which produced 36.5 gl^{-1} of the acid when the liquid medium containing 50 gl^{-1} glucose was supplemented with further 50 gl^{-1} glucose on 9th day. Further work is in progress to double up the production of citric acid to match the industrial strains used in citric acid production-

RENNET FROM *ASPERGILLUS NIGER* IN SOLIDSUBSTRATE FERMENTATION

V. Shanmuganathan, V. Arasaratnam and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

Rennet is used in the manufacture of cheese from milk. As the calf rennet is expensive and difficult to get in large amounts, microbial rennet has come into use. Optimization of rennet production by *Aspergillus niger* was done in rice bran medium. During solid state fermentation, production of rennet, glucoamylase, pH and moisture content of the moldy bran were monitored at intervals from the time of inoculation. Maximum activity of rennet was observed at 40 h. Moisture content of the medium decreased while the pH of the moldy bran increased as fermentation progressed. When enzyme was extracted from moldy bran with tap water, distilled water and 1% NaCl solution, highest extraction was obtained with distilled water. Kinetic properties of the enzyme were studied. The enzyme activity was assayed by the clotting of milk protein at pH 5.0 and 40°C for 10 minutes. Optimum temperature and pH for rennet activity were 40°C and pH 5.0 respectively. Stability of the enzyme in extract and in dried moldy bran (13.5% W/W moisture) were compared. The enzyme was more stable when it was stored as dried moldy bran than extract under our experimental conditions.

IMMOBILIZATION OF GLUCOAMYLASE FOR THE HYDROLYSIS OF STARCH AND DEXTRINIZED STARCH

S. Balakumar, V. Arasaratnam and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

The isoelectric pH of glucoamylase from *Aspergillus niger* was between 3.5 and 4.0. In the studies for the selection of carrier for immobilization of glucoamylase, cation exchanger Amberlite IR-120 and anion exchanger Amberlite IRA-904 were used. For Amberlite IR-120, immobilization yields of protein and glucoamylase units were 10 and 11% respectively at pH 3.3 and at pH 2.5 were 14.6 and 15.1% respectively. Retentivities of Amberlite IR-120 for glucoamylase activity at 55°C and at pH 3.3 and 2.5 after 5 successive batch reactions (each 10 min duration) were 1.6 (+/- 0.47) and 2.7 (+/- 0.47) respectively. Cation exchanger Amberlite IR-120 was not suitable for immobilization of this enzyme as it showed poor retaining capacity. Hence the experiments were carried out with anion exchanger Amberlite IRA-904. The capacity was 42mg protein (493 AMG units) per gram (wet Wt) of resin at pH 4.5, giving an immobilization yield of 64% protein and 67.5% AMG units. The activity yield (a measure of functional fraction of expected immobilized enzyme activity) was 2.2% which indicates poor expression of immobilized glucoamylase activity. The retentivity of the enzyme activity was 94.4% (+/- 2.3). Relative activities of soluble glucoamylase with 2% (W/V) starch, dextrinized starch (DE 36) and maltose were 100, 52.2 and 37.5% respectively. The activity yields of Amberlite IRA-904 immobilized glucoamylase were 22.3 and 28.0% with dextrinized starch and maltose respectively. Effectiveness factor, which is a measure of diffusional restriction for substrate molecule was 7.3, 1.6 and 1.1 for starch, dextrinized starch and maltose respectively. Thus glucoamylase is suitable for the physical immobilization on Amberlite IRA-904 and for continuous saccharification. It is desirable to use dextrinized starch than soluble starch and maltose with the immobilized glucoamylase.

PURIFICATION AND PROPERTIES OF GLUCOSE OXIDASE FROM *ASPERGILLUS NIGER*

S. Kanagaratnam, S. Mahendran, V. Arasaratnam and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine,
University of Jaffna

Glucose oxidase which catalyzes the oxidation of glucose by molecular oxygen has application in food industry and in quantitative determination of D-glucose in body fluids and in industrial solutions. Hence glucose oxidase from *A. niger* (CISIR N₄) was purified and characterized. Glucose oxidase was purified 6.7 fold by DEAE-cellulose anion exchange chromatography and specific activity increased from 195 to 1306 μ moles min⁻¹ mg protein⁻¹. The recovery of glucose oxidase activity was 56.7%. Glucose oxidase showed zero order kinetics for 20 min at 37°C and linear in initial reaction rate was observed in the range of 0-4 μ g protein. The enzyme had a broad temperature optimum between 35°-45°C and pH optimum was 5.0 when the glucose oxidase activity was measured in the coupled reaction with peroxidase. At pH 5.6 the enzyme retained its full activity both at 30° and 37°C, and at 45°C it retained 90% of the initial activity for 6h. The enzyme was fairly stable and on storage for 3 days, lost 3%, 9% and 12% of the initial activity at 30°, 37° and 45°C respectively. The enzyme retained full activity at pH 5.6 for 6h and during this period lost 5% and 10% of the initial activity at pH 5.0 and 3.5. However on storage for 3 days at 30°C at pH 5.6, 5.0 and 3.5, the enzyme lost was 5%, 7% and 86% of the initial activity respectively. The glucose oxidase was more stable at 30°C and at pH 5.6 and hence could be efficiently utilized in the manufacturing and analytical processes under these conditions.

GLUCOSE PRODUCTION FROM RAW STARCH IN CORN FLOUR

V. Arasaratnam, N. Nithianantharajah and K. Balasubramaniam

Department of Biochemistry, Faculty of Medicine, University of Jaffna

Optimum ratio of glucoamylase to α -amylase for synergistic hydrolysis of starch in corn flour was 1.8 AGU/1.0 KNU. Hydrolysis of starch in dry milled corn was most efficient compared with that of wet milled corn steeped in water or NaOH. With increase in hydrolysis of starch in corn flour, release of proteins, reducing sugars and colour into the hydrolysate increased with a decrease in residual matter and filtration rate of the hydrolysate. Addition of β -glucosases and proteases did not improve the filtration rate of corn flour hydrolysate. However a change in pH of the corn flour hydrolysate from pH 5.0 to 4.5 increased its filtration rate. Addition of activated charcoal to corn flour hydrolysate at pH 4.5 further increased the filtration rate. Addition of charcoal had also removed the colour and proteins present in the hydrolysate without altering the sugar content. When 1.6 kg and 4 kg of corn flour suspensions were synergistically hydrolysed by α -amylase and glucoamylase and purified, glucose yields were 76% and 50.2% respectively. Glucose yields were calculated based on the total starch content in corn flour.

(AGU- AmyloGlucosidase Unit; KNU-Kilo Novo Unit).

IMPACT OF THE LIBERALISATION POLICIES AND THE SRI LANKAN ECONOMY

K. Kandiah and N. Balakrishnan
Department of Economics, University of Jaffna

The development effort in Sri Lanka since 1977 has been based on liberalisation policies centred around an 'open economy' and outward-looking export-led strategy with a strong market orientation, giving a prominent place to private capital, both local and foreign. This paper attempts a critical appraisal of the liberalisation policies, their underlying perspectives and impact on the economy in the post-1977 period. The liberalisation policies and their perspectives largely conformed to the 'standard' IMF-World Bank prescriptions - the so-called stabilisation and structural adjustment policies.

The paper highlights the strongly free market orientation with a diminished role for the state sector in direct production activity, privatization of several state enterprises and the penetration of international capital in many fields of activity in the economy. The major trends in growth, investment, domestic budget, price level and employment are analysed to indicate the economy's response to the new policies.

The economic performance has been a mixed one. There was a marked difference in performance during 1978 - 82 and thereafter; the latter period in many respects shows a disappointing record. Import dependence, external imbalance and external debt increased substantially in the post-1977 period. The dependence, to an unprecedented extent, on international capital has far-reaching implications for the economy. Increased rate of investment in the period was not matched by domestic savings mobilisation.

The study also examines the growth-equity problems in the context of the liberalisation policies. The indications are that there has been a deterioration in income distribution and the Janasavia programme was introduced as an antipoverty measure, partly to counter the adverse effects of free market policies on low income groups.

The major thrust of the development strategy is on export-led industrialisation. But in the context of the current growth trends, the pattern of industrial production and the global economic environment, this continues to be an uphill task.

19TH CENTURY REVIVALISM IN JAFFNA
SOCIAL HISTORICAL STUDY

M. Selvin
Department of History, University of Jaffna

Earlier Societies had religio-centric cultural life. Even after the arrival of the foreigners, Jaffna also had a similar form of Society. English education, Christianization and westernization were introduced by the colonialists. As a result of this, Jaffna's religious sphere was disrupted.

In the 19th Century, many socio-economic and administrative changes were introduced by the colonial rulers and the educational system in Ceylon. This educational system facilitated the introduction of native Ceylonese into the Government Services. This new opportunity attracted wealthy upper level people and they tried to obtain maximum benefits of English education to achieve this object. Due to this many upper level people changed their religion.

At the time of this social crisis, Arumuga Navalar played a prominent role in order to safeguard the Hindu Religion. Navalar proposed a model and institutionalized the religious and educational system. This system, even though it was meant for the whole society, really benefited the people from the upper and middle levels of the social hierarchy. The Social structure and the mode of production which prevailed then did not allow the lower rungs of the society to share in the benefit of this revivalism.

The present paper is an attempt to analyse the above problem, focussing on the interplay between Navalar's revivalism and Society.

SOCIAL INEQUALITY AND THE DISTRIBUTION OF ENGLISH PROFICIENCY AMONG JAFFNA UNIVERSITY STUDENTS

A. S. Canagarajah and M. Saravanapava Iyer
Department of Linguistics, University of Jaffna

Sociolinguist Basil Bernstein has suggested that (1) certain valued forms of language are unequally distributed in society according to the socio-economic status of the members; (2) these respected linguistic codes provide an advantage for the children in the educational institutions, which actively used such codes and thereby provides them advantages in employment and social status; (3) through this process, society reproduces its characteristic form of social stratification. Contemporary sociologist Pierre Bourdieu strengthens this description by including language in the larger construct of culture: that is, certain values and styles of communication which are unequally enjoyed, thereafter predispose the owners to differential educational and socio-economic prospects. Although these theorists have considered "language" in terms of codes, registers or dialects of the same language, in Sri Lanka English is the language that is privileging.

A three page questionnaire distributed to 297 new entrants to the Arts Faculty in 1990/91 confirms the first of Bernstein's hypotheses: students from higher socio-economic groups, who have been to "good" schools whose parents enjoyed a higher proficiency in education and English, whose families encounter English oftener in their day to day life, are more proficient in English. It can be inferred from the schooling of the students and parents that the other hypotheses might also be true-although further studies are needed to confirm these.

The implications for language planning and ESL instruction are many. (1) Despite years of Sinhala and Tamil nationalism, English still remains a language associated with socio-economic advantages. (2) Thiru Kandiah's hypothesis that the maldistribution of English socially affects the motivation, attitudes and proficiency of ESL students receives emphasis. (3) Language teachers are compelled to artificially simulate the English cultural background to lower class students in order to make up for the linguistic disadvantages and lack of exposure in their home setting.

A STUDY OF THE TEACHING OF PRIMARY SCIENCE IN THE JAFFNA EDUCATIONAL DISTRICT

K. Sinnathamby

Department of Education, University of Jaffna

Primary Science is taught in 442 schools in the Jaffna educational district. The main aim of this study is to evaluate the present position of science teaching introduced in year 4 with effect from 1985.

The science background of the primary science teachers, teaching facilities, and evaluation of achievement are under study here. Data were collected through a questionnaire administered to all the primary science teachers of this district.

The research has brought to light several weaknesses and problems related to primary science education.

14.7% of the primary science teachers had science education below G.C.E. (O/L); 47.4% had science education above ordinary level; 34.2% of them had no previous teaching experience while 52.6% underwent a little training through inservice classes.

While 90.5% of the teachers agreed on the time allotted for science teaching in year 5, 59.2% disagreed with the sufficiency of time for year 4. Majority of teachers had agreed on the sufficiency of the basic science concepts taught. But nearly a third expressed the view that these are difficult areas as well.

The practice of following teacher-centred approaches in teaching, observed in 66.2%, is not a healthy sign. Anyway, adherence to evaluation practices at the end of each unit by 67.7% of the teachers, is a welcome practice. But, it doesn't appear that all of them had a clear stand or understanding of the type of tests to be used.

Shortage of apparatuses for practicals, insufficiency of teaching time, and poor knowledge of subject matter among teachers and low awareness of teaching methodology are identified as major problems faced by teachers, related to teaching.

Insufficient time, language deficiency of children, and absence of a clear understanding of the syllabus by the teachers are problems identified in relation to achievement evaluation.

Suggestions have been made towards the solution of problems identified in the study.

Financial assistance from the University of Jaffna is gratefully acknowledged.

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44.7% of the primary science teachers had science education below G.C.E. (O/L); 47.4% had science education above ordinary level; 34.2% of them had no previous teaching experience while 52.6% underwent a little training through inservice classes.

While 80.2% of the teachers agreed on the time allotted for science teaching in year 5, 59.2% disagreed with the sufficiency of time for year 4. Majority of teachers had agreed on the sufficiency of the basic science concepts taught. But nearly a third expressed the view that these are difficult areas as well.

The practice of following teacher-centred approaches in teaching, observed in 68.2%, is not a healthy sign. Anyway, adherence to evaluation practices at the end of each unit by 67.7% of the teachers, is a welcome practice. But it doesn't appear that all of them had a clear stand or understanding of the type of tests to be used.

Shortage of apparatuses for practicals, insufficiency of teaching time and poor knowledge of subject matter among teachers and low awareness of teaching methodology are identified as major problems faced by teachers related to teaching.

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Financial assistance from the University of Jaffna is gratefully acknowledged.

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