PROCEEDINGS
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JAFFNA SCIENCE ASSOCIATION

ABSTRACTS 1995

Fourth Annual Session
27 – 29 April, 1995
JAFFNA, SRI LANKA.

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EDITOR'S NOTE

This booklet contains the abstract of the papers accepted for presentation at the fourth annual session of the Jaffna Science Association to be held at the University of Jaffna from 27 to 29 April 1995. It contains seven abstracts in Pure Sciences, twelve in Applied Sciences, two in Medical Sciences, and two in Social Sciences.

The Editor wishes to express his sincere thanks to the chairmen of all sections for their assistance in getting these abstracts refereed in time for presentation at this annual session.

Prof.K.Kandasamy
Chief Editor

Department of Physiscs
University of Jaffna
27 April 1995

CONTENTS

Histological ultrastructural and histochemical studies of the dorsal body cells in

Cryptozona belangeri (Deshayes).

Padmini Krishnarajah
(Department of Zoology, University of Jaffna,)

Cryptozona belangeri (Deshayes) is a common land Stylommatophoran pulmonate gastropod snail. It occurs in the gardens and lawns around the university premises in South India, emerging actively at twilight to feed.

It is a protandric hermophrodite and at the time of mating, the counterparts come close together and exchange caresses with their tentacles and oral lappets.

C. belangeri was collected and culture maintained in cages, under laboratory conditions. The immature and mature snails were followed for screening the snails belonging to different weight groups, and the histological investigation was done in the immature and snails and ultrastructural investigation of the dorsal body was done in the mature snail. Histochemical observations for PAS positive carbohydrates, proteins and lipids were done in the immature and mature snails.

The dorsal body is located in the tissue sheath around circumoesophageal ganglian and the cells are abundant in the inter-cerebral region dorsal to the intercerebral commissure. In the immature snail dorsal bodies are distributed loosely and cells are less flattened and spindle shaped, whereas in normal mature snail the dorsal body cells are distributed in clusters. Cells are more or less oval shaped and contain densely packed granules and a central lacuna. Ultrastructure of the dorsal body cell in mature *C.belangeri* contains irregular shaped nucleus with high electron density. It is associated with rough endoplasmic reticulum. Lipid droplets are abundant in smooth endosplasmic reticulum away from it.

In histochemistry the dorsal body cells contain less positive PAS carbohydrate substances but protein is intensively positive. The mature dorsal body cells and the lipid granules are fairly positive in nature.

THE ROLE OF CEREBRAL GANGLION ON OOGENESIS AND OVIPOSITION OF SITOTROGA CEREALELLA (OLIVIER) (LEPIDOPTERA: GELECHIIDAE)

Rathiga Ramanathan, Padmini Krishnarajah and V.K.Ganesalingam.
(Department of Zoology, University of Jaffna,)

It is well known that endocrine mechanism controls reproduction in insects. In this mechanism the neurosecretory cells of 'brain", corpora allata, corpora cardiaca and prothoracic glands are involved. The significance of the cerebral ganglion, particularly the median neurosecretory cells, on reproduction of *Sitotroga cerealella* is not known.

In this study the role of median neurosecretory cells of the cerebral ganglion on oogenesis and oviposition in *S.cerealella* was investigated in the laboratory.

The median neurosecretory cells of the cerebral ganglion of one day old virgin and mated female moths were cauterized by using a fine hot entomological needle.

Determination of the number of chorionated eggs in the ovary was made by dissecting the treated moths every day, up to 7^{th} day after cauterization. Control experiments were carried out with mated female moths. Each experiment was replicated seven times.

It was observed that there was a significant difference in the average number of chorionated eggs found in ovaries of the mated cauterized and mated control moths ($p<0.05$).

There was no significant difference in the average number of chorionated eggs in the ovaries of mated cauterized and unmated cauterized moths ($p>0.05$).

It is concluded that cauterization of neurosecretory cells of cerebral ganglion in *S.cerealella* causes retention of eggs in the ovary; thereby preventing normal oviposition, and does not have any deleterious effect on oogenesis in either mated or unmated moths.

A STUDY OF THE NARCOTIC EFFECT OF YELLOW OLEANDER

(THEVETIA PERUVIANA) ON NYMPH OF COCKROACH (PERIPLANETA AMERICANA)

Subathra Kanapathipillai and V.K.Genesalingam.
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Although many plants have been tested for narcotic and repellent effects on insect pests, the yellow oleander seed has not been tested.

A study was made in the laboratory on the effects of seed kernel aqueous extract and oil of *Thevetia peruviana* on nymphs of *Periplaneta americana*.

The extract was prepared at a concentration of 5/5 gm/ml and it was diluted by adding 5 ml of distilled water up to the concentration of 5/90 gm/ml. Eight replicates were used in this study. Fifty percent mortality was observed at the concentration of 5/31 gm/ml.

The results showed that the injected aqueous extract of yellow oleander seed kernel caused mortality in the nymphs of *P.americana* and the percentage of mortality decreased with dilution of the extract. Concentration from 5/5 gm/ml ($F=907.308$, d.f=1, $p<0.001$) to 5/55 gm/ml ($f=26.824$, d.f=1, $p<0.001$) was significant in causing mortality of cockroach nymphs, whereas concentration from 5/60 gm/ml ($F=2.801$, d.f=1, $p>0.001$) to 5/90 gm/ml ($f=0$, d.f=1, $p>0.001$) was not significant.

When the oil was mixed with one gram of oven dried well crushed bread and fed to the nymph, the percentage of mortality increased with increase in volume of oil applied. Based on LD_{50} the effective volume was 0.575 ml.

When oil was fed with food to starved and well fed nymphs there was no significant difference in mortality in any concentration.

It is concluded that the seed kernel extract of yellow oleander *T.Peruviana* could be used to cause mortality in nymph of *P.americana* by using the aqueous seed kernel extract or oil in suitable concentration and volume.

Histopathology caused by *Dactylogyrus vastator*

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From each gill arch, diverging rows of filaments are given off and on both sides of each filament are located plate-like lamellae where gaseous exchange occurs (Roberts, 1978). Examination of the gills of heavily infected carp, under the dissecting microscope, revealed the presence of parasites and loss of definition of the gill structure. The epithelial cells of the respiratory plates were damaged or entirely absent in places, leaving the endothelial surface exposed.

Although D *actylogyrus vastator* is known as a serious pathogen there is no detailed accounts of histopathology (Paperna, 1964). This experiment was conducted to show the gill histopathology caused by D.vastator. One set of fish was maintained as a control for the experiment and the experimental stock kept under the same conditions as the uninfected fish. Water quality was maintained relatively constant throughout the experiment. Samples of 10 fish from infected and control tanks were removed from each tank at 2 week intervals. The dissected gills were sectioned to see the nature of the gill pathology with period of time. The gill shows severe hyperplastic tissue formation from the second week of the experiment together with adhesion of the adjacent lamellae. After the fourth week of the experimental period, in some points within the secondary lamellae, there were sings of the presence of granular leucocytes possibly involved in the cellular defence against the parasite.

The experimental fish showed different degrees of pathology namely hyperplasia together with cell proliferation the extent of which is proportional to the period of infection by D.Vastator.

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A SURVEY OF ANOPHELINE MOSQUITOES IN JAFFNA PENINSULA IN SRI LANKA

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An increase in the incidence of malaria has been noted in recent years in Jaffna peninsula. Since the common vector of malaria in Sri Lanka is Anopheles culicifacies Giles and the only previous record of Anophelines from Jaffna peninsula is of Anopheles larvae by Rajendram and Antony (1991) a survey of the Anopheles adult population was initiated. Mosquitoes were collected with the human bait, bovine bait and knockdown method, the last using a mixture of pyrethrum and kerosene.

The following Anopheles species were collected: Anopheles culicifacies Giles from Kanthoradai, Alaveddy, and Ariyalai, at 2.44% of the total mosquito population, Anopheles nigerrimus Giles from Alaveddy and Ariyalai, at 2.5%, Anopheles subpictus Grassi from Suthumalai, Manipay, Navali, Sithenkerney, Ariyalai and Vadamarachi East (Ampan, Chempian pattu, Kudathanai), at 56.03%, Anopheles pallidus (Theobald) at 0.17% and Anopheles fluviatilis James at 0.18% both from Alaveddy. No Anopheles adults were collected from Kokuvil, Kondavil and Thirunelvely throughout the year. Though Anopheline and Culicine larvae inhabit clean and polluted waters respectively, the adult mosquitoes tend to dwell in similar environmental conditions.

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G.f. Rajendram and **N.R.Antony**.1991. Survey of peridomestic mosquito species of Jaffna peninsula in Sri Lanka. Southeast Asian Journal of Tropical Medicine and Public Health 22(4): 637-642.

ON CERTAIN FINITE HYPERGROUP ALGEBRAS

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Let Ω be a non empty set, and $C(\Omega)$ the vector space of all complex valued functions on Ω. Following Jewett[4], we say that $C(\Omega)$ is a hypergroup algebra if there is a binary operation $*$ on $C(\Omega)$ such that $C(\Omega)$ is an algebra with an identity satisfying some group like conditions. For example, we require

$$\delta_x * \delta_y = \sum_{i=1}^{n} \alpha_i \delta_{x_i} \text{ for some } \alpha_i > 0 \text{ , } \sum_{i=1}^{n} \alpha_i = 1 \; x_i \in \Omega, n \in \mathbb{N},$$

where δ_a is the Dirac-delta function on Ω for $a \in \Omega$. In this case, we say that Ω is a hypergroup.

Examples of hypergroups include
(i) double coset spaces of finite groups by subgroups .
(ii) dual objects of finite groups.

In this paper, we present several examples illustrating the ideas involved. In particular, we consider the permutation groups S_n and its certain subgroups , also the dual objects of theirs, $n \leq 5$.

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Green's Function for a Wedge in the Plane

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Let **W** be an open wedge shape domain in the plane of an angle γ, $0<\gamma\leq 2\pi$. Let G(x,y) be the Green's function of the following problem:

$$(\nabla^2 - S)\, U(x,y) = 0 \quad \text{for } (x,y) \in W,\ S>0$$
$$\text{and } U(x,y)=0 \text{ on the boundary of } W.$$

We shall prove the following unpublished result due to D.B.Ray (see the foot note of page (44) of [1]).

Result:
Let (r,θ) be polar coordinates whose origin is the vertex of the wedge W and whose $\theta=0$ axis is one edge of the wedge W.

For $x=(a,\alpha) \in W$ and $y=(b,\beta) \in \overline{W}$ we have

$$G(x,y) = \pi^{-2} \int_0^\infty dx\, K_{ix}(\sqrt{s}b)\, K_{ix}(\sqrt{s}a) \left\{ \cosh(\pi - |\alpha-\beta|)x - \frac{\sinh \pi x}{\sinh \gamma x} \cosh(\gamma - \alpha - \beta)x + \frac{\sinh(\pi-\gamma)x}{\sinh \gamma x} \cosh(\alpha-\beta)x \right\}$$

where $K_\nu(z) = \int_0^\infty e^{-z\cosh t} \cosh(\nu t)\, dt$ is the modified Bessel function.

This expression for G(x,y) is in the form of Kantorovich-Lebedev transform. Kantorovich and Lebedev introduced a transformation of functions in 1930's known as Kantorovich-Lebedev transform [2], with a view of applications to wedge shape boundary value problems. However we prove the result in the direct manner not using any such transformations.

References:

[1] H.P.Mckean and I.M.Singer **"curvature and the eigen values of the Laplacian"** J.Diff.Geometry, 1,43-69 (1967).

[2] A.Erdelyi, **"Tables of Integral Transforms"**, Vol 2, McGraw-Hill Book Company Inc., New York (1954).

EFFECT OF CONTINUOUS APPLICATION OF PHOSPHORUS ON YIELD COMPONENTS AND YIELD OF LOW LAND RICE IN RED-YELLOW LATOSOLS.

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Field experiments in Randomised complete block design with three replicates were conducted at Ramanathan paddy farm Kilinochchi to study the effect of continuous application of phosphorus on it's availability, uptake, yield components and yield of low land rice in Red-Yellow Latosols. Rice variety Bw 351 belongs to 3 1/2 months age was used in this experiment. Experiments were planed to conduct for four cropping seasons (92/93 Maha, 93/94 Maha, 94 Yala and 95 Yala) Nitrogen and potassium fertilizers applied in this experiment were based on the recommendation of the Department of Agriculture. Phosphorus application varied according the treatement as followos.

TREATMENTS OF PHOSPHORUS APPLICATION P_2O_5 Kg/ha

TREATMENTS	FIRST SEASON CROP 92/93 Maha	SECOND SEASON CROP 93/94 Maha	THIRD SEASON CROP 94 Yala	FOURTH SEASON CROP 95 Yala
T_1	No phosphorus	No phosphorus	No phosphorus	No phosphorus
T_2	23	23	23	23
T_3	11.5	11.5	11.5	11.5
T_4	23	No phosphorus	23	No phosphorus
T_5	11.5	No phosphorus	11.5	No phosphorus
T_6	23	No phosphorus	No phosphorus	23
T_7	11.5	No phosphorus	No phosphorus	11.5

Results pertaining to yield components and grain yield obtained from first three seasons cultivation are discussed in this paper.

Results obtained from first season crops (92/93) Maha) reveals that no difference in yield components or grain yield were found between control treatment which received no phosphorus and rest of the treatments received 23 kg P_2O_5/ha and 11.5 kg P_2O_5/ha. Little numerical difference obtained among treatments in grain yield and yield components were found to be not statistically significant. Results from the second cropping season and the third cropping season also indicate that phosphorus application fails to influence either yield components or grain yield. No significant difference in yield components or grain yield were found between control the treatment(T_1) and the treatement(T_2) which received recommended phosphorus for all seasons.

The results obtained in three cropping seasons indicate that the soil is capable of releasing adequate amount of phosphorus is required for plant under submerge condition. This is possible because the :Lateritic soil is capable of fixing more phosphorus. The fixed phosphorus is mainly in the form of ferric phosphate get reduced to ferrous phosphate and became available to plants under submerge condition due to the reduction process. However on completion of fourth season crop along with soil and plant analysis to calculate the soil available phosphorus and plant uptake we will be in a better position to make conclusion.

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IMPROVED CONDITIONS FOR *ASPERGILLUS NIGER* TO PRODUCE GLUCOAMOLASE IN SOLID STATE CULTURE

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and
K.Balasubramaniam.
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Aspergillus niger CFTRI 1105 was cultivated on solid medium for glucoamylase production. When soya meat powder concentration in the medium of one kg was varied from 0.0 to 200g while keeping the total carbohydrate concentration constant, maximum activity (274 U DMM^{-1} ; Dried mouldy medium) was obtained on the 3rd day in the medium containing 460g paddy husk and 200g of soya meat powder. Moisture content in the range of 60 - 65% of the medium not only improved the enzyme production(340 U DMM^{-1}) but also helped to obtain maximum activity on 2nd day. Among different spore number studied (from 4.5×10^5 to 4.5×10^9), 4.5×10^8 spores g^{-1} wet medium was the best. Soya meat powder (375 U DMM^{-1}) was the best for glucoamylase production than soya flour (275 U DMM^{-1}) and corn flour (275 U DMM^{-1}). The effect of paddy husk to soya meat powder ratio in solid state media was studied and the optimum paddy husk to soya meat powder ratio was 80:20 to obtain maximum glucoamylase (1700 U DMM^{-1}) production.

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IMPROVEMENT OF THE THERMAL STABILITY OF IMMOBILIZED ALPHA AMYLASE BY COUPLING WITH PROLINE

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α- Amylase was immobilized to Sepharose-4B activated by electrophilic method using cyanogen bromide. The α-amylase coupled was 77% of the total protein added. Further L-proline was covalently linked to the immobilized α-amylase by carbodiimide. Optimum carbodiimide concentration for the coupling of proline to the immobilized α-amylase and the suitable proline concentration for the coupling were determined. Activity of immobilized α-amylase was not altered after coupling to proline. The thermal stability of soluble α-amylase, immobilized α-amylase and immobilized α-amylase-proline conjugates (samples coupled to two different proline concentrations) were studied at 45°c and 60°c. Soluble α-amylase lost its total activity on the 30th and 16th days at 45°c and 60°c respectively. Immobilized α-amylase-proline conjugate < 85.35 μg proline/g gel) lost only 78% activity at 45°c on the 30th day while the same preparation took 20 days at 60°c to lose the total activity. On the other hand the immobilized α-amylase-proline conjugate (785.32 μg proline/g gel) lost only 30% of its original activity at 45°c on the 30th day and took 30 days at 60°c to lose its total activity. These results show that the coupling of proline to immobilized enzymes increases their thermal stability.

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ETHANOL FROM STARCH IN RICE FLOUR

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and
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Rice flour of different concentrations(160, 200, 280 and 300 g l^{-1}) was suspended in tap water and hydrolysed either by one step (simultaneous) or two steps liquefaction and saccharification using α-amylase (2.5 KNU g^{-1} DS) and glucoamylase (2.3 AGU g^{-1} DS) for 4h. At all rice flour concentrations studied, the recovery of total reducing sugars and the dextrose equivalent (DE) were higher when the hydrolysis was performed in two steps. With increase in rice flour concentration from 160 g l^{-1} to 300 g l^{-1} the recovery in one step process decreased from 85.4% to 55%, while that in the two step procedure decreased from 99.4% to87.9%. When the hydrolysate (DE 74.6%) obtained by the hydrolysis of 280 g l^{-1} rice flour was inoculated with a commercially available yeat prepartion(Fermipan), at 48h, 25.3 g l^{-1} ethanol was obtained and no further increase in the ethanol production was observed. Addition of glucoamylase (0.53 AGU ml^{-1}) had increased the ethanol production from 25.3 g l^{-1} to 68 g l^{-1}. Therefore the rice flour was liquefied and the liquefied preparation was subjected to simultaneous saccharification and fermentation. By this process at 48h, 53g l^{-1} and at 72h, 68.4 g l^{-1} ethanol was obtained. A study was performed to recycle the yeast cells for ethanol production. When rice flour hydrolysate of DE 100 having 250 g l^{-1} total sugar was used as medium, in the first and 2nd cycles at 120h, 45 g l^{-1} and 73.6 g l^{-1} ethanol was obtained respectively. In the 3rd and 4th cycles at 92h, 60 g l^{-1} and 62 g l^{-1} ethanol was respectively obtained. From these experiments it can be concluded that the starch in rice flour can be liquefied and could be subjected to simultaneous saccharification and fermentation. Furthermore recycling of the cells can decrease the time required for the ethanol production.

KNU - Kilo Novo Unit; AGU - Amylo Glucosidase Unit;
DS - Dry Substance

CONTINUOUS HYDROLYSIS OF STARCH AND DEXTRINIZED STARCH BY AMBERLITE IRA-904 IMMOBILIZED AMYLOGLUCOSIDASE

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Continuous hydrolysis of starch, dextrinized starch (DE 36) and maltose was performed at pH 4.5 using thermostated (30 and 50°c) column reactors (1.7 x 15 cm) having 7000 AMG units in 25g Amberlite IRA-904. The productivity of the enzyme reactor at 30°c for 2% (w/v) starch, dextrinized starch(DE 36) and maltose increased from 3.2, 8.25 and 7.92 to 10.9, 49.5 and 47.5 respectively when the flow rate was increased from 1 to 6 ml ml^{-1}, while glucose yield decreased from 37.0 to 20.8% for starch and no change in glucose yields for dextrinized starch(98%) and maltose (96%). For the hydrolysis of dextrinized starch (20%, w/v; DE 36) glucose yield decreased from 82.5 (at 1ml min^{-1}) to 55% (at 1ml min^{-1}) at 30°c. The productivities for dextrinized starch solutions 2, 4, 10 and 20% (w/v; DE 36) were 10.9, 98.2, 237.6 and 290.4 g l^{-1} h^{-1} respectively at a flow rate of 6ml min^{-1} at 30°c. At 55°c and 6ml min^{-1} flow rate the productivities for starch (2%; w/v) and dextrinized starch of concentrations 2, 4, 10 and 20% (w/v; DE 36) were 18.5, 52.3, 101.9, 250.8 and 353.6 respectively while the glucose yields for dextrinized starch 2, 4 and 10% (w/v) were 18.5, 52.3, 101.9, 250.8 and 353.6 respectively. The glucose yield for starch (2%, w/v) and dextrinized starch (20%, w/v) at 55°c decreased from 52 and 90% to 35 and 66.8% respectively when the flow rate was increased from 1 to 6ml min^{-1}. Temperature has a negligible effect on the productivity of the column reactor, when dextrinized starch solutions of 2, 4 and 10% (w/v; DE 36) were used. The glucose yield did not change with increase in flow rate up to 6 ml min^{-1} however productivity increased linearly. Productivities at 30 and 55°c with 20% (w/v; DE 36) dextrinized starch were 290.4 and 353.6 g l^{-1} h^{-1} respectively. Thus temperature has an influence on the hydrolysis of higher concentrations of dextrinized starch under experimental conditions.

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SOLID STATE FERMENTATION FOR CITRIC ACID PRODUCTION BY ASPERGILLUS SP UV_2

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and
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When the production medium [(50 ml) containing (g l^{-1}) glucose 140; NH_4NO_3, 0.5; KH_2 PO_4, 0.5; $MgSo_4$, 0.1; peptone, 7.0; $ZnSo_4$, 0.1 x 10^{-3} ; ferrous ammonium sulphate, 0.1 x 10^{-3}; $CuSo_4.5$ H_2O, 0.06 x 10^{-3}; (ml^{-1}) methanol 30 and gingilly oil, 2 and paddy husk, 42.5 gl was inoculated with spore suspension of Aspergillus sp UV_2 and inoculated at room temperature (30°c), maximum citric acid (5.45g kg^{-1} Moldy Husk) was produced at 3rd day. Therefor fermentation time was shortened by 12 days when the fungus was grown in solid medium than in liquid surface culture. Hexa cyanoferrate (0.5g l^{-1}) supplementation has decreased the citric acid production to 5.17g kg^{-1} Mould Husk. The effect of parboiled paddy husk and raw paddy husk on citric acid production were compared. Citric acid production was 4.03 and 4.14g kg^{-1} Mouldy Husk respectively on 3 and 2 days in the media containing parboiled paddy husk and raw paddy husk. As the citric acid production was decreased when the parboiled husk and the raw husk were used, the to husk preparations were washed and the citric acid production were compared. Maximum citric acid production with unwashed and washed parboiled husks preparations were 4.03 and 5.22g kg^{-1} Mouldy Husk at 3 days respectively, whereas with unwashed raw husk and wased raw husk were 4.14 and 4.36g kg^{-1} Mouldy Husk at 2 and 3 day respectively. Therefore it can be assumed that washing has removed the undesirable substances from parboiled husk and essential nutrients present in raw paddy husk. Maintenance of humidity (50%) has improved the citric acid production. The citric acid production in the test and control were 6.4 and 4.0g kg^{-1} Mouldy Husk at 2 days and 3 days.

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EFFECT OF DIFFERENT NITROGEN SOURCES ON CITRIC ACID PRODUCTION BY *ASPERGILLUS* SP CM_1

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Aspergillus SP CM_1 was grown in production medium which contained (gl^{-1}) NH_4NO_3, 0.5; peptone, 7.0; glucose, 140; KH_2PO_4, 0.5; $MgSO_4.7H_2O$, 0.1; $ZnSO_4$, 0.1 x 10^{-3}, ferrous ammonium sulphate, 0.1 x 10^{-3} and $CuSO_4.5H_2O$, 0.06 x 10^{-3} and (ml^{-1}) methanol, 30 and gingilly oil, 2. Maximum citric acid ($47.1gl^{-1}$) was produced on the 15th day at room temperature (30°c). When the production medium was supplemented with either soya bean flour ($20gl^{-1}$) or soya meat powder ($20gl^{-1}$), citric acid production was decreased to $16.1gl^{-1}$ and $20.8gl^{-1}$ at 15 and 9 days respectively while promoting the growth of the fungus by 1.6 and 1.5 folds respectively. To study the effect of peptone on citric acid production the fungus was grown in production medium and peptone free production medium and maximum citric acid produced was $47.1gl^{-1}$(15 days) and $19.5gl^{-1}$ (16 days) respectively. To avoid the use of peptone and to improve citric acid production the peptone free production medium was supplemented with either soya bean flour ($20gl^{-1}$) or soya meat powder($20gl^{-1}$) and citric acid production has decreased to $10.85gl^{-1}$ (at 11 day) and $16.0gl^{-1}$(at 12 day) respectively with 3.0 fold increase in growth. Therefore supplementation of peptone free production medium with either soya bean flour or soya meat powder did not improve citric acid production. As the above said organic nitrogen sources didn't improve the citric acid production, the concentration of NH_4NO_3(inorganic nitrogen source) was increased from 0.5 to $0.75gl^{-1}$in the production medium and citric acid has raised from $47.1gl^{-1}$to $52.0gl^{-1}$(at 12 day) while the growth of the fungus remaining constant. Further when the concentration of peptone was doubled to $14.0gl^{-1}$, citric acid production has increased to $58.0gl^{-1}$(at 8 days).

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COMPARISON OF LACTIC ACID PRODUCTION BY COMMERCIALLY AVAILABLE AND LOCALLY ISOLATED STRAINS

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A strain of *Lactobacillus sp* isolated from soured milk was compared with industrially used *Lactobacillus delbrueckii*. Both strains were cultured at room temperature in static culture. When *Lactobacillus sp* and *L.delbrueckii* were grown in milk (total sugar 60g l^{-1}) the rate of lactic acid production was 1.25g$l^{-1}h^{-1}$and 0.58g $l^{-1}h^{-1}$ respectively, while the efficiency of lactic acid production was 59.4% and 76%. When *Lactobacillus sp* and *L.delbrueckii* were cultivated in whey (total sugar 30g l^{-1}) at 60h 14.5g l^{-1} and 21g l^{-1} lactic acid was produced which corresponds to 42.8% and 86.7% efficiencies respectively, while rate of lactic acid production was same as above. However when *Lactobacillus sp* and *L.delbrueckii* were grown in synthetic medium [(g l^{-1}) glucose 30; yeast extract 10; K_2HPO_4 0.5; KH_2PO_4 0.5; sodium citrate 1; salt solution 1ml (salt solution gl^{-1} $MgSO_4.7H_2O$ 50; $MnSO_4.H_2O$ 3.1; $FeSO_4.7H_2O$ and ascorbic acid 5)] the lactic acid produced at 60h was 5g $^{-1}$ and 25g l^{-1} which corresponds to 10.3% and 92.5% lactic acid production efficiencies. Thus the lactic acid production rates by *Lactobacillus sp* in natural media were higher than that of L. delbrueckii, whereas *L. delbrueckii* performed better in synthetic medium. However the *L. delbrueckii* was efficient in producing lactic acid than *Lactobacillus sp.*

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PRELIMINARY STUDIES ON LARGE SCALE PRODUCTION OF YEAST CELL MASS

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The influence of aeration on yeast cell mass production was studied in fed-batch culture with two different nitrogen concentrations while mixing at room temperature. Glucose level in the medium was maintained at 30g l^{-1} by adding glucose syrup at appropriate time intervals. When the yeast was grown in the medium containing 30g l^{-1} glucose and 1.4g l^{-1} elemental nitrogen while aerating at the rate of 40 bubbles min^{-1} and 120 bubbles min^{-1}, cell mass (dry weight) formed was 6.1g l^{-1} and 7.8g l^{-1} respectively. In the above conditions ethanol produced was 35.6g l^{-1} and 26g l^{-1} respectively and the efficiencies of substrate utilized for ethanol and cell mass production were 81.5% and 92.5% respectively. To the above medium addition of 1.15g l^{-1} peptone (having 1.6gl^{-1} elemental nitrogen) further increased the cell mass to 13.5g l^{-1} and 16.5g l^{-1} at 40 bubbles min^{-1} and 120 bubbles min^{-1} aeration rates, while decreasing the ethanol production to 22g l^{-1} and 12g l^{-1} respectively. When the glucose concentration was increased to 150g l^{-1} with the increased elemental nitrogen level in the medium at 120 bubbles min^{-1} aeration rate, 15g l^{-1} cell mass and 41.4g l^{-1} ethanol were produced. Therefore increase in glucose concentration has lead to an increase in ethanol production while decreasing the cell mass. Hence to obtain higher cell mass the glucose concentration should be maintained at 30g l^{-1} while aerating at 120 bubbles min^{-1}.

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EFFECT OF NITROGEN SUPPLEMENTATION ON ACID PROTEASE PRODUCTION BY *ASPERGILLUS NIGER*

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The effect of supplementing basic medium with different nitrogen sources on acid protease production by *Aspergillus niger* CISIR N4 was studied. Basic medium consisted of (gkg^{-1}) rice bran, 900; soya flour, 20; yeast extract, 3.0; peptone, 62.5; $FeSO_4$, 0.01; $MgSO_4$, 0.5; $(NH_4)_2SO_4$, 5.0; KH_2PO_4, 5.0 (a total of 11.46 gkg^{-1} elemental nitrogen) and 50% of moisture content. When basic medium was supplemented with different inorganic nitrogen sources such as $(NH_4)_2SO_4$, urea, $(NH_4)_2HPO_4$ and NH_4NO_3 (at 11.46 gkg^{-1} elemental nitrogen level), at 47h, NH_4NO_3 supplemented medium showed the higest clotting activity (114.6 Ug^{-1} DMB). Therefore NH_4NO_3 was selected as the best inorganic nitrogen source and $(NH_4)_2SO_4$ in the basic medium was replaced with NH_4NO_3. To study the effect of different organic nitrogen sources yeast extract, peptone, soya flour, meat and intestine were supplemented to the basic medium (11.46gl^{-1} elemental nitrogen). Among the nitrogen sources, soya flour supplemented medium gave the highest clotting activities (582.21 Ug^{-1} DMB) at 47h. Therefore the effect of soya flour concentrations was studied by supplementing 10, 20, 30, 40 and50% of soya flour to the medium. At 47h, maximum proteolytic (28.17 Ug^{-1} DMB) and clotting activites (600 Ug^{-1} DMB) were obtained in the medium containing 20% soya flour. These results show that rennet can be produced by Solid State Fermentation (SSF) in a medium containing soya flour 200gkg^{-1} and rice bran 800gkg^{-1} with 50% moisture content.

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OPTIMIZATION OF A MEDIUM FOR *Bacillus licheniformis* 6346 TO PRODUCE ALPHA-AMYLASE BY SOLID STATE FERMENTATION

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A solid state media for *Bacillus licheniformis* 6346 was formulated. The basic medium contained (gkg^{-1}), rice husk, 280; soluble starch, 50; $(NH_4)_2HPO_4$, 15; $Na_2HPO_4.2H_2O$, 5; KCl, 3; $MgSO_4.7H_2O$, 0.07 and 650ml water. In this basic medium maximum α-amylase activity (389 U DMB^{-1}) was obtained at 96h. To the basic medium either gingily oil or coconut or both were added to find the effect of the oils on enzyme production (total oils added, ml kg^{-1} was 12) and maximum α-amylase was produced in the medium containing gingili oil (9 ml kg^{-1}), and coconut oil (3ml kg^{-1}). To this media either $(NH_4)_2HPO_4$ or $(NH_4)_2SO_4$ or a mixture of $(NH_4)_2HPO_4$ and $(NH_4)_2SO_4$ (15g kg^{-1}) was added and $(NH_4)_2HPO_4$ was suitable for enzyme production at 4th day (792 U DMB^{-1}). To find a suitable carbon source, rice flour, corn flour, soya meat powder, wheat flour and soluble starch (90g kg^{-1} total reducing sugar content in the medium) were selected and the media having either rice flour or soya meat powder gave highest enzyme production (1056 U DMB^{-1} and 1071 U DMB^{-1}) at 4th day. The optimum rice flour or soya meat powder concentration in the media was 50g kg^{-1} medium. Supplementation of 23g kg^{-1} soluble starch to the media produced highest enzyme at 4th day. From these experiments the optimized solid state fermentation media for α-amylase production should have rice bran, either rice flour or soya meat powder, soluble starch, gingelly oil and coconut oil and minerals.

PRELIMINARY STUDIES ON THE PRODUCTION AND CHARACTERIZATION OF ALPHA AMYLASE FROM *ASPERGILLUS ORYZAE*

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Aspergillus oryzae was cultivated in solid state medium containing paddy husk (70g), soya meat powder (30g) and minaral solution [$FeSO_4$ 0.062gl^{-1}; $MgSO_4$ 0.063gl^{-1}; $CuSO_4$ 0.01gl^{-1}] at room temperature. Maximum α-amylase activity (33.645 U g^{-1} Dry Mouldy Medium (DMM)) was obtained at 114h. To improve the enzyme production, the effect of starch concentration on α-amylase production was varied by changing the starch concentration from 35% to 75% while keeping the nutrients to husk ratio as 3:7. Among the different starch concentrations studied, maximum α-amylase activity (244 U DMM^{-1}) was obtained at 58% of starch concentration. The α-amylase obtained has shown maximum activity at pH 4.9 in 0.01M citrate phosphate buffer at room temperature. The optimum temperature for the enzyme was 50°c at pH 4.9. Studies on the other kinetic properties of the enzyme are under way.

Malaria transmission by Anopheles species in Jaffna Peninsula

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An increase in the incidence of malaria has been noted in recent years in Jaffna peninsula. Blood film examination indicated 12.4% malarial infection in 1993 and 15.8% in 1994. Though Anopheles culicifacies Giles is the major vectors of malaria in Sri Lanka. Other Anopheles species may also be vector of Plasmodium. Hence Anopheles species were collected from various parts of Jaffna peninsula during January 1993 to September 1994 and salivary glands and midguts of adults dissected and stained with Leishman's stain, for sporozoites and oocysts respectively.

Positive identification was obtained only in Anopheles subpictus Grassi. Of a total of 1288 adults dissected, comprising 882 salivary gland and 967 midgut dissections, sporozoites were detected in the salivary gland and oocysts in the midgut of 1 adult collected from Jaffna town and oocysts in 3 midguts of adults collected from Ariyalai, Alaveddy and Ampan (Vadamarachi East).

No positive identification of Plasmodium was made in A. Culicifacies in a total of 94 adults,comprising 84 salivary gland and 88 midgut dissections: in Anopheles nigerrimus Giles in 413 adults, comprising 162 salivary gland and 180 midgut dissections: and in 4 adults, of Anopheles pallidus (Theobald) and 2 adults of Anopheles Flulviatilis James.

Although we were unable to demonstrate that the parasites detected were human plasmodia, these results strongly implicate Anopheles subpictus as an important vector of human malaria in Jaffna peninsula.

Clinical Features and Histological Variations of Benign Breast Lumps in Patients Admitted to the General Hospital (Teaching) Jaffna.

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Examination were made on 123 female patients who were admitted to the General Hospital (Teaching), Jaffna during the period of June 1993-May 1994. Those who were found to have benign breast lesions were included in this study. All biopsies were examined with haematoxylin and eosin stained paraffin sections.

Among the 123 patients 51 (41.5%) were married and 72 (58.5%) were un married. The benign breast lumps were found to be very common (91.1%) in women between 14-45 years age and 40 (35.7%) in this group were married. After 45 years of age only 11 cases (8.9%) of benign breast lumps occurred. Most of the lumps were of single type. Three patients (2.4%) had bilateral lumps (lumps in both breasts at the same time). Five patients (4.1%) had a past history of breast lumps.

Histological examination of the lesions showed 67 (54.1%) fibroadenoma,50 (41%) fibroadenosis,4 (3.3%) cystosarcoma phyllodes and 2 (1.6%) lactating adenoma.

The duration of the lumps were varied from one week to 3 years. In the population studies, the majority of the women with breast lumps were in 14-45 years of age group and the commonest lesions were fibroadenoma and fibroadenosis type.

An analysis of Nigrahasthána according to Saiva Siddhantins

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In the Indian tradition, philosophical discussions seeking truth are denoted by the term Váda within the general frame of Kathá. Vádi and Prativádi are the direct participants in a Váda, in which the Vádi puts forth his thesis with an intention of establishing it and the Prativádi responds by showing the faults in the Vádi's arguments in order to establish his own contention. Vardhamana-a Nyaya logician (A.D 1215), delineates 'Váda" in the following terms.

1. Vádi is one who seeks to establish a thesis without giving place for any fallacies and guarding himself against blemishes.
2. Prativádi is one who attempts to advance his own thesis.
3. Each of them will attempt to expose the weaknesses in each other's argument and attempt to establish one's own thesis.
4. Adjudication of success etc.

Nigrahasthána literally means the locus of defeat. The following determinants are formulated derivatively to define Nigrahasthána, in a Váda.

1. The thesis put forth by a Vádi must be in accordance with the accepted pramána and appropriate logic ('tarka')
2. The thesis sought to be established must not be inconsistent with the philosophical position of the school to which one subscribes.
3. The thesis should be sought to be advanced with the help of an argument with all its constituent aspects.

Violation of these determinants in an argument by a Vádi or Prativádi is counted as a point of defeat. In the history of Indian logic it was Caraka who made first a list of fifteen occasions of defeat. These fifteen occasions of defeat are different in their characteristics. Some of them are fallacies, some linguistic mistakes, some others are just the breachers of the conventions of Vada. The author of Nyaya-sutra, identified twenty-two occasions of such defects. In Saiva Siddhantha literature it is in, Umapathi Sivacaryar's commentary of Pauskara Ágama that we find for the first time discussions on Nigrahasthána.

This paper is an attempt to present for the first time systematically Saiva Siddhantin's expositions of Nigrahasthána. It is hoped that and attempt of this type will enable to view Saiva Siddhantha not mearly as an article of assumed faith but as a system of logically intergreted school of thought as complete as any other major school of Indian or Western philosophical system.

TAMIL HOUSE - HOLDERS TERRACE INSCRIPTION AT ANURADHAPURA - A REAPPRAISAL

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This inscription was discovered at Anuradhapura on a rock boulder (28'.9"x 2.9" - 5'.3") in 1939 by paranavitana. The reading of this was first published in 1940 and later reproduced in 1970 by him. The crux of my reappraisal is the interpretation of the following lines:

'Ilubaratahi Dameda Samane Karite
Dameda gahapatikana pasade'

This has been rendered into English as Terrace of the Tamil householders caused to be made by Tamil Samana of Ilubarata.

The perusal of the estampage of this inscription shows that the form Ilubarata cannot be taken as a place name by reading the suffix as 'hi', a locative case ending as paranavitana has done. Perhaps 'hi' should be read as 'ha', a genitive case ending. Probably a fissure in the rock in the form of a line on the top portion of the letters ra, ta and ha was unnoticed by him. Moreover Paranavita has inadvertently read the letter following ' I ' as 'Lu' which should be La, which appears both in Sri Lankan and Tamil Nadu Brahmi inscriptions. Hence the form Ilabaratahi is actually Ilabarataha.

This form has two segments namely Ila and barata. While the former refers to Sri Lanka, the latter mentions a clan, known as 'Paratavar' of Sangam literature. It is very likely that the genitive case ending 'ha' in this form ILa barataha is used in the agentive sense as in the case of samana. Hence the actual reading of this portion should be that the Paratavan of Ilam and Samanan of Tamilakam caused this terrace to be made for the use of the Tamil traders. Finally an analysis is also made of the script, language and other forms of this Inscription.