ISSN 0115-8848

# TRANSACTIONS
# of the
# NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY
# Philippines

## ABSTRACTS of PAPERS
## Presented during the
## 29th NAST Annual Scientific Meeting

**"A Progressive Philippines Anchored on Science:**
***Building A Culture of Science in the Philippines"***

11-12 July 2007

**2007**
**Volume 29**
**Issue No. 1**

**Republic of the Philippines**
**National Academy of Science and Technology**
**Philippines**

© 2007 National Academy of Science and Technology Philippines

ISSN 0115-8848

Trans. Nat. Acad. Sci. Tech. Philippines
Vol. 27, No. 1

Published by the National Academy of Science and
Technology Philippines
3rd Level Science Heritage Building
DOST Complex
Bicutan, Taguig Metro Manila 1631 Philippines
nast@dost.gov.ph; secretariat@nast.ph
http://www.nast.ph; http://www.nast.dost.gov.ph
Tel no. (63 2) 837-2071 loc. 2170 to 73
Tel / Fax No. (63 2) 837-3170

Issue Editor: Academician Evelyn Mae Tecson-Mendoza
NAST Staff-in-Charge: Guada B. Ramos
Aristotle P. Carandang

# 29th ANNUAL SCIENTIFIC MEETING

## *A Progressive Philippines Anchored on Science:* Building a Culture of Science in the Philippines

11-12 July 2007, The Manila Hotel

**29th ASM STEERING COMMITTEE**

Acd. Evelyn Mae T. Mendoza - Chair

*Members*

National Scientist Lourdes J. Cruz
National ScientistBienvenido O. Juliano
Academician Jose O. Juliano
National Scientist Clara Y. Lim-Sylianco
Academician Apolinario D. Nazarea
Academician Bienvenido F. Nebres, SJ
Academician William G. Padolina
Academician Caesar A. Saloma

# TABLE OF CONTENTS

## POSTER SESSION

***Agricultural Sciences*** **Page**

***Biological Sciences***

## NOTICE OF CORRECTION

Trans. Nat. Acad. Sci. & Tech. (Philippines) 28: (2006)
Abstracts of Papers Presented during the
28th NAST Annual Scientific Meeting
12-13 July 2006

We are hereby printing the correct abstracts for the following papers with apologies to the authors for the mistake.

1. ESTD No. 8, p. 148, Characterization and Cementitious Solidification/ Stabilization of a Sludge Generated by a Metal Coating/Planting Plant Using Rice Hull Ash as Additive. Rex B. Demafilis, Renacel P. Promentilla, Ronald R. Navarro, Albert A. Samuela.
2. ESTD No. 13, p. 153, Production of Hydrogen from Ethanol through Steam Reforming Using a Fabricated Catalytic Reactor. Sixto A. Valencia, Jovita L. Movillon, Catalino G. Alfafara, Erli E.D. Lee.
3. ESTD No. 10, pp. 149-150, Removal of Lead from Electroplating Wastewater using Phosphonomethylated Polyetheleneimine (PPEI) – $Ca^{2+}$ as Chelating Flocculant. Jovita L. Movillon, Ronald R. Navarro, Casiano S. Abrigo Jr., Myra G. Briones, Elson R. Montibon, and Myriam L. Perez

*See pp 174-176 for the abstracts*

# POSTER SESSION

# *AGRICULTURAL SCIENCES DIVISION*

**ASD-1**

## GUILD STRUCTURE IN MT. MAKILING FOREST RESERVE: ITS IMPLICATIONS TO SILVICULTURE AND NATURAL RESOURCES MANAGEMENT

**Amelita C. Luna[1]* and Antonio F. Gascon[2]**

[1]Office of the Coordinator for Research, Extension and Linkages (OCREL)
[2]Institutre of Renewable Natural Resources (IRNR)
College of Forestry and Natural Resources (CFNR)
University of the Philippines Los Baños, College, Laguna
Tel:049 536 5305; Email: trr472@yahoo.com

The project research site was located in a matured secondary forest near Mudspring area in Mt. Makiling Forest Reserve (MFR). The study revealed that a 4-ha permanent plot in the MFR had a complex and diverse forest community composed of forest trees and palms belonging to 44 families, 126 genera and 179 species. The area has an average density of 192 tree/ha and average basal area was 43m$^3$/ha. The highest diameter at breast height (dbh) is seen in *Octomeles sumatrana, Ficus minahassae* and *Litsea garciae*. Based on population structure, 17% of the total number of trees were *Celtis luzonica,* followed by *Diplodiscus paniculatus* and *Chisocheton cumingianus* (8 and 4%, respectively of the total population.) Based on canopy classes, *C. luzonica* was composed of 20%, 13% and 67% canopy, sub-canopy and understories, respectively. Based on mortalities, the higher values are noted for *Caryota cumingii* (45%), *Macaranga bicolor* (42%), *Ficus minahassae* (40%) and *L. garciae* (37%). *D. paniculatus* and *C. luzonica* have mortalities of 12% and 11% respectively. To enhance succession in the area, it should be subjected to enrichment using the autogenic and allogenic succession principles where shade-loving trees should be planted in the natural gaps while intolerant trees should be planted in the Chablis. To enhance watershed values of the forest, it is suggested that 3-canopy levels be maintained, the natural values and induced gap areas be regenerated and the forest litter be maintained.

**Keywords**: guild structure, autogenic, allogenic, succession

**ASD-2**

# PERMANENT FIELD LABORATORY AREAS IN MT. MAKILING FOREST RESERVE: A MODEL FOR SUSTAINABLE NATURAL RESOURCE MANAGEMENT

**Amelita C. Luna[1]*, Enrique L. Tolentino Jr.[2], Ramon A. Razal[3], Nelson M. Pampolina,[4] Emmanuel Rhodantes G. Abraham[2], Manuel L. Castillo[4], Cristino L. Tiburan[3], Elsa P. Santos[5], and Aileen A. Jara[4]**

[1]Office of the Coordinator fort Research, Extension and Linkages (OCREL),
[2]Institute of Renewable Natural Resources (IRNR)
[3]Department of Forest Products and Paper Sciences (FPPS)
[4]Department of Forest Biological Science (FBS)
[5]Department of Social Forestry and Forest Governance (SFFG)
College of Forestry and Natural Resources (CFNR),
University of the Philippines, College, Laguna 4031
Tel: 049 536 5305; Email: trr472@yahoo.com

The Permanent Field Laboratory Areas (PFLA) was established in Mt. Makiling Forest Reserve (MFR) in 2002 as part of long-term objective of the College of Forestry and natural Resources to actively use (MFR) as a training laboratory to produce highly capable and well-grounded graduates of forests and natural resources science and management. Institutionalization of PFLA allowed the conduct of centrally coordinated activities in the establishment, development, use and maintenance of a network of permanent field laboratory/demonstration area in Mt. Makiling. The project aims to generate basic data and to develop a system of managing and using results of actual field and laboratory exercises, undergraduate and graduate thesis and dissertation researches. *Parashorea malaanonan*, *Celtis luzonica* and *Diplodiscus paniculatus* predominate in the plot. To quantify ecological parameters of tree populations and forest dynamics, tree censuses diameter at breast height (dbh) e" 5cm) and saplings/seedlings censuses (dbh $\leq$ 5 cm) were conducted in the three 1-ha plot. Recent typhoon caused uprooting and stem breakage. Typhoon is considered one of the natural disturbances with a major impact on forest dynamics and long-term observation is needed to evaluate basic parameters.

**Keywords**: PFLA, tree populations, tree dynamics

**ASD-3**

# CARBON SEQUESTRATION POTENTIAL OF LARGE LEAF MAHOGANY (*Swietenia macrophylla* King) AND DIPTEROCARP PLANTATIONS IN MAKILING FOREST RESERVE

**Elenita L. Racelis**

TREES-CFNR, University of the Philippines Los Baños, College, Laguna, Philippines
Email: ellen_indo@yahoo.com

The amount of carbon accumulated was determined in the biomass of both large leaf Mahogany and Dipterocarp plantations in the Mt. Makiling Forest Reserve (MFR). The carbon pools investigated included: above-ground biomass (tree and understorey/herbaceous vegetation), ground-biomass (litter and course woody debris), and below-ground biomass (roots and soil).

Results showed that the large leaf Mahogany stand had a total biomass production of 605.25 tons $ha^{-1}$ while the Dipterocarp stand amounted to 563.93 tons $ha^{-1}$. Converting the biomass accumulation to total carbon stored, these amounted to 542.05 tons C $ha^{-1}$ and 639.81 tons C $ha^{-1}$ for large leaf Mahogany and Dipterocarp stands, respectively.

Based on the three carbon pools investigated, the results are as follows: for the large leaf Mahogany stand: above-ground, 246.63 tons C $ha^{-1}$; ground biomass, 20.02 tons C $ha^{-1}$; and below-ground biomass, 275.40 tons C $ha^{-1}$. While the Dipterocarp stand, the results are as follows: above-ground, 248.08 tons C $ha^{-1}$; ground biomass, 20.46 tons C $ha^{-1}$; and below-ground biomass, 371.27 tons C $ha^{-1}$.

Out of the three carbon pools studied, the below-ground biomass had the highest carbon deposits primarily contributed by its soil component. Both plantations exhibited the same order in terms of the amount of C stored in its different carbon sinks. Specifically, the actual amount of carbon stored per carbon pool for large leaf Mahogany and Dipterocarp stand, respectively, were determined to be in the following order: SOC (253.36 tons C $ha^{-1}$; 326.61 tons C $ha^{-1}$), tree biomass (245.48 tons C $ha^{-1}$; 245.51 tons C $ha^{-1}$), roots (22.04 tons C $ha^{-1}$; 44.66 tons C $ha^{-1}$), ground litter (18.35 tons C $ha^{-1}$; 17.39 tons C $ha^{-1}$), CWD (1.67 tons C $ha^{-1}$; 3.07 tons C $ha^{-1}$), understorey/ herbaceous vegetation (1.15 tons C $ha^{-1}$; 2.57 tons C $ha^{-1}$).

Results of the study further showed that both plantations exhibited higher carbon content compared to a natural forest, a secondary forest, some fast growing plantations and agroforestry farms based on previous studies conducted in the country. On the average, the amount of carbon stored from both plantations is equal to 590.93 tons C $ha^{-1}$ as against that of a natural forest (392.96 tons C $ha^{-1}$), secondary forests (ave. of 337.68 tons C $ha^{-1}$), fast growing plantations (ave. of 253.89 tons C $ha^{-1}$) and agro forestry systems (ave. of 106.94 tons C $ha^{-1}$).

Therefore, it can be concluded that the potential of forest plantations to sequester carbon can be maximized by considering species-site compatibility, appropriate silvicultural practices, minimizing anthropogenic disturbances or impacts, and allowing the stand attain optimum physical productivity.

**Keywords:** carbon sequestration, mahogany, Makiling

**ASD-4**

# POSSIBLE LINK OF ENDOMYCORRHIZAS WITH POTENTIAL BIOINVASIVE MAHOGANY (*Swietenia macrophylla* King) IN PERMANENT PLOTS OF MT. MAKILING FOREST

**[1]Alicia S. Bombane, [1]Nelson M. Pampolina, [2]Amelita C. Luna**

[1]Department of Forest Biological Sciences
[2]Office of the Coordinator for Research, Extension and Linkages
College of Forestry and Natural Resources
University of the Philippines Los Baños. 4031
Email: nelmpampolina@yahoo.com

Endomycorrhizal fungi associated with Mahogany wildlings from natural secondary forest (PFLA 1) and mahogany plantation (PFLA-3) were investigated to compare fungal density and diversity during dry and wet seasons. The PFLAs were assessed in terms of plant diversity, Mahogany wildling density, presence of threatened and endemic trees, and soil attributes. Ten previously established 10 x 10 m sampling plots were selected within the permanent plots and five Mahogany wildlings were randomly collected during the dry and wet seasons, including roots and soil. Endomycorrhizal spores were isolated, characterized and identified for density, diversity, and correlation with root infection and wildling density. Plant diversity in PFLA 1 (H=3.868) was higher than PFLA 3 (H = 2.932) while Mahogany wildlings was 1,910 and 7,630 per hectare, respectively. Five endomycorrhizal genera (*Glomus, Acaulospora, Gigaspora, Scutellispora*, and *Sclerocystis)* and 31 species were isolated with total density of 332 spores/100g dry soil. Spores were abundant in PFLA 3 during wet season with *Glomus* being dominant. The highest and lowest density was observed in PFLA-3 with 94 (wet season) and 72 (dry season) spores per 100 g/ dry soil and diversity of H'=2.129 (PFLA 1) and H'=1.401 (PFLA 3) during the wet season. Endomycorrhizal density was positively correlated with root infection (r2=0.6) and wildling density (r2=0.2). The results showed that diversity and density of endomycorrhizal fungi could have promoted abundance of mahogany wildlings. Further study should be conducted to conserve the threatened and endemic species that are in competition with Mahogany.

**Keywords**: Endomycorrhizas, Mahogany plantation, Bioinvasion

**ASD-5**

# GROWTH AND SURVIVAL OF *Jatropha curcas* L. IN MARGINAL AND MINE SOILS AS AFFECTED BY MYCORRHIZAL INOCULATION

**Aina Albano[1], Erena Kasahara[1], Nelly S. Aggangan[2] and Nelson M. Pampolina[3]**

[1]University of the Philippines Manila, Padre Paura, Manila
[2]National Institute of Molecular Biology and Biotechnology (BIOTECH)
Tel/Fax: 049 536 0563; Email: nea@laguna.net /nelly_aggangan@yahoo.com
[3]Forest Biological Sciences, College of Forestry and Natural Resources
University of the Philippines Los Baños, College, Laguna 4031

*Jatropha curcas* has been recently very popular as alternate source of oil for biodiesel. *Jatropha* plantation establishment is targeted at unproductive areas such as the abandoned mine sites and marginal grasslands. This study aimed to determine the growth and survival of seedlings and cuttings in mine soil collected in abandoned mine sites in Mogpog, Marinduque and in Paracale, Camarines Norte. Soil was also collected from marginal grassland in Caliraya, Laguna. Seeds and cuttings of *Jatropha* were planted first in garden soil and later transferred in plastic pots filled with one kg mine or grassland soil. Inoculation with mycorrhizal fungi was done during transplanting. The experiment was done in a screenhouse following a Randomized Complete Block Design with 10 replicates. Nursery raised mycorrhizal and non-mycorrhizal seedlings were planted in an abandoned mine site in Barangay Capayang, Mogpog, Marinduque following a RCBD with four blocks.

Results show that non-mycorrhizal *Jatropha* seedlings planted in Caliraya soil died one month after transplanting. In Mogpog mine soil, all seedlings died three months after transplanting. Those inoculated with Mykovam survived longer (two months) than the other treatments (one month). On the other hand, all cuttings survived in both Caliraya and in Paracale soils. In Mogpog mine soil, cuttings died two months after transplanting. Mycorrhizal fungi indigenous mine sites promoted 348% higher seedling height than Mykovam. Likewise, mine VAM promoted higher height of cuttings grown in Caliraya and Paracale soils. In the field, mycorrhizal seedlings were taller (19.3 cm) and had bigger stem diameter (20.6 mm) than the uninoculated counterpart (13.7 cm height and 7.81 mm diameter). All mycorrhizal seedlings survived from July 2006 to December 2007 withstanding the typhoon Milenyo and Reming. By contrast, the uninoculated seedlings gave 70% survival. This indicates that *Jatropha* can be used to rehabilitate unproductive areas such as the abandoned mine sites and marginal grasslands and that mycorrhizal inoculation plays a significant role.

**Keywords**: *Jatropha curcas*, mine soil, abandoned mine sites, mycorrhiza

**ASD-6**

# POTENTIAL ENDOMYCORRHIZAL PLANTS FOR REHABILITATION OF LEPANTO MINE SITE, MANKAYAN, BENGUET

**[1]Melanie L. Manalo, [1]Nelson M. Pampolina, [2]Nelly S. Aggangan**

[1]Department of Forest Biological Sciences
College of Forestry and Natural Resources
[2]National Institute of Biotechnology and Microbiology
University of the Philippines Los Baños, College, Laguna 4031
Email: nelmpampolina@yahoo.com

The diversity of plants and endomycorrhizas in Lepanto Mine Site was investigated in this study. Four transects and twelve sampling plots were established randomly along several ecosystems to assess the diversity of trees, intermediate and undergrowth in 10 x 10 m, 3 x 3 m, and 1 x 1 m plots, respectively. Endomycorrhizal fungi were isolated from the soil collected in each transect by wet sieving and decanting technique for morphological identification and examination under the microscope. The pH, organic matter and copper content in soil were also analyzed. Ecological parameters (density, dominance, frequency, diversity and evenness) for plants and endomycorrhiza were determined. Overall, there were 28 plant species under 28 genera and 18 families, predominating the intermediate layer. Plant diversity was very low (H' = 0.838-1.077) but evenly distributed. Indigenous (*Pipturus arborescens*, *Nauclea orientalis*, *Pinus insularis*, *Melastoma malabathricum*, *Schizostachyum spontaneum*) and introduced (*Gliricidia sepium*, *Chromolaena odorata*, *Psidium guajava*) species were commonly found, including *Dillenia philippinensis* which was cited by IUCN as threatened. Endomycorrhizal spores comprised of 8 *Glomus sp.* and 4 *Acaulospora sp.* with density of 18 – 78 spores/100 g dry soil and diversity (H' = 1.350 – 2.080) nearly similar with other mine sites in the country. The soil was generally acidic (3.67 – 3.93) to slightly acidic (5.33 – 5.67) with low organic matter (0.46 ± 0.35 %), and high copper content (64.72 ± 42.56 mg/cc). There is a need to assess accumulation of copper in plants and endomycorrhiza. The above results indicate the important function of mycorrhizal plants in rehabilitation copper-rich environment in the country.

**Keywords**: Endomycorrhizas, Plant Diversity, Mine Site, Copper-rich ecosystem

**ASD-7**

# EVALUATION OF CARBON LOCKED IN THREE MANGROVE ECOSYSTEMS OF QUEZON, PHILIPPINES

**Rodel D. Lasco[1], Florencia B. Pulhin[2] and Dixon T. Gevaña[3]**

[1] Country Coordinator, World Agroforestry Centre (ICRAF-Phil), Khush Hall, International Rice Research Institute, Los Baños, Laguna
[2] University Researcher, Forestry Development Center, College of Forestry and Natural Resources, University of the Philippines Los Baños,
[3] Research Associate, Environmental Forestry Programme, College of Forestry and Natural Resources, University of the Philippines Los Baños, Laguna
Email: wuweidix@yahoo.com

The Intergovernmental Panel for Climate Change (IPCC) defines climate change as a change in climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere in addition to natural climate variability observed over comparable time periods (IPCC, 1995). Known cause of climate change is the accumulation of greenhouse gases (GHGs) in the atmosphere such as carbon dioxide, methane, nitrous oxides and chlorofluorocarbons.

Tropical forests play key role in climate change mitigation. Forests absorb carbon dioxide from the atmosphere during the process of photosynthesis to make sugars and other organic compounds for growth and metabolism. In the Philippines, studies have shown the potential of various land uses to store and sequester carbon (Lasco et al., 2001a; Lasco et al., 2001b;Lasco and Pulhin, 2001). However, limited studies had been undertaken to assess the amount of carbon stored in the mangrove forests of the country. Thus, this study attempted to estimate the carbon locked in the three mangrove ecosystems in Quezon, Philippines namely the *Rhizophora* community, *Avicennia* community and *Rhizophora- Avicennia-Sonneratia* community. Following the ASB method, sample plots were established to measure the carbon stored in the following carbon pools: aboveground, necromass and soil. Results show that the *Rhizophora* community has biomass density of 152.99 ± 13.61 Mg while *Avicennia* and *Rhizophora- Avicennia-Sonneratia* communities have 133.68 ± 5.21 and 134.51 ± 5.55, respectively. In terms of carbon locked, the mangrove ecosystems are in the following order: *Avicennia* community > *Rhizophora* community >*Rhizophora- Avicennia-Sonneratia* community. Using the average value obtained from the study, mangrove area measuring 157 ha managed by Mirant can store to as much as 15 Gg C when fully restored.

**Keywords:** carbon density, mangrove forests, carbon locked

**ASD-8**

## ALMACIGA (*Agathis philippinensis* Warb.) RESIN PRODUCTION AND MARKET OPPORTUNITY FOR UPLAND COMMUNITIES IN KARAGAN VALLEY, NEW BATAAN, PROVINCE OF COMPOSTELA VALLEY, PHILIPPINES

**Arsenio B. Ella, M. L. Santander Jr. and C. C. Garcia**

Forest Products Research and Development Institute (FPRDI)
Department of Science and Technology (DOST), College, Laguna 4031
Email: Arsie_Ella@yahoo.com

Inventory was conducted of almaciga stands found within two Certificate of Ancestral Domain Title (CADT) areas, i.e., Limparongan and Maragdao covering 5 ha and 20 ha respectively. Stand and stock table for the two areas was prepared showing the number and volume of almaciga trees per hectare.

Limparongan which comprises 33% of the total CADT areas in the uplands of Karagan Valley, also served as experimental site for the initial resin tapping study. The study was carried out following Forest Products Research and Development Institute (FPRDI) procedures. The results showed that resin yield was directly proportional to diameter classes and number of cuts per tree.

The development of almaciga resin tapping as an alternative source livelihood option for forest settlers will rely heavily on the following identified strengths: a) resin from the area has very good quality as per results of the chemical analysis conducted by FPRDI chemists; b) resin supply is plentiful as validated by the resource inventory of almaciga stands and resin yield collected in the initial tapping; and c) concerned upland communities have been trained on proper methods of resin tapping.

**Keywords:** Almaciga, *Agathis philippinensis*, resin

**ASD-9**

## USE OF SSR MARKERS FOR CHARACTERIZING DIFFERENT STRAINS OF 'CARABAO' MANGO

**Lilian F. Pateña[1], Darshan S. Brar[2,3], Lourdes B. Cardenas[3], and Ramon C. Barba[1,3]**

[1]Crop Science Cluster-Institute of Plant Breeding, College of Agriculture, University of the Philippines Los Baños (UPLB), College, Laguna 4031,
[2]Plant Breeding, Genetics and Biotechnology Division, International Rice Research Institute, Los Baños, Laguna 4030, and
[3]Institute of Biological Sciences, College of Arts and Sciences, UPLB.

Mango (also called manga, mangot, mangou) *Mangifera indica*, contains about 47 species. The Philippine 'Carabao' mango belongs to the Philippine race which has pale green or red new growth and polyembryonic fruit that is light green blushed yellow and elongated kidney-shaped.The 'Carabao' is the only Philippine mango export variety, and this has several strains. The National Seed Industry Council (NSIC), has put on hold the approval of new varieties of mango pending the availability of a system to distinguish the different 'Carabao' strains. Our study aims to develop a system of characterizing the different 'Carabao' strains through the application of the SSR marker technology.

The CTAB method for DNA extraction in rice was modified and a protocol for mango DNA extraction was developed using young, yellowish green leaves with PVP and mercaptoethanol. Among the 12 rice primers tested, six primers (50%) worked in mango. Sixteen (16) mango primers are now being tested in more than 80 accessions of 'Carabao' mango.

**Keywords:** Mango, *Mangifera indica*, SSR, strain identification

**ASD-10**

## PROPAGATION OF LANZONES BY ROOTING OF TERMINAL STEM CUTTINGS

**Ramon C. Barba[1] and Lilian F. Patena[2]**

[1]National Academy of Science and Technology, Department of Science and Technology, Taguig, M. M. and Institute of Biological Sciences, College of Arts and Sciences, UPLB and
[2]Crop Science Cluster-Institute of Plant Breeding, College of Agriculture, University of the Philippines Los Baños, College, Laguna 4031

Rooting of cuttings is an easier and more efficient means of plant propagation compared to marcotting or grafting. Rooting of lanzones, *Lansium domesticum* Correa, stem cuttings was unsuccessfully attempted at UP College of Agriculture in 15 trials in 1915, 1922, 1925, and at Puerto Rico in 1977.

A study was conducted to compare the rooting of semi-hardwood cuttings under mist. Treatments were: 1). wounding vs. non-wounding, in combination with 2). treatments of the basal ends with a). Water as control, b). Rootone rooting powder, c). 50 ppm indolebutyric acid {IBA} and, d). 100 ppm IBA. Each treatment combination consisting of 48 cuttings were rooted in washed river sand in one seedflat and placed on top of a bench provided with intermittent mist from 8 am to 5 pm daily. Softwood leafy terminal cuttings failed to root under mist, enclosed

frame, full sunlight and partial shade. Semi hardwood cuttings rooted 29.17% under mist and 16.67% in enclosed frame. Wounding by slicing 1 cm of bark at the base, significantly improved the number of cuttings that rooted (71.88% vs. 46.87%), number of roots (3.52 vs. 3.08) and length of roots (5.72 vs. 4.30cm), regardless of chemical treatment. Likewise, 50 ppm IBA consistently gave the best results followed by 100 ppm IBA, Rootone and Control. Chemicals improved rooting regardless of wounding. The effects of wounding and chemicals were both independent and additive. Rooting percentage ranged from 25.00% (Control) to 89.58% (wounded x 50 ppm IBA). Plants readily survived potting in a 50/50 mixture of sandy soil and coconut coir in 4-inch pots under shade and occasional misting. Statistics used was a 2x4 factorial, 4 replications, completely randomized design. Analysis of variance was made for every treatment comparison. The data clearly showed the independent, additive, and distinct advantages of wounding and chemical treatments.

A ramification of this study, more important than an efficient method of propagation by rooting of cuttings, is the theory and prospect of reducing juvenility in lanzones. Marcots may fruit in 5-6 years regardless of the size. Seeds take some 12 to 15 years to fruit. Grafts may take 10 years to fruit and it may take 2-3 more years to grow seedling rootstocks. It is apparent that the seedling rootstock imparts juvenility on the scion taken from a mature tree. R C Barba planted 10 seedlings of lanzones in 1984 and all fruited only in 2006, after 22 years. In comparison, 5 rooted cuttings from a mature tree were planted 10 years ago in the same location in which 2 died and the 3 remaining trees have fruited the last 2 years. With these observations, with the ease and convenience of propagation by cuttings, compared to marcotting, the long gestation period of seedlings and grafts and our knowledge and observations of the growth habit of lanzones, we will not hesitate to recommend, henceforth, the rooting of stem cuttings as the propagation method for lanzones.

**Keywords:** Lanzones, *Lansium domesticum*, rooting, cuttings, grafting

**ASD-11**

## PATTERNS OF VARIATION OF THE LEAF OUTLINES OF TEN CLOSELY RELATED *Aglaonema* species

**Cesar G. Demayo, Mark Anthony J. Torres, and Kene Padayhag**

Department of Biological Sciences, College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Patterns of variation of the leaf outlines of ten closely related *Aglaonema* species was investigated using Elliptic Fourier Analyses (EFA), eight of which are hybrids. A total of sixty-six (66) outline points were collected from around the leaf outlines. EFA of these outline coordinates returned a total of forty coefficients that were used as morphometric variables in several multivariate methods of statistical analyses. Results of the analyses showed no clear-cut distinction among the different species included in this study as revealed be the scatter plot and dendogram produced using two ordination methods—suggesting a high degree of similarity among the species. PCA of the outline coordinates confirmed the existence of directional asymmetry with regards to the direction of the leaf apex among all ten species. This result suggests a common genetic architecture that confers directional asymmetry among the ten closely related *Aglaonema* species.

**Keywords**: PCA, outline coordinates, dendrogram

**ASD-12**

## INTRA- AND INTERSPECIFIC VARIATIONS IN THE SHAPES OF THE CORONA OF SELECTED PHILIPPINE HOYAS (Asteridae, Asclepiadaceae)

**Mark Anthony J. Torres[1], Cesar G. Demayo[1] and Monina Siar[2]**

[1]Department of Biological Sciences, College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City
[2]Institute of Plant Breeding University of the Philippines Los Banos, Laguna

Quantitative evaluation of the shapes of the corona of the flowers of selected Philippine Hoyas was done using image analysis and Elliptic Fourier analysis (EFA) to give light into the nature of these plants and their systematic relationships. To do this, the shapes of both structures were summarized using chain-coding techniques. This procedure eliminated the size component of the two biological forms. Then, the chain codes were converted into Elliptic Fourier (EFA) descriptors using a mathematical algorithm. The information contained in the EFA descriptors were summarized through principal component analysis based on a variance-covariance matrix of the coefficients. The scores of the components were then used in subsequent statistical analyses. Results showed wide variations in the shapes of the corona among the species especially in the shape and relative sizes of the corona hood and the amount of asymmetry corona traits. Hierarchical cluster analysis of the mean coefficients of the EFA descriptors were also used to determine the systematic relationships of the different species and the results are discussed in the light of morphological integration and evolution. Results also showed that Elliptic Fourier analysis is very effective in illustrating graphically and statistically variations in the shapes of biological structures.

**Keywords**: corona, hood, EFA, chain-coding

**ASD-13**

## SEED DEVELOPMENT AND DESICCATION SENSITIVITY IN LETTUCE (*Lactuca sativa* L. cv. 'Tango')

**Roel C. Rabara[1*], Miller B. McDonald[2], David Tay[3] and Yael Vodovotz[4]**

[1]Philippine Rice Research Institute, Maligaya, Science City of Muñoz, 3119 Nueva Ecija, Philippines. Email: rcrabara@philrice.gov.ph
[2]Department of Horticulture and Crop Science, Email: mcdonald.2@osu.edu
[3]Ornamental Plant Germplasm Center, Email: tay.9@osu.edu
[4]Food Science and Technology, Parker Food Science Bldg., Email: vodovotz.1@osu.edu
Ohio State University, Columbus, Ohio 43210-1086, USA.

Seed development of orthodox species undergoes maturation drying which is the terminal event of seed development. Because of this character, it has been suggested by several researchers that desiccation of orthodox seeds plays an important role in the transition from developmental program to a germinative mode. To test this hypothesis, seeds of lettuce cv. 'Tango' at different stages of development were dried and germinated. The onsets of germination and desiccation tolerance in developing seeds were determined in the greenhouse-grown lettuce plants. Tagged flower heads were sampled every day starting at 4 days after flowering (DAF). Freshly extracted seeds were immediately tested for germination and other seed samples were subjected to slow (equilibrium over salt solution with 54% relative humidity) and fast-drying (drying over activated desiccant) for 2 days before seeds were sown. Most of moisture loss (91-100% of final seed moisture) occurred during the first day of drying for both drying methods. The seeds achieved equilibrium in the second day of slow drying. The moisture content (MC) of seeds at different stages of development when fresh ranged between 15-78% and when dried for 2 days ranged between 2.2–6.9% and 5.7-13.9% for fast and slow-drying, respectively. Seed maturity in lettuce was achieved 14 DAF but germination of freshly harvested was observed as early as 4 DAF (45%). Maturation drying was observed at 9 DAF as indicated by the onset of loss of moisture content in the seeds. The physiological maturity was achieved at 10DAF. Germination of dried seeds was only observed starting at 6 DAF (3% germination) and 7DAF (13% germination) for slow and fast-dried seeds, respectively. Slow drying of seeds improved the vigor of seeds however; fast drying resulted in a decrease in vigor. This study showed that premature drying did not influence germinability of developing lettuce seeds and is not a requirement in the transition of lettuce seeds from developmental to germinative mode.

**Keywords**: lettuce, seed development, desiccation, maturation drying, physiological maturity

**ASD-14**

# EFFECT OF MICROBIAL INOCULANT TO PIG LIQUID FERTILIZER ON GERMINATION INDEX OF CHINESE CABBAGE

**TI Kim[1], YH Yoo[1], ES Chung, Antonio J. Barroga[2], CB Yang[1] and MK Kim[3]**

[1]RDA, National Livestock Research Institute, Suwon, Korea
[2]Department of Animal Science, College of Agriculture, Central Luzon State University, Nueva Ecija
[3]Division of Applied and Chemistry, School of Agricultural Biotechnology, Center for Plant Molecular Genetics and Breeding Research, College of Agriculture and Life Sciences, Seoul National University, Seoul, 151-742, Korea

This study was conducted to investigate the effect of Synechocystis sp KACC 91007 when added to a pig slurry or pig liquid fertilizer (PLF) on the germination index (GI) of Chinese cabbage. The preliminary experiment involved the screening of inoculant levels which were: 0.05, 0.1, 0.2, and 0.3%, respectively. The 0.05% level of inoculant was selected based on low phytotoxicity and high GI. The PLF underwent a 107- day aerobic and anoxic processing conditions. The T-N, T-P, NH4, and NO3-N concentrations of the untreated pig slurry were: 2,873, 753, 1,441.6 and 16.48 ppm, respectively. Using aerobic processing treatment, the fertilizer value of the PLF were: 3,672, 164, 183.87 and 21.97 ppm, respectively. In contrast, the fertilizer value of the PLF processed under anoxic condition was reduced to: 1,261, 68, 161, and 16.87 ppm. The GI value of the untreated PLF under aerobic and anoxic processing condition was 83 and 40.4 %, respectively. With the addition of the 0.05% microbial inoculant, the GI improved by more than 40 and 50 % , respectively, when the PLF was processed under both anoxic and aerobic conditions. The above findings proved that the aerobic processing of PLF for 107 days was better than anoxic and yielded higher T-N, which is macro-nutrient fertilizer material. Consequently, the addition of 0.05% microbial inoculant resulted to a higher GI of the Chinese cabbage specifically under aerobic processing condition.

**Keywords:** Synechocystis sp, Chinese cabbage, microbial inoculation, pig liquid fertilizer

**ASD-15**

# *IN VITRO* SHOOT PROLIFERATION RESPONSE OF *Musa* cv. 'Lakatan' TO 6-BENZYLAMINOPURINE (BAP) AND THIDIAZURON (TDZ)

**Ann Janel A. Vidallon[1]*, Alex B. Quilang[2], Carnette C. Pulma[2] and Jovita A. Anit[2]**

[1]Biology Department, College of Arts and Sciences,
[2]Plant Biotechnology Laboratory, Research and Development Center
Rizal Technological University, Boni Avenue, Mandaluyong City 1550
Email: plantbiotech_rtu@yahoo.com

'Lakatan', a triploid banana is the most highly priced and popular cultivar grown in the Philippines. Tissue culture provides disease-free and true-to-type planting materials where the important requirements are the culture medium and plant growth regulator (cytokinin). 6-benzylaminopurine (BAP) induces more shoot formation than other types of adenine-based cytokinin. Thidiazuron (TDZ) is one of the most active phenylurea with cytokinin-like activities and more active at low concentration than adenine-type cytokinin for woody and herbaceous plants. Hence, effects of Murashige and Skoog's with BAP and TDZ on banana explants are compared. TDZ (1 and 2 ppm) provided 80% positive response compared to 50% in BAP (10 and 20 ppm). Explants in the first (4 weeks) and second (8 weeks) subcultures on BAP produced more phenolic compound. Its presence is crucial because it hinders the continuous proliferation and growth of the explant. Calli were formed after 2-3 days in TDZ after four days of inoculation while it took 4 days in cultures with BAP. Explants in TDZ generally exhibited higher multiplication rate than in BAP after the second subculture. The average number and length of shoots of plantlets in TDZ cultures were significantly different from those grown in BAP. TDZ (1 ppm) induced the highest average number of shoots at 6 cm, followed by TDZ (2 ppm) at 5 cm while those on BAP 10 and 20 ppm had only at 3 and 4 cm, respectively. The average length of shoots obtained at TDZ was highest at 1 ppm at an average of 7.5 cm, then 6 cm at 2 ppm. Microplants in 10 and 20 ppm BAP, however, developed to 2 and 3 cm, respectively. Therefore, TDZ provided better results than BAP. It will be essential for a faster and more productive banana micropropagation.

**Keywords**: banana, Musa cv '*Lakatan*', *in vitro*, tissue culture, shoot proliferation, callus, cytokinin, 6-benzylaminopurine, BAP, Thidiazuron, TDZ

ASD-16

## GROWTH RESPONSE OF *Dendrobium crumenatum* (Orchidaceae) TO KNUDSON C MEDIA WITH SUPPLEMENTS

**Alexander B. Quilang*, Norberto R. Bautista, Gale Taylan and Rachel F. Madera**

Research & Development Center
Rizal Technological University
Boni., Ave., Mandaluyong City
Email: plantbiotech_rtu@yahoo.com

Growth response of *Dendrobium crumenatum* on Knudson C media with upplements: Hormex ™, a rooting hormone (1ml/L media); HB101™, an organic ooting hormone (1ml/L media) and Gaviota 30-10-10™, a fertilizer (1/4 tsp./L media) vas determined. Protocorms were grown on each medium and plantlets, which vere randomly selected, were measured after seven months. Parameters measured vere plant height (roots excluded), number and length of shoots and roots, presence of callus and color of plantlets. The difference between treatments were not tatistically significant except for Gaviota™ which compared to a standard culture nedium provided an amount greater than the required nutritional requirement of he plant thereby causing phytotoxicity. Thus, micropropagation of *D. crumenatum* ould make do without the above-mentioned supplements.

**Keywords:** *Dendrobium crumenatum*; supplements; phytoxicity ;growth response; Knudson C

ASD-17

## RESPONSE OF YAM (*Dioscorea alata* L.) TO VARIOUS GROWTH REGULATOR

**Marlon N. Bonajos [1,2] and Prescy Rose B. Pinuela [1,2*]**

[1] Biology Department, College of Arts and Sciences
[2] Plant Biotechnology Laboratory
Rizal Technological University,Boni Avenue, 1550 Mandaluyong City
Email: prescyrose@yahoo.com, plantbiotech_rtu@yahoo.com

*Dioscorea alata L.* (Kinampay) is known for its sweet aroma and good taste nd is dubbed as the "Queen of Philippine Yams". Tissue culture can yield more lants, hence determining which plant hormone could provide more callus, shoot nd leaf formation was studied. One cm long node explant was inoculated into

solid MS media (T1-control) and into MS with different concentrations of Naphthaleneacetic acid (NAA) [T2 (2.5 ppm), T3 (5.0 ppm), T4 (7.5 ppm)]; 6-benzylaminopurine (BAP) [T5 (2.5 ppm), T6 (5.0 ppm), T7 (7.5 ppm); and kinetin (KN) [T8 (2.5 ppm), T9 (5.0 ppm), T10 (7.5ppm)]. The following parameters were obtained with four trials: (1) number of days prior to callus induction; (2) length and number of shoots; and (3) number of leaves. Callus formation was observed after five to 15 days after inoculation. Explants in T6 and T10 responded within 8 days while it took 12-14 days in all NAA treatments. All cultures showed positive response in all treatments but it was in T5 and T6 where callus were predominantly formed thus the most effective media with respect to callus induction. T6 generated an optimum response in shoot length of 0.8 mm while T10 had only 0.27 mm. Shoot formation was observed in T5-T10 but the most number of shoots were formed in T9 at 1.95 whereas T7 had only 1. All explants on kinetin media underwent direct organogenesis where T9 displayed the most number of leaves at 4.0. However calli continuously developed on NAA and BAP. Generally, T1 showed minimal reaction since it did not undergo direct organogenesis as well as embryogenesis. Therefore, BAP (T5 and T6) is highly active for callus induction and Kinetin (T9 and T10) is the most effective in shoot and leaf formation.

**Keywords**: Yam, *Dioscorea alata* L., plant growth regulators, tissue culture, naphthaleacetic acid (NAA), 6-benylaminopurine (BAP), kinetin (KN),

**ASD-18**

## EFFECT OF SILVICULTURAL MANAGEMENT ON THE BASIC PROPERTIES OF BAMBOO

**Marina A. Alipon[1], David M. Midmore[2], Elvina O. Bondad[1] and Ma. Salome R. Mora[1]**

[1]Forest Products Research and Development Institute
Department of Science and Technology, College, Laguna 4031
[2]Central Queensland University, Rockhampton Central Queensland,Australia.

Kauayan tinik (*Bambusa blumeana*) and giant bamboo (*Dendrocalamus asper*) culms from old plantations established 15 and 9 years, respectivel, prior to silvicultural treatments, were harvested and assessed over a period of 5 years. The kauayan tinik poles underwent 13 combinations of silvicultural treatments i.e., irrigation, fertilizer, mulch, organic matter and number of culms maintained. All practices except irrigation were also applied to giant bamboo in 10 combinations.

The basic properties: anatomical, chemical, physical and mechanical including culm wall thickness and diameter of the above species were tested and evaluated. The data were statistically analyzed.

The culm wall thickness and diameter were improved, although not generally significant. On the other hand, basic properties of culms with and without treatments were generally comparable. The best treatments to adopt by farmers in regenerating bamboo stands for poles were discussed. Likewise, the end-uses of bamboo culms that underwent various treatments were also included.

**Keywords**: bamboo, *Bambusa blumeana, Dendrocalamus asper*

**ASD-19**

## ASSESSMENT OF VERMICOMPOSTING AS A WASTE MANAGEMENT TECHNOLOGY AND A LIVELIHOOD TECHNOLOGY

**Joel L. Adorada***

Bureau of Plant Industry, Los Baños National Crop Research and Development Center, Los Baños, 4030 Laguna
E-mail: jladorada@yahoo.com

A survey was conducted on twenty-four (24) vermicomposting facilities all over the country. The survey included an intensive evaluation of the different vermi systems in terms of technical management, economic viability, social and environmental impacts.

The vermicomposting adoptors consisted mostly of middle to upper class farmer entrepreneurs. Several innovations were introduced in their farms in order to optimize the performance of their systems and make use of their available resources, thus making each system unique in form and quantity. In terms of economic viability, the technology was proven to be a good source of income. The return on investment ranged from Php 142.04 to 540.65 which varied according to size/scale. The social impact for most of the adoptors was not yet realized since their labor requirement was minimal. On the other hand, large scale vermi facilities have already demonstrated the positive social influences of the technology adoption and implementation such as job creation and good community relations. For the environmental impacts, the technology has the potential to affect water, air and land resources positively. Some possible impacts include organic waste management, air pollution reduction, and reduction in the application of chemical fertilizers and pesticides to some extent.

**Keywords**: vermiculture, vermicomposting, vermicompost, African night crawler, technical management, environmental impact, social impact, economic impact

**ASD-20**

# CONSERVATION AND MORPHOLOGICAL DIVERSITY OF INDIGENOUS LEGUMES IN THE PHILIPPINE HIGHLANDS

**Belinda A. Tad-awan* and Esther Josephine D. Sagalla**

Benguet State University
La Trinidad, Benguet, Philippines 2601
Email: belle_tadawan@yahoo.com.ph

This study was conducted with the aim of collecting, characterizing, evaluating, conserving and determining the diversity and relationships of indigenous grain legumes: rice beans and lima beans in Benguet, Philippines.

All collection trips were conducted in the 13 municipalities of Benguet province with elevations ranging from 200 to 2,929 meters above sea level. Rice bean and lima bean collections were characterized using the descriptor's list by International Plant Genetic Resources Institute. The collections were further evaluated at the Benguet State University experimental farm from 2005 to 2006. Clustering of the collections was done using the Ward's method.

In the rice bean (*Vigna umbellata* L.) germplasm, diversity analysis revealed low variation within the collection and the accessions were clustered into four. Cluster 1 collections were late maturing; cluster 2 was vigorous; cluster 3 had high flower bud production and cluster 4 was the highest seed yielder.

Grouping the lima beans (*Phaseolus lunatus* L.) revealed three clusters. Cluster 1 is associated to flowering, seed setting and filling characteristics. Collections under cluster 1 were the latest to set pods and seed fill. Cluster 2 is associated to pod length and number. Cluster 3 is related to seed width, length and weight. The lima bean germplasm showed medium variation.

**Keywords**: *Vigna umbellata* L., *Phaseolus lunatus* L., germplasm, diversity and cluster analysis, Philippine highlands

**ASD-21**

# DEVELOPMENT OF IMPROVED VARIETIES OF FIELD LEGUMES: MUNGBEAN (NSIC Mg11 AND NSIC Mg14), SOYBEAN (NSIC Sy8), AND PEANUT (NSIC Pn9 AND NSIC Pn10)

**Flora A. Jarilla*, Eugenia M. Buctuanon, Felicidad N. Cruz, Gloria P. Lanting, Adelaida P. Martizano, and Julie Ann Aragones**

Bureau of Plant Industry - Los Baños
National Crop Research and Development Center
Los Baños, 4030 Laguna
E-mail Address: bpi_eg05@yahoo.com and fajjica@yahoo.com

Field legumes (mungbean, soybean and peanut) are some of the popular and important crops grown in the Philippines. BPI-LBNCRDC continuously conducts research on developing superior lines/varieties of these crops through varietal improvement.

Promising lines of mungbean and soybean were field tested and evaluated under the Preliminary Yield Trial (PYT) in 1992 to 1998 and General Yield Trial (GYT) in 1994 to 2000. Potential varieties from the GYT were screened further in different regions of the country under the National Cooperative Trial (NCT) in 1999 to 2003. Likewise, peanut entries were tested and evaluated under the PYT in 1996 to 1998 and under the NCT in 1998 to 2000. Evaluation was conducted to screen and develop varieties with high bean yield, early and uniform maturity, and resistant to natural occurrence of diseases.

Based on the on-station and across location performances, five varieties were approved and released by the National Seed Industry Council (NSIC) in 2001 and 2004 for commercial production. Approved in 2001 were: EGM 4310 as NSIC Mg11 locally named "Kintab", EGSy 96-6-1 as NSIC Sy 8 with "Mapusyaw" as local name, and EG Pn57 as NSIC Pn9 and EGPn62 as NSIC Pn10 locally named as "Likas" and "Yaman", respectively. In 2004, EGM 93-266 was approved as NSIC Mg14 with local name "Kulabo".

**Keywords**: preliminary yield trial, general yield trial, national cooperative trial, national seed industry council, varietal improvement

**ASD-22**

## OPEN FIELD PRODUCTION OF HIGH VALUE COMMERCIAL CROPS USING PRESSURIZED IRRIGATION (HVCC TECHNO DEMO FARM)

**Lorna M. Javier* and Dennis E. Eusebio**

Bureau of Plant Industry-
Los Baños National Crop Research and Development Center
Los Baños, 4030 Laguna
E-mail: bpi_eg05@yahoo.com

The High Value Commercial Crop Development Program techno-demo farm project at the BPI-LBNCRDC was perceived to showcase the new technology on Pressurized Irrigation (drip irrigation and fertigation system) in the production of high value commercial crops in the open field and also to determine the economic viability of using the technology.

The production of high value commercial crops (HVCC) such as super sweet corn, eggplant, daikonfoliage, lettuce and cucumber in the open field promises to be profitable venture. The use of drip lines and pressurized irrigation makes water and fertilizer use more efficient. Manual labor in terms of watering and fertilizer application is reduced by 60%. Therefore minimizing the most laborious and time consumable watering of the crops .

Private entrepreneurs were the most interested in the technologies being showcased. These clienteles represented different provinces nationwide who regularly consulted the staff through telephone, e-mail and farm visits .

Keywords : pressurized irrigaion,drip irrigation, fertigation ,F1 hybrids and high value commercial crops

**ASD-23**

## IMPROVING THE YIELD OF GREENHOUSE GROWN-LETTUCE THROUGH UTILIZATION OF ORGANIC SUBSTRATES

**Clarita P. Aganon***

Ramon Magsaysay- Center for Agricultural Research and Environment Studies
Central Luzon State University, Science City of Muñoz, Nueva Ecija
Email: cpaganon@yahoo.com

Cultivation of crops inside the greenhouse involves the modification of some growth factors such as humidity, light and temperature. Greenhouse provides the much needed protection against heavy rainfall and insect pests resulting in better crop quality. Lettuce is a high value vegetable crop and one of its requirements for a successful production is appropriate nutrient management. Inorganic fertilizers, while they contain high levels of nutrients, are limited only to 2-3 major elements, unlike organic fertilizers which can supply almost all the essential elements for proper plant nutrition. The protection provided through greenhouse cultivation and appropriate management of nutrients together will lead to successful lettuce production.

We studied the use of organic substrates either mixed with the soil or as a soilless media for lettuce production. Ground culture (soil culture) was used as a control treatment. Each of coco coir dust, CC (8 t $ha^{-1}$), household waste compost, HWC (16 t $ha^{-1}$), and CC + HW (4 + 8 t $ha^{-1}$) were mixed with the upper 10 cm soil in the plots. In soilless treatments, the amounts of organic materials were: CC (37 t $ha^{-1}$), HWC (75 t $ha^{-1}$) and CC+HWC (18 + 38 t $ha^{-1}$). All treatment plots received blanket application of 90-30-30 kg N, $P_2O_5$, $K_2O$ $ha^{-1}$. The experiment was laid out in Randomized Complete Block Design with three replications and treatment plot size of 1 x 3 m. Yields were taken from one sq m.

Best yields were from plots treated with HWC and CC + HWC with a yield advantage over the ground-cultured lettuce of 24 and 22 percent, respectively. HWC as soilless substrate compared with the soil-mixed organic materials with a yield advantage over the ground-cultured lettuce of 26 percent.

Mixing either CC+HWC or HWC with the soil improved the physical and chemical soil fertility resulting in higher yield of lettuce. On the other hand a soilless substrate of HWC had the same effect as mixed organic substrates.

**Keywords**: coconut coir dust, household waste compost, organic substrates, soilless, greenhouse, ground culture

**ASD-24**

## EFFICIENCY OF MARKER ASSISTED SELECTION (MAS) FOR FERTILITY RESTORER (*Rf*) GENES OF WILD ABORTIVE (WA) TYPE OF RICE CYTOPLASM

**LM Perez, TE Mananghaya, HM Pastor and R Baybado**

Philippine Rice Research Institute (PhilRice), Maligaya
Science City of Muñoz, Nueva Ecija, 3119 Philippines

Molecular markers have been proven useful in the transfer of gene(s) from donor parents to elite rice cultivars and in tracking down the presence of these genes in the progenies. In hybrid rice, DNA markers tightly linked to the fertility restorer loci in the wild abortive (WA) cytoplasmic male sterility system of rice have been reported. This study highlights the application of RG140 and S10019 DNA markers in selecting plants carrying the restorer gene(s) *Rf3* and *Rf4*, respectively. In the set of 143 male parent entries evaluated in 2005 WS and 2006 DS, efficiency of MAS for *Rf* gene was 64% and 83%, respectively. An estimated 50% potential reduction of SN materials to be used in hybridization is possible when any or both marker alleles of *Rf3* and *Rf4* were present in the male parents. In the initial evaluation (2006 WS) of the 146 male parent entries used in 2006 DS crosses, MAS was 87% efficient to identify possible restorer lines and is estimated to reduce approximately 68% of the SN materials that are normally being handled during hybridization to produce Philippine 3-line hybrid cultivars.

**Keywords:** molecular markers, fertility restorer (Rf) genes, hybrid rice, wild abortive, cytoplasmic male sterility system

**ASD-25**

# FUNCTIONAL ANALYSIS OF CANDIDATE *RESTORER OF FERTILITY* GENES AND DEVELOPMENT OF DNA MARKERS FOR WILD-ABORTIVE CYTOPLASMIC MALE STERILITY IN RICE

**Antonio A. Alfonso*, Melanie I. Revita, Nelson S. Garcia, Jerry C. Serapion Eleanor S. Avellanoza, Christine Jade A. Dilla and Emily O. Espejo**

Plant Breeding and Biotechnology Division, Philippine Rice Research Institute, Maligaya, Science City of Muñoz, Nueva Ecija, Philippines 3119
aaalfonso@philrice.gov.ph

Hybrid vigor can increase crop yield by as much as 20-30%. In rice, massive adoption of superior hybrids is considered a major strategy to attain rice self-sufficiency. However, the lengthy and tedious process of developing parental lines and producing $F_1$ hybrid seeds are the main constraints. This study aims to fast-track hybrid rice breeding by developing DNA markers that can classify potential parental lines based on their ability to restore fertility in CMS plants. This will limit testcrosses only to potentially useful combinations, thus, saving resources and increasing efficiency. Another objective is to clone the rice *Restorer of fertility* (*Rf*) gene for the wild-abortive (WA) cytoplasm. This will be useful both in marker-assisted breeding and in designing strategies to simplify F1 hybrid seed production. Based on reports that duplicate genes (*Rf3* on chromosome 1 and *Rf1B* on chromosome 10) control fertility restoration in WA-CMS rice, two candidate *Rf* genes were isolated from IR64. To test the function of these genes, transgenic complementation assay was carried out by introducing two plasmid constructs containing these genes into the CMS lines of Mestizo2 and 3 through biolistic and *Agrobacterium*-mediated transformation. Pollen fertility in more than 100 regenerants ranged from completely sterile to highly fertile. Correlation of transgene presence as determined through PCR and restoration of pollen fertility is being performed using T1 populations derived from highly fertile T0 regenerants. In another activity, potential *Rf*-linked markers were produced by testing primers designed using public genomic sequences. For *Rf3*, six polymorphic bands were identified when 18 primer combinations were evaluated. For *Rf1B*, evaluation of 14 primer combinations revealed three polymorphic bands. These are being tested for their cosegregation with fertility restoration. Large amplicons from B and R lines are being sequenced to develop markers and understand the comparative structure of the *Rf* loci in these lines.

**Keywords**: hybrid rice, cytoplasmic male sterility, restorer gene, molecular marker, candidate gene approach

**ASD-26**

# QUANTITATIVE TRAIT LOCI (QTL) ANALYSIS AND MAPPING OF FEMALE AND MALE FERTILITY GENES IN AN INTERSPECIFIC CROSS OF TOMATO (*Lycopersicon esculentum* Mill. X *Lycopersicon pimpinellifolium* [Jusl.] Mill.)

**Mia Desiree C. Azañes[1], Elaine Brigid Graham[2] and Merlyn S. Mendioro[1]**

[1] Genetics and Molecular Biology Division,
Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Banos, College, Laguna 4031
[2]Asian Vegetable Research and Development Center, Shanhua, Tainan, Taiwan

Quantitative traits related to female fertility were mapped on the chromosomes of the recombinant inbred lines of a cross between cultivated tomato (*Lycopersicon esculentum* Mill.) and currant tomato (*Lycopersicon pimpinellifolium* [Jusl.] Mill.). Morphological characteristics related to fertility were observed. Most of the fertility traits observed has values near that of *L. pimpinellifolium* parent. At $\alpha<0.05$, a significant weak association was observed for pollen number and number of seeds per fruit. On the other hand, at $\alpha<0.01$, very weak associations were detected for fruit weight and stigma exertion; and fruit weight and pollen number. Forty-one Simple Sequence Repeats (SSR) markers and two Single Nucleotide Polymorphism (SNP) markers were used to saturate the previous genetic map for the LA1269 RILs. A total of sixteen markers (14 SSR and 2 SNP) were incorporated into the genetic map of the same population. The phenotypic and genotypic data gathered were used in the QTL analysis. A total of 11 QTLs related with fertility with LOD scores greater than 2.0 was detected. These include the following: one fruit weight QTL which is located at chromosome 7; one for pollen number at chromosome 11; four for pollen viability at chromosomes 4, 5, 6, and 9; two for number of seeds per fruit both at chromosome 3; one for number of flowers per inflorescence at chromosome 8; and two for stigma exertion at chromosomes 6 and 8.

**Keywords**: QTL, fertility genes, SSR, *Lycopersicon esculentum*, *Lycopersicon pimpinellifolium*

ASD-27

# QTL MAPPING OF FLOWER MORPHOLOGY, FRUIT-RELATED TRAITS, BACTERIAL SPOT RESISTANCE, AND LEAF FLECKING IN AN INTRASPECIFIC CROSS OF PEPPER (*Capsicum annuum* L.)

**Abriel S. Bulasag[1], Elain Brigid H. Graham[2] and M.S. Mendioro[3]**

[1] UP Rural High School, College of Arts and Sciences
University of the Philippines Los Baños, Paciano Rizal, Bay, Laguna
Email: uprhsuplb@yahoo.com
[2] Asian Vegetable Research and Development Center, Shanhua, Taiwan
[3]Institute of Biological Sciences, College of Arts and Sciences
University of the Philippines Los Baños

To map QTL markers linked to flower morphology, fruit-related traits, bacterial spot resistance and leaf flecking, recombinant inbred lines were developed from an intra-specific cross of pepper, *Capsicum annuum* Linn (bacterial spot susceptible sweet pepper (Nacional AG-506) x resistant male hot pepper (CNPH703). A total of 20 tomato SSR primers amplified genes in the parentals. Thirty-six QTLs were found, 15 for flower morphology, 9 for bacterial spot resistance, 2 for foliar flecking and 10 for fruit-related traits. Majority of the QTL were found in Linkage Groups (LG) 10A, 03B, and 10C with 8,7, and 9 QTL, respectively. For LG10A, majority of the QTL were associated with flower morphology (style exertion, pistil color, and pistil length). QTL associated with resistance to *Xcv* race 1 were found in LG03B. For LG10C, QTL for the four morphological characters were found, these include Xcv race 8 resistance, style exertion, pistil color, pistil length, number of petals, anther color and fruit length to width ratio. QTL for flower morphology were found on chromosomes 8 and 1 while QTL for fruit-related traits were found on chromosomes 1, 2 and 3. A QTL for resistance to Xcv race 8 was also found on chromosome 3 while leaf flecking was found on chromosome 1,(LG10C). Genes coding for bacterial spot resistance for both race 1 and race 8 seem to be introgressed from the parentals towards the 121 F7 RIL offsprings. The same may be said for genes coding for capsaicin, among other fruit-related traits and floral morphology traits. The QTL markers found on the same chromosome or linkage group were also strongly correlated according to the Pearson table of correlations at both a= 0.05 and a=0.01.

**Keywords**: intrapecific cross, pepper, QTL, *Capsicum annuum*, bacterial spot resistance, flower morphology, leaf flecking

**ASD-28**

# PERFORMANCE OF THE SECOND BACKCROSS ($BC_2$) GENERATION OF PAPAYA AGAINST PAPAYA RINGSPOT VIRUS (PRSV-P) AND EVALUATION OF AGRONOMIC TRAITS

**Simeona V. Siar[1], Andres Godwin C. Sajise[1], Gil A. Beligan[1], Antonio C. Laurena[1], Roderick A. Drew[2] and Christopher M.O'Brien[2]**

[1] Fruit and Ornamental Crops Section, Crop Science Cluster - Institute of Plant Breeding, College of Agriculture University of the Philippines Los Baños, College 4031 Laguna,
[2] School of Biomedical and Molecular Sciences, Griffith University, Nathan Campus, Brisbane 4111 Queensland, Australia
Email: moninasiar@yahoo.com

Performance against papaya ringspot virus (PRSV-P) of the second backcross ($BC_2$) generation of papaya from backcrossing the resistant $BC_1$ plants to its recurrent parent, 5648, was studied. $BC_1$ is the product of hybridization between papaya inbred line, 5648 and F1 intergeneric hybrid, 410. Intergeneric hybrid 410 is a cross between *Carica papaya* x *Vasconcellea quercifolia* where *V. quercifolia* is the source of resistance to PRSV-P.

A total of 137 $BC_2$ plants were manually inoculated three times at two-week intervals in the screenhouse. Fifty-two plants or 38 % showed typical symptoms (ranging from chlorosis to shoe-stringed leaves) of papaya ringspot virus after inoculations. Surviving healthy plants (27 plants) were transplanted in the field and were exposed to aphid vectors from susceptible papaya (inbred 4172, and Davao Solo) plants that had a high inoculum level of PRSV-P. Leaves were collected from all the twenty-seven plants and were assayed for virus concentration. ELISA test result showed that only four out of twenty-seven plants tested were positive to the virus. It was also observed that another four $BC_2$ plants already showed mild infection of the virus based on visual inspection but were negative after performing the ELISA test. The mild symptom during the first few months after field transplanting did not progress in those four plants, which explained the result of the serological test.

Evaluation of some agronomic characters was also done. The $BC_2$ plants were routinely checked to know how the backcross plants perform compared with the susceptible lines 4172 and Davao Solo. Differences between $BC_2$ plants and the susceptible check were highly evident in terms of severity of symptom on the leaves and on the number of observed spots in the fruit. The promising results could provide the basis for restoration of the papaya industry in those regions that have been devastated by disease in the Philippines.

**Keywords**: Papaya ringspot virus (PRSV-P), backcrossing, intergeneric hybrid, inbred lines, ELISA, *Carica papaya* x *Vasconcellea quercifolia*

**ASD-29**

# SSR PRIMER PAIR "MANAM 1 AND 2" CONFIRMED THE INTROGRESSION OF PAPAYA RINGSPOT VIRUS RESISTANCE (PRSV-P) FROM *Vasconcella spp.* TO *CARICA PAPAYA*

**Simeona V. Siar[1]*, Antonio C. Laurena[2], Andres Godwin C. Sajise[1], and Neil H. Tan Gana[2]**

Fruit and Ornamental Crops Section[1], and Biochemistry Laboratory[2],
Crop Science Cluster- Institute of Plant Breeding, College of Agriculture,
University of the Philippines
Los Baños, College, Laguna, Philippines
Email: moninasiar@yahoo.com; .Fax: 049 5363438; Tel. No.: 049 5363304

Resistance to papaya ringspot virus (PRSV-P) from *Vasconcella quercifolia*, a wild relative of papaya was introgressed into IPB-developed inbred lines. A resistant back cross $(BC)_1$ plant was obtained from the hybridization between papaya inbred line, 5648 and F1 intergeneric hybrid 410. Intergeneric hybrid 410 is a cross between *Carica papaya* x *Vasconcella quercifolia*. Simple sequence repeats (SSRs) were used as molecular markers to fingerprint and confirm the introgression of the resistant trait from *V. quercifolia* to the $BC_1$, IPB inbred lines, and F1 intergeneric hybrid lines. SSRs or simple sequence repeats are composed of a few base pairs (1-6 bp in length) and the repeat units are generally found in the non-coding regions of the DNA called introns.

*C. papaya* nucleotide sequences were downloaded from the GenBank database and analyzed for the presence of SSRs using several programs such as the WebTROLL. Nine repeat motifs were identified and several primer pairs were designed based on conserved sequences flanking the SSRs. All the polymorphic bands generated by *V. quercifolia* were characterized by the separation of PCR fingerprints/amplicons and nucleotide sequencing. Sequences were aligned and compared to the *C. papaya* sequences. A primer pair (MANAM 1and 2) was identified as markers that can be used in screening resistant progenies of the succeeding backcross generations.

Results indicated the introgression of the PRSV resistance trait from *V. quercifolia* to *C. papaya* (BC1 5648 x 410). The generated polymorphic bands differentiated the *C. papaya* genotypes from its wild relative, *V. quercifolia*. This technique represents a practical approach of designing SSR primers based on exons rather than intronic-based sequences.

**Keywords**: Papaya ringspot virus (PRSV-P), molecular markers, introgression, SSRs, primers

**ASD-30**

## INHERITANCE AND TRAIT EXPRESSION OF PRSV COAT PROTEIN GENE IN TRANSGENIC PRSV-RESISTANT 'DAVAO SOLO' PAPAYA (*Carica papaya* L.)

**Marivi G. Colle, Alma O. Canama, Hayde F. Galvez, Lolita M. Dolores Pablito M. Magdalita and Desiree M. Hautea***

Institute of Plant Breeding-Crop Science Cluster, College of Agriculture
University of the Philippines Los Baños, 4031 College, Laguna, Philippines
Email: deshautea@yahoo.com, mgcolle@yahoo.com

The Philippine papaya industry has continuously suffered production losses since the outbreak of Papaya Ringspot Virus (PRSV) disease in 1982. Efforts are underway to develop papayas that are resistant to the PRSV disease through bioengineering. The coat protein (CP) gene of Philippine PRSV (Bulacan isolate) was introduced into the genome of Davao 'Solo' papaya variety through *Agrobacterium*-mediated transformation. Inheritance of the CP transgene and expression of resistance to the virus conferred by the transgene were established in two successive generations through polymerase chain reaction (PCR) analysis, PRSV challenge, and kanamycin leaf bleach assay. Chi-square analyses were done to determine the inheritance and type of gene action of the CP gene and resistance expression. Results of segregation analyses of the PCR product of CP transgene showed that the CP gene was inherited in a 3:1 Mendelian ratio. Similar segregation ratios and inheritance patterns were also obtained for the CP-mediated resistance to the virus and expression of *nptII* marker gene by leaf bleach assay. The results indicate that the CP transgene has been stably integrated into the papaya genome.

**Keywords**: *Carica papaya*, transgenic papaya, PRSV coat protein, *nptII* marker gene, *Agrobacterium*--mediated transformation

**ASD-31**

## WHITE RUST: A NEMESIS OF CHRYSANTHEMUMS IN THE HIGHLANDS OF NORTHERN PHILIPPINES

**Luciana M. Villanueva*, Teresita D. Masangcay Nordalyn B. Pedroche and Alfonso O. Fagcayang**

Benguet State University, La Trinidad 2601, Benguet
Email: lmvillanueva12003@yahoo.com

Chrysanthemum (*Dendranthema* grandiflora T. Zveler) is one of the leading cutflowers and potted plants in the local and international markets. In the Philippines, the major production areas are Baguio City, Benguet, Laguna and

Cavite in Luzon, Cebu and Bacolod in the Visayas and Davao in Mindanao. However, production and quality of chrysanthemums are being threatened by the occurrence of several diseases, one of which is white rust. White rust is considered to be the most important disease of chrysanthemums worldwide. It is caused by the fungus, *Puccinia horiana* Henn. White rust infections appear initially as small light green to yellow spots on the upper leaf surfaces and beige to pink rust pustules are present on the underside of the leaf. The pustules become white over time followed by necrosis and abscission of diseased tissue. The pathogen has no alternate host and does not infect the common weeds found in the area. It can survive in the soil 2-3 weeks after inoculation. Chrysanthemums are most susceptible during the first 7 weeks after transplanting and gradually become less susceptible as they mature. Inoculation of 10,000 spores/ml at transplanting and 15 days after transplanting (DAT) significantly enhanced an early occurrence of rust symptoms on susceptible plants, high infection rate and a concomitant 80% reduction of marketable yield. On the other hand, inoculation of 10 spores/ml at 60 days after transplanting (DAT) significantly affected delayed symptom development, lowest infection rate and more marketable cutflower without reduction in yield. The disease is favored by very densed planting density and high nitrogen fertilization. Development of a sustainable management strategy for the disease is therefore needed.

**Keywords**: white rust, pustules, *Puccinia horiana*, chrysanthemum, nemesis, alternate host, susceptible

**ASD-32**

## BIOCHEMICAL, PATHOGENIC AND AFLP ANALYSIS OF *Ralstonia solanacearum* FROM THE PHILIPPINES

**Joselito E. Villa*[1], Kenichi Tsuchiya[2], Mitsuo Horita[3], Neilyn O. Villa[4], Mitsuro Hyakumachi[5]**

[1]United Graduate School of Agricultural Science
1-1 Yanagido, Gifu University, Gifu, Japan
e-mail: joeyvilla@yahoo.com
[2] Division of Microbiology, National Institute for Agro-Environmental Sciences
Kannondai 3-1-3, Tsukuba, Ibaraki 305-8604, Japan
[3]National Agricultural Research Center for Hokkaido Region, Sapporo, Hokkaido, Japan
[4]Genetics and Molecular Biology Division, Institute of Biological Sciences
University of the Philippines Los Baños, College, Laguna, Philippines
e-mail: neilyn24@yahoo.com
[5]Laboratory of Plant Disease Science, Gifu University, 1-1 Yanagido, Gifu, Japan

In the Philippines, bacterial wilt caused by *Ralstonia solanacearum* is one of the most important diseases affecting vegetables and banana plants. Knowledge of their biological and genetic characteristics is very important in order to make a sound control measure. In this study, we screened 89 strains of *R. solanacearum* isolated from various hosts for their biovar classification, pathogenicity and genetic diversity. The results of the biochemical test on the utilization of trehalose and D-ribose showed that the strains isolated from vegetables were either classified as biovars 2, 3, 4 or N2. This is the first report of biovar N2 in the Philippines. All strains isolated from banana were classified to biovar 1. The results of the pathogenicity tests divided the strains to 9 pathogenicity groups based on their virulence in tomato, potato, eggplant, sweet pepper and tobacco. One strain isolated in tomato was pathogenic to tobacco and all strains isolated from banana were non-pathogenic to all the tested crops. To have a good comparison of the local strains' genome, foreign strains were included in the AFLP-DNA analysis which divided the strains into 4 clusters. Cluster 1 was composed of strains isolated from solanaceous crops, ginger and *Morus* sp. from China. Cluster 2 grouped the potato strains (biovar N2) from Philippines and BDB strains from Indonesia. Cluster 3 has the local and foreign strains isolated from potato (biovar 2) and banana (biovar 1). Cluster 4 has solely the tomato strain from USA. The results revealed the very diverse characteristic of *R. solanacearum* strains in the Philippines. This is one of the reasons that make this pathogen difficult to control.

**Keywords**: Amplified Fragment Length Polymorphism, hypersensitivity reaction, biovar classification, *R. solanacearum*

**ASD-33**

## *Plasmodiophora brassicae* Wor. PATHOTYPES IDENTIFIED IN BENGUET

**Bernard S. Tad-awan[1], Maria Theresa P. Bacli and Cristina D. Bidang**

[1]Department of Plant Pathology, College of Agriculture
Benguet State University, La Trinidad, Benguet
Email: btadawan@yahoo.com

The research aimed at determining pathotypes and virulence of the collections and single spore-derived culture (SSDC) of *Plasmodiophora brassicae* Wor. in Benguet. The virulent pathotype identified is used as inoculum source for selection or breeding for resistance for certain crucifer crops as component of disease management.

The collections from La Trinidad and Buguias, Benguet as well as single spore-derived culture from the La Trinidad collection were subjected to the European clubroot differential (ECD) host lines and assessed for pathotype make-up based on clubbing and consequent assigned denary values for each host line.

Two pathotypes designated as pathotypes 31/31/31 and 19/31/31 were identified from the *Plasmodiophora brassicae* populations from La Trinidad, Benguet. Another, pathotype 21/23/31, was identified from the Buguias population.

From the pathotype (31/31/31), 14 SSDCs of 220 inoculated seedlings or 6.36% success rate were produced through the technique of Jones and Ingram (1982) versus the unsuccessful result from using that of Some *et al.* (1996).

One of the SSDC was subjected to ECD host test and was identified as pathotype 16/16/19.

In order of virulence based on the 25% cut-off disease index, the pathotype 31/31/31 was the most virulent, infecting seven ECD host lines with the highest (100%) on the universally susceptible cultivar, ECD 05 (Chinese cabbage Graanat). Likewise, pathotype 19/31/31 is virulent on seven ECD lines with the highest (79.17%) on ECD #7 (Giant Rape Commercial).

The SSDC pathotype 16/16/19 was virulent only on ECD 05 and 10, with 75.83% and 71.66% indices, respectively. This pathotype with virulence differing from its collection source may indicate composite make-up of a collection.

The use of the identified virulent pathotype (31/31/31) is recommended as inoculum source when screening for clubroot resistance.

**Key words**: pathotype, collection, single spore-derived culture, European clubroot differential host

**ASD-34**

## MAPPING OF QTL FOR BACTERIAL STALK ROT RESISTANCE IN CORN

**Alma O. Canama*, Hayde F. Galvez, Cecilia B. Pascual and Desiree M. Hautea**

Institute of Plant Breeding, Crop Science Cluster, College of Agriculture
University of the Philippines Los Baños, 4031 College, Laguna, Philippines
Email: aoc78ph2k@yahoo.com

Bacterial stalk rot (BSR) caused by *Pectobacterium chrysanthemi pv. zeae* is one of the most important diseases in maize (*Zea mays* L.). Improved host resistance provides an efficient method of increasing corn production especially in infested areas. The advent of DNA marker technologies has paved the way to map qualitative and quantitative traits in maize.

This study is the first report on molecular mapping of BSR resistance in maize. A set of 120 $F_3$ progenies derived from the cross, P8 (BSR-susceptible) x YIF62 (BSR-resistant) parental inbred lines, was used in the molecular analysis. A linkage map consisting of 35 simple sequence repeats (SSR), 34 amplified fragment length polymorphism (AFLP) and eight resistance gene analog (RGA) markers, was constructed covering a distance of 932.8 cM with approximately 12.1 cM marker density. The integrated linkage map is about 54% of the total map length of the maize map standard. Quantitative trait loci (QTL) analysis based on composite interval mapping (CIM) and multiple interval mapping (MIM) revealed three putative QTLs associated with resistance to BSR. The QTL with the largest effect (40.41%) was mapped in chromosome 8 and exhibited over-dominance gene action. The other two QTLs both located in the same region of chromosome 2 showed additive gene effects, and accounted for more than 40% of the total phenotypic variation observed. Results from this study have contributed to the understanding of the genetics of BSR resistance in maize, the resistance genes involved and their most likely gene actions and in designing efficient and effective strategies to breed for BSR resistance in maize.

**Keywords:** bacterial stalk rot, linkage map, maize, SSR, AFLP, RGA, QTL

**ASD-35**

## BUILDING NATIONAL PEST LISTS TO UNDERPIN AGRICULTURAL EXPORTS IN THE PHILIPPINES

**Bonifacio F. Cayabyab[1], Wilma R. Cuaterno[2] and Ian Naumann[3]**

[1]National Crop Protection Center – Crop Protection Cluster
College of Agriculture,
UP Los Baños, College, Laguna, Philippines
[2]Bureau of Plant Industry, San Andres, Manila,
[3]Office of the Chief Plant Protection Officer,
Department of Agriculture, Fisheries and Forestry, Canberra Australia
Email: bfcayabyab@yahoo.com

The development challenge for the Philippines, as the country seeks to increase competitiveness and expand trade in agricultural commodities, is to manage plant health to maximize productivity, to address food security concerns and to generate rural income. A key element is to generate list of arthropod pests and plant diseases of crops. Such data are required by potential trading partners to assess the quarantine risks associated with importing agricultural commodities. Thus it is a must to produce a credible pest list now.

The Bureau of Plant Industry the National Crop Protection Center and the National Museum conducted a workshop to plan for the rehabilitation of the arthropod pests collections and plant disease herbaria. This activity was funded by the Australian government. A follow-up undertaking was done on SPS awareness of the importance of pest lists, stock stake of biological collections and entomological/pathological collections and preservations techniques funded by AUSAid. Trainees from BIOTECH, CPC-UPLB, MNH and DA RCPC IV participated on biological collections study tour and specialized short courses on pathogens and arthropods collections, curation and data management in Australia from October 2006 - December 2006

**Keywords:** pest list, arthropods pest, plant disease herbaria, specimen

**ASD-36**

## COST-EFFECTIVENESS OF THE ENHANCED LIGHT TRAP FOR INSECT PEST CONTROL OF LOWLAND HYBRID RICE AND COTTON+CORN CROPPING SYSTEM

**Aida D. Solsoloy, F.G. Calamaan, L.C. Paraoan & Y.L.Abrina**

Cotton Research Center
Cotton Development Administration
Batac, Ilocos Norte

The effectiveness of the enhanced light trap in controlling insect pests of rainfed lowland hybrid rice and cotton-corn intercropping system was assessed during the dry season, October 2005- May 2006 at the Central Experiment Station.

The enhanced light trap effectively controlled the major pests infesting rice specifically *Nephotettix virescens*, *Recilia dorsalis*, *Sogatella furcifera*, *Nilaparvata lugens*, *Hydrellia philippina*, *Sesamia inferens*, and several unidentified species of leaffolders and stemborers.

Cotton with the light trap produced a greater number of bolls and subsequently higher seedcotton yield than the comparative farm. Further, the number of chemical spraying for bollworm, *Helicoverpa armigera*, control was only 2x in contrast to the 5x of the comparative farm which also was exposed to 950 strips of the egg parasitoid, *Trichogramma chilonis*.

Paddy rice, corn kernel and seedcotton yields were higher on the area with the light trap than that without light trap. Partial budget analysis showed a high index of profitability using the enhanced light trap attributable to the increase in yield and excellence in pest control.

The trap is highly recommended to farmers and distribution to be done through government intervention.

**Keywords**: enhanced light trap, insect pests of cotton, rice, corn, seedcotton, grain yields, partial budget analysis

**ASD-37**

## CORN BLOTCH LEAFMINER: AN OBSCURE PEST OF CORN THAT IS BECOMING PREVALENT?

**Bonifacio F. Cayabyab[1], Edwin P. Alcantara[2], Augusto C. Sumalde[1], and Wilma R. Cuaterno[3]**

[1]Crop Protection Cluster College of Agriculture
[2]BIOTECH
University of the Philippines Los Baños,
College, Laguna 4031,
[3] Bureau of Plant Industry, Malate, Manila,
Email: bfcayabyab@yahoo.com

An uncommon Agromyzid fly was serendipitously observed in corn areas of Mexico and Lubao, Pampanga in April– July 2006. It was also noted in Camiling, Tarlac, Los Baños Laguna and at Xavier University, Cagayan de Oro City. Gabriel (2001) cited an Agromyzid leafminer that attacks corn based on Capco's (1957) list of corn pest.

The adult is a tiny fly. It laid eggs on leaf surfaces. The larvae tunnel into the leaves leaving behind transparent tunnels or mines. As the maggots grow, the mines increase in width. When larvae are mature they drop off the plant and pupate in the soil. The mean counts of mines per 100 plants replicated 3 times in sweet corn and Bt corn in Anao, Mexico and Santiago, Lubao Pampanga were; .30, .31, and .32, .33 respectively. The mean counts on hybrid corn in Sawat Camiling Tarlac and MANRESA, Xavier University Cagayan De Oro City were .27, and .30 respectively. The mean count on lagkitam in Los Baños was .28. This pest is becoming prevalent in the country. We identified this pest as *Agromyza parvicornis* (Agromyzidae: Diptera) corn blotch leafminer.
e country.

**Keyword**: corn blotch leaf miner, *Agromyza parvicornis*, pest survey, corn

**ASD-38**

# POST-COMMERCIALIZATION MONITORING OF ASIAN CORN BORER *Ostrinia furnacalis* (Guenee) RESISTANCE TO Bt CORN IN THE PHILIPPINES AND THE IMPACT OF POLLEN DISPERSAL ON NON-TARGET LEPIDOPTERA

**Bonifacio F. Cayabyab[1], Edwin P. Alcantara[2], Augusto C. Sumalde[1], Wilma R. Cuaterno[3], Blair D. Siegfried[4] and Ma. Charisma Malenab[1]**

[1]Crop Protection Cluster, College of Agriculture
[2]BIOTECH
University of the Philippines Los Baños,
College, Laguna 4031
[3] Bureau of Plant Industry, Malate, Manila
[4]Institute of Agriculture and Natural Resources, Department of Entomology, University of Nebraska, Lincoln, NE 830816, U.S.A.
Email: bfcayabyab@yahoo.com

Corn is the number two crop in the Philippines next to rice. Since its approval for commercial use in the Philippines in 2002, farmer adoption of Bt corn (Mon 810) has increased. More than 162,050 hectares of Bt corn have been planted since its commercialization. Post-commercialization monitoring of the performance of Bt corn is required to detect the development of Asian Corn Borer (ACB) resistance at the earliest possible time and the possible effect of Bt corn on native biodiversity. This study attempted to estimate the frequency of Cry1Ab resistance alleles in ACB that will serve as quantitative baseline data for monitoring resistance.Also, the effects of Bt corn on non-target Lepidoptera, *Hypolimnas bolina* was evaluated. It was conducted from March 2006 to December 2006 at the National Crop Protection Center – Crop Protection Cluster, CA, UP Los Baños, Laguna.

The hypothesis that the frequency of Cry1 Ab resistance in ACB is low ($<10^{-3}>$) was tested using Andow et al. (1998) protocol. Neonate larvae ($F_2$) were assayed in artificial corn borer diet containing a discriminating dose ($LC_{99}$ = 120 ng/cm2) (Alcantara et al., unpubl.) of Cry 1 Ab protein. Four hundred one (401) females of the ACB from farms at Lubao, Pampanga were used to establish isofemale lines. The larvae from the $F_2$ screen were susceptible to Cry 1Ab protein. The mortality rate for all of the isofemale lines was at its peak during the first seven days of exposure to the toxin.

The effect of Cry1Ab protein on nontarget Lepidoptera, *Hypolimnas bolina,* was determined. Bioassays using 10x the maximum hazard dose of Cry1Ab protein was utilized. Individual larvae were exposed to 1 cm diameter leaf disc of *Ipomoea triloba* Linnaeus soaked in solution of Cry1Ab protein. Controls were exposed to

*I. triloba* leaf discs soaked in 0.1 M carbonate buffer. Fifty larvae were used in treated and control experiments, respectively. Two trials were done. Mortality was scored after seven days. On the average, six out of 100 first instar (three-day old) larvae exposed to Cry I Ab protein for several days died. Mortality at seven percent was also observed in the control set-up. These initial results showed that Cry1 Ab protein is not hazardous to the butterfly, *H. bolina.*

**Keywords:** post commercialization monitoring, Asian corn borer, Bt corn, non-target, Lepidoptera, *Hypolimnas* bonina

**ASD-39**

## IDENTIFICATION OF RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD) MARKERS FOR BRUCHID RESISTANCE GENE IN MUNGBEAN (*Vigna radiata* (L.) Wilczek)

**Michael Leonardo C. Delomen[1], C. Liu[2] and R.P. Laude[1]**

[1] Genetics and Molecular Biology Division
Institute of Biological Sciences, College of Arts and Sciences,
University of the Philippines Los Banos, College, Laguna 4031
[2]Asian Vegetable Research and Development Center, Shanhua, Tainan, Taiwan

To develop bruchid resistant mungbean varieties, introgression of bruchid resistance genes from the wild strain *Vigna radiata* var. *sublobata* to domesticated *Vigna radiata* was done. Marker assisted selection (MAS) was employed to hasten the screening of resistant and susceptible samples. To identify random amplified polymorphic DNA (RAPD) markers for bruchid resistance (*Br*) gene, ten UBC (University of British Columbia) primers were tested on 208 mungbean DNA samples. These samples were all previously identified as either resistant or susceptible via direct exposure to bruchid infestation. A total of 61 polymorphic bands for all ten primers were scored and analyzed. Two polymorphic bands were found to be present in high frequency in resistant samples: a 1400 bp DNA fragment produced by primer UBC 168 (present in 73% of highly resistant samples) and a 750 bp DNA fragment produced by primer UBC 313 (present in 80% of highly resistant samples). These two markers were also shown to be absent in susceptible samples. These data suggest that these two markers are possibly linked to the *Br* gene.

**Keywords**: mungbean, bruchid resistance, introgression, MAS, RAPD

**ASD-40**

## INDIGENOUS BIOLOGICAL CONTROL AGENTS OF *Brontispa longissima* (Gestro) IN THE PHILIPPINES

**Jessamyn D. Recuenco-Adorada* and Mario V. Navasero**

Crop Protection Cluster, National Crop Protection Center, College of Agriculture
University of the Philippines Los Baños, 4031 College, Laguna
E-mail: jdradorada@yahoo.com

*Brontispa longissima* (Gestro), commonly known as coconut leaf beetle (CLB) is an invasive pest from Indonesia which is one of the potentially most serious pests of coconut and other Palmae species. This was suspected to have entered the Philippines in 2004 via ornamental palm importation from other Southeast Asian countries. Due to the rapid spread of the pest, the coconut leaf beetle (CLB) is currently invading Visayas and Mindanao since its possible entry from Luzon in 2004. The absence of its natural enemies from its country of origin like *Ascecodes hispinarum* Boucek, has hampered the control of this pest. However, based on CLB collections, five indigenous biological control agents have been retrieved, namely, *Hispidophila (Haeckeliana) brontispa* Ferrierre (egg parasitoid), *Tetrastichus* sp.(pupal parasitoid), *Chelisoches morio* (Fabricius) (earwig), *Metarrhizium anisopliae* (green muscardine fungus) and *Beauveria bassiana* (Balsamo) Vuillemin (white muscardine fungus) which has the high potential to reduce CLB populations.

**Keywords:** *Brontispa longissima* (Gestro), coconut leaf beetle, *Hispidophila (Haeckeliana) brontispa* Ferrierre, *Tetrastichus* sp., *Chelisoches morio* (Fabricius), *Metarrhizium anisopliae, Beauveria bassiana* (Balsamo) Vuillemin

**ASD-41**

## BIOEFFICACY OF TOBACCO (*Nicotiana tabacum* L.) SEED POWDER AGAINST CORN WEEVIL (*Sitophilus zeamays*)

**Shirley C. Agrupis and Shirley B. Gudoy**

College of Arts and Sciences, Mariano Marcos State University
Batac, Ilocos Norte
Email: shirleyagrupis@yahoo.com

The use of botanical pesticides for agricultural stored food stuffs is the most environment-friendly way to safeguard the consuming public from the risk of possible pesticidal residue poisoning.

The laboratory and *in situ* bioefficacy tests of Tobacco Seed Powder (TSP) against corn weevil were evaluated. Dry tobacco seeds were powderized and different TSP quantities at 1, 3, 5, 7, 9, 11, and 15 g were prepared and mixed separately into a 7 g uninfected corn kernels previously placed in a petri dish. Percent (%) mortality of the test insects was evaluated 6 h after application and every 6 h thereafter for 72 h.

The 15 g TSP outperformed the other treatments including the positive control. The commercial insecticide and the 15 g TSP showed 100% mortality of the test insects after 66 and 72 h, respectively.

The *in situ* test used the best treatment from the laboratory experiment. The 15 g TSP was then tested and was evaluated in two preparations; the TSP in powder form and TSP in tea bag. Each of the TSP preparation was used to treat the 100 g corn kernels which were previously infested with 30 healthy corn weevils placed in a rectangular box of 6.5 x 4.5 inches dimension. After one month observation period, the TSP in powder form showed the highest and fastest insecticidal action at par with the TSP in tea bag including the commercial pesticide.

Furthermore, percent (%) damage of the corn kernels was least pronounced in TSP powder form. Percent germination of the corn kernels treated with TSP in powder form gave 100% germination while those seeds treated with the commercial insecticide, negative control, and TSP in tea bag gave 98%, 45% and 82%, respectively.

**Keywords**: Tobacco seed powder (TSP), pesticidal, mortality, bioefficacy

**ASD-42**

## UTILIZATION OF *Eocanthecona furcellata* (Wolff) AGAINST TOMATO FRUITWORM *Helicoverpa armigera* (Hubner) AND EGGPLANT FRUIT AND SHOOTBORER *Leucinodes orbonalis* Guenee

**Teotimo M. Aganon* and Ellen S. Romero**

Central Luzon State University
Science City of Munoz, Nueva Ecija
Email: tim_aganon@yahoo.com

A study on *Eocanthecona furcellata* against tomato fruitworm *Helicoverpa armigera* Hubner and eggplant fruit and shootborer *Leucinodes orbonalis* Guenee was undertaken. Different densities of *Eocanthecona furcellata* Wolff were evaluated against tomato fruitworm and eggplant fruit and shoot borer. The feeding capacity of *E. furcellata* against third instar larvae of *H. armigera* and *L. orbonalis* were evaluated under laboratory condition.

First nymphal instar of *Eocanthecona furcellata* fed 1.22± 0.33 larvae while the adult fed 10.24±0.64 larvae of *L. orbonalis* in one day. The feeding capacity

increased as the predator grew from first instar to adult stage. A similar trend was observed on the feeding capacity of *Eocanthecona furcellata* against larvae of *H. armigera*. It showed that the attack rate of adults was higher than the nymphs. The first instar nymph preyed 1.68±0.42 larvae while the adult preyed 11.96±0.71 larvae of *H. armigera*.

Results on field release of *E. furcellata* showed that higher rates significantly increased the yield of both tomato and eggplant. Field release of 5 adult *E. furcellata* per tomato plant produced an average yield of 2.03 kg per plant as against field release of 3 and 1 adult *E. furcellata* per plant with an average yield of 1.75 and 0.98 kg per plant, respectively. In eggplant, field release of 5 adult *E. furcellata* per plant of eggplant produced an average yield of 1.37 kg per plant.

Feeding capacity of *E. furcellata* against tomato fruitworm and eggplant fruit and shootborer increased from young to older instar. The adult had higher feeding capacity than the nymph.

**Keywords:** *Eocanthecona furcellata*, *Helicoverpa armigera*, *Leucinodes orbonalis*, field release, feeding capacity

**ASD-43**

## YEAST SUPPLEMENTED BROTH FOR THE PRODUCTION OF *Pasteurella* VACCINES FOR CATTLE, CARABAOS AND POULTRY

**Irene A. Papa[1]*, Ma. Immaculada P.Torres[2], Criselda T. Bautista[2], Teresita G. Alip[1], Ana Luisa B. Vergara[1] and Helen A. Molina[3]**

[1]National Institute of Molecular Biology and Biotechnology (BIOTECH), University of the Philippines Los Baños (UPLB), College, Laguna
[2]HIPRA Diagnostic Laboratory, Alabang, Muntinlupa City
[3]College of Veterinary Medicine (CVM), UPLB, College, Laguna 4031
*Email: iwapapa@yahoo.com

Hemorrhagic septicemia and fowl cholera, caused by *Pasteurella multocida*, are economically important diseases because of the great morbidities and mortalities they cause. In the Philippines, these highly fatal diseases has been classified as one of the top priority diseases. Vaccines are of great help in preventing these diseases together with good sanitation procedures. The production of vaccines from locally isolated strains of *Pasteurella* will have a great impact on both the economy and livestock production. This study presents the potential of using yeast supplemented broth for the production of *Pasteurella* vaccines for cattle, carabaos and poultry.

Tryptic soy broth (TSB) supplemented with 0, 0.1 and 0.5% (w/v) of either yeast extract (YE)(BBL) or baker's yeast (BY) were evaluated as media for the growth of *P. multocida* in shake flask experiments. TSB with 0.5% BY after 8 hours of incubation at 37ÚC showed the best growth of *Pasteurella* at $1.5 \times 10^{10}$ cells/ml compared with only $4.5 \times 10^{9}$ and $1.08 \times 10^{10}$ cells/ml in TSB alone and TSB with 0.5% YE, respectively. On the other hand, TSB supplemented with 0.1% of either BY and YE showed a population of $6.75 \times 10^{9}$ and $3.75 \times 10^{9}$ cells/ml, respectively. Vaccines formulated from TSB supplemented with 0.5% baker's yeast passed the safety and potency tests conducted using Swiss white mice and thus, can be a good and cheaper alternative medium for the growth of *P. multocida* for local vaccine production.

**Keywords:** *Pasteurella multocida*, vaccine production, baker's yeast, hemorrhagic septicemia, fowl cholera.

**ASD-44**

## PHYSICOCHEMICAL CHARACTERIZATION OF POSTHARVEST QUALITY OF EXCELSA AND LIBERICA COFFEE PRODUCTS

**Fe N. Dimero, Alejandro DC Mojica and Yolanda A. Ilagan***

Cavite State University, Indang, Cavite, Philippines
Email: yoly_ilagan@yahoo.com

Specific agronomic, harvest and postharvest practices for Excelsa and Liberica coffee were surveyed, described and assessed. Postharvest qualities of Excelsa and Liberica coffee from major producers in Bataan, Batangas and Bulacan were characterized in terms of moisture content, bulk density, bean color and defects.

Results indicate that although there is a declining interest in coffee farming, majority of the old commercial coffee farmers are still maintaining their Excelsa and Liberica coffee, together with other crops.

All the coffee farmer respondents used color of berries as maturity index, and harvested coffee by stripping. Only 81 % of the farmers practiced trimming, and cleaning. Majority of the farmers practiced sorting before and after drying of berries. A wide range of bulk density values for Excelsa and Liberica was observed which indicates irregularities in terms of size. Moisture content of coffee samples was in conformity with the standard, 13%. Black beans, brown beans, and silver skin residues were found present in all samples evaluated. Foreign materials like stones and sticks were found to be minimal

**Keywords**: postharvest, coffee products, Excelsa , Liberica

**ASD-45**

# IMPORTANT ALGAL POLYSACCHARIDES EXTRACTED FROM *Undaria undarioides* (Yendo) OKAMURA

**Shirley C. Agrupis[1] and Jun-ichi Azuma[2]**

[1]Mariano Marcos State University, Batac, Ilocos Norte
E-mail: shirleyagrupis@yahoo.com
[2]Laboratory of Forest Biochemistry (Recycling System Biomass),
Faculty of Agriculture, Kyoto University Japan
Email: azumaji@kais.kyoto-u.ac.jp

Two important polysaccharides; fucoidan and alginate, were successfully extracted from brown algae, *Undaria undarioides*. This kelp, locally known as *Hirome* in Japan, productively thrives in the warm waters of Japan sea specially in Wakayama and Okinawa Prefecture. Polysaccharides were extracted and characterized according to published procedures in Kyoto University, Forest Biochemistry Laboratory (Recycling System Biomass), Japan.

Fucoidan and alginate are complex polysaccharides found in the cell wall matrix of brown algae and has recently gained prominence because of their wide range of industrial and biomedical applications. Fucoidan has a number of advancements in cancer treatment and other biomedical uses while alginate is widely used as gelling agent and stabilizers for foods and recently been explored for biological and biotechnological applications.

Sugar content of fucoidan analyzed by HPAEC with sulfuric acid hydrolysis showed galactose (47.29%) and fucose (37.68 %) as its primary component sugars. Mannose, xylose, and glucose contributed 9.07, 4.75, and 1.29 %, respectively, to its total carbohydrate component. The polysaccharide of alginate had fucose (37.01 %) as the most dominant sugar. Xylose, glucose, and mannose were present in decreasing order at 17.72, 12.84, and 8.52%, respectively.

The infrared absorption properties of the isolated fucoidan and alginate were consistent with the previous studies from other brown algae sources. The spectrum of fucoidan indicated a hydroxyl group (H-O stretching) at 3422 $cm^{-1}$. The prominent band at 1254 $cm^{-1}$ was caused by the S=O stretching vibrations. The band at 820-850 (C-O-S) $cm^{-1}$ is common to all sulfated polysaccharide due to sulfate absorption.

The desired signals of the two polysacharrides were not detected in the prepared samples for the $^{13}C$-NMR analysis due to their high viscosity that hampered good peak resolution. For fucoidan, which gave better resolution than alginate, the weak signals at 5.34 ppm and 1.27 ppm indicated the presence of L-fucopyranosyl units and methyl protons of the L-fucosyl residues. Also, the prominent signal at 2.17 ppm indicated the methyl signal of the acetyl group of the fucoidan structure. All the above results confirmed the true nature of fucoidan and alginate isolad from *Undaria undarioides*.

Dry weight yield of fucoidan and alginate based on oven dry sample of the kelp were considerable at 2.03% and 28.91%, respectively. The above results and the temperate growth requirements of this species indicates its great promise for farming under the Philippine sea conditions for further exploration to varied -applications.

**Keywords:** Fucoidan, *Undaria*, Brown algae

**ASD-46**

# STOCK ASSESSMENT OF MUDCRAB *Scylla* spp.) IN THE MARINE WATERS OF CAMOTES ISLANDS CENTRAL HILIPPINES: BASIS FOR MUDCRAB CULTURE AND PRODUCTION PROPOSAL

**Berenice Tampus, Genesis Cunanan, Emely Gorgonio, Rosemarie Ymas, and Serapion Tanduyan**

Cebu State College of Science and Technology- Fishery and Industrial, College
6050 San Francisco, Cebu Campus
e-mail: standuyan@yahoo.com

Mud crab is a highly priced marine commodity mostly found in mangrove areas. Mangroves have been exploited for the past years including Camotes Islands having a mangrove area of 717 hectares. That is why stock assessment of mudcrab *(Scylla spp.)* found in Camotes Islands was studied in two lunar cycles including the socio-economic profile of collectors, rate of extraction and catch per unit effort (CPUE). Physicochemical parameters in all the sites were also taken. Mud crabs including associated species were collected using crab lift nets "bintol" through systematic sampling at the eight sampling sites with a distance of 50 meters from each other taking into account the carapace length, width and weight up to species level.

Results show that there were only two species of mudcrab caught, the *Scylla olivacea* and *paramamosain* with *S. olivacea* as the dominant one. In Unidos, San Francisco, Cebu mudcrab caught weighed 1,400 grams, in Calmante, Tudela, 250 grams and in San Juan, Pilar, 320 grams during the first operation (last quarter and new moon). During the second operation (first quarter and full moon) Unidos got 180 grams, Teguis, Poro weighed 53 grams and San Juan, Pilar, 150 grams. Their carapace length varied from 8- 11 cm and carapace width from 12- 15 cm in first phase period. For the second phase, carapace length varied from 7- 10 cm and the width was from 10-14 cm. There were only 7 species of mudcrab caught during the two operations.

Results further showed that the respondents (mudcrab collectors) were more or less evenly distributed with a total of 15 collectors. The age of respondents slightly varied and more than seventy percent of the total respondents were married compared to single ones. One hundred percent were males. Majority of them lived in the area for more than 30 years.

The physicochemical parameters of the research area slightly differed during the first phase and second phase periods (phases of the moon). There were 3 species of crabs caught —the *Charybdis hawainensis, Portunus pelagicus* and the red spotted crab in association to mudcrab species during the operation. The carapace length, width and weight of the associated species slightly differed depending on the species.

The catch per unit effort (CPUE) ranged from 37.3- 277.1 grams per hour during the first phase period and 52.8 – 180.1 grams per hour during the second operation.

**Keywords**: *Scylla spp.*, Comotes Islands, Crab Lift Nets, Assessment

**ASD-47**

# DEVELOPMENT OF CONCH SHELLS (*Strombus* sp.) MEAT AND SHRIMP *(Metapenaues* sp.) AS FOOD SEASONING

**Ermelinda M. Kiamco, Serapion N. Tanduyan, Gliceria L. Gonzales and Asteria L. Macarimbang**

Cebu State College of Science and Technology
Fishery and Industrial College, 6050 San Francisco, Cebu Campus
e-mail: standuyan@yahoo.com

The development of conch shells meat and shrimps into food seasoning was tried to determine its effectivity in terms of palatability, odor, flavor and general acceptability.

The conch meat and head and skin of shrimps were collected after boiling. A 1:1 proportion of ground conch meat and shrimps was mixed with ground pepper, onion, garlic, salt with gelatin as binder. It was packed at 11 grams. There were four treatments in the study. Treatment 0 uses Knorr shrimps; Treatment 1, mixture of conch-shrimp, Treatment 2, conch and Treatment 3 shrimp. All the treatments were used as seasoning to pancit canton, vegetable soup and porridge preparations. They were subjected to organolyptic evaluation by 50 tasting panel members who were teachers and students of CSCST-FIC, San Francisco, Cebu using the 9 point Hedonic scale.

Results revealed that for palatability, Treatment 3 got 6.89 (liked moderately); Treatment 0, 1, and 2 rated 6.10, 6.24 and 6.04, respectively (liked slightly). For the attribute on odor, Treatment 3 obtained 7.15 (liked moderately), followed by Treatment 1, 6.68 (liked moderately), and Treatment 0 and Treatment 2, 6.24 (liked slightly). For flavor, Treatment 3 rated 6.91 (liked moderately) and the rest, Treatment 0, 1 and 2 rated 6.16, 6.32 and 6.39 (liked slightly). For general acceptability, Treatment 3 was 6.94 (liked moderately) and Treatment 0, 1 and 2 rated 6.20, 6.39 and 6.08, respectively (liked slightly). Analysis of variance (ANOVA) showed that there is no significant difference on the effects of the shrimps and conch shells as food seasoning in terms of flavor, palatability, odor, and general acceptability.

**Keywords:** *Strombus mutabilis, Metapenaeus ensis,* shrimp, conch shells, food seasoning

# *BIOLOGICAL SCIENCES DIVISION*

**BSD-1**

## GENETIC CHARACTERIZATION OF PILI (*Canarium ovatum* Engl.) FROM ALBAY, CAMARINES NORTE AND CAMARINES SUR, PHILIPPINES THROUGH ISOZYME ANALYSIS

**Merlyn S. Mendioro*, Ma. Genaleen Q. Diaz, Vera Marjorie E. Velasco, Maylynn C. Alcaraz, Roselle C. Lalamunan, Karen G. Amoloza and, Luisa Villamael**

Genetics and Molecular Biology Division,
Institute of Biological Sciences
College of Arts and Sciences, University of the Philippines
Los Banos College, Laguna
Tel: 049 5363368; Fax: 049 5362517; Email: msmendioro@yahoo.com

Based on esterase (EST), acid phosphatase (ACP), alkaline phosphatase (ALP), genetic variability was noted in nineteen accessions of pili (*Canarium ovatum* Engl.) from Albay, Camarines Norte, and Camarines Sur and in 11 accessions of unknown origin. Seven presumptive loci were determined. Two presumptive loci were observed in EST (EST1 and EST2), ACP (ACP1 and ACP2) and three for ALP (ALP1, ALP2, and ALP3). Percent polymorphism was 100%. Using a similarity coefficient of 0.60, the thirty accessions were divided into five clusters. Accessions of different origin grouped together which would indicate that variability exists in the accessions considered. To further prove that genetic diversity exists in pili, twenty five accessions collected from Oas, Albay were also subjected to isozyme analysis. Eighteen presumptive loci were determined: three for glucose-6-phosphate dehydrogenase (G6PD), two each for EST, phosphogluconate dehydrogenase (PGD), malate dehydrogenase (MDH), ACP, ALP, and phosphoglucomutase (PGM), and one each for glutamate oxaloacetate (GOT), phosphoglucoisomerase (PGI), and alcohol dehydrogenase (ADH). Only ALP2, G6PD2 and G6PD3 were monomorphic. The observed heterozygosity for ACP1, ACP2, ALP1, EST1, EST2, and PGD2 was higher compared to the expected heterozygosity. Fifteen of the presumptive loci were polymorphic (83.33%). Considering a similarity coefficient of 0.70, four clusters were obtained although the 25 accessions were collected only from a single location, Oas, Albay. This would indicate that accessions were genetically different. Pili being dioecious, is

an obligate cross-pollinating crop. Genetic variability observed can be explained through recombination occurring during sexual reproduction.

**Keywords**: *Canarium ovatum* Engl., isozyme analysis, pili, polymorphism, genetic variability

**BSD-2**

## GENETIC DIVERSITY OF *Brassica rapa chinensis, B. rapa parachinensis* AND *B. oleracea alboglabra* USING SIMPLE S EQUENCE REPEATS

**Stephanie U. Celucia[1], Neilyn O. Villa[1]* and Robert dela Peña[2]**

[1]Genetics and Molecular Biology Division, Institute of Biological Sciences
University of the Philippines Los Baños, College, Laguna, Philippines
Tel: 0918 628 3949; Email: neilyn24@yahoo.com
[2]Asian Vegetable Research and Development Center, Taiwan

The genetic diversity of 39 accessions of *Brassica rapa chinensis*, 28 accessions of *B. rapa parachinensis*, and 29 accessions of *B. oleracea alboglabra* was studied. Twelve primers were used and produced 122 scorable bands in which 77 were polymorphic. The average of polymorphic loci was 71.08%. Genetic diversity among the species was very high indicating great genetic differences within each species. Geographical origin of the species greatly affects genetic diversity. The phylogenetic tree showed that *B. rapa chinensis* and *B. rapa parachinensis* are genetically closely related to each other. Also, greater genetic diversity was shown within *B. oleracea alboglabra* species compared to *B. rapa chinensis* and *B. rapa parachinensis* species. Theses results provide useful information for crop improvement and in properly selecting parents of crosses to produce agronomically improved lines.

**Keywords**: genetic diversity, SSR, microsatellite markers, *Brassica rapa chinensis, B. rapa parachinensis, B. oleracea alboglabra*

**BSD-3**

# LIQUID NITROGEN-FREE EXTRACTION PROCEDURE FOR *Penicillium chrysogenum* and *Saccharomyces cereviseae* GENOMIC DNA ISOLATION

**Franco G. Teves[1*], Elma B. Quiao[1], Shiela Dagondon[1], and Lydia M. Bajo[2]**

[1*] Molecular Genetics and Microbial Technology Laboratory, Department of Biological Sciences, Telefax: (063) 351 6131; Email: franco_teves@yahoo.com
[2] Department of Chemistry, College of Science and Mathematics, MSU-Iligan Institute of Technology, 9200 Iligan City

Nucleic acid extraction and purification are crucial steps in molecular biology experiments. Disruption of eukaryotic cells with cell walls, or tissues, is usually initiated using liquid nitrogen which quickly freezes samples, protecting nucleic acids from being degraded by non-specific nucleases, and making cells or tissues brittle, paving the way for mechanical breakage of cell walls. Other reagents are then added to prevent nucleic acid degradation, especially for ribonucleic acid (RNA), which easily undergoes digestion by very stable contaminating ribonucleases.

A genomic DNA isolation protocol was modified, originally designed for isolating plant genomic DNA for the isolation of fungal genomic DNA without liquid nitrogen. By eliminating this reagent in the modified DNA extraction procedure, genomic DNA from *Penicillium chrysogenum* and *Saccharomyces cereviseae* was obtained with comparable quality and concentration when compared to using liquid nitrogen. The essential modifications include freezing and/or cooling of all materials and reagents prior to use, use of modified lysis buffer, and the utilization of acid-washed sand for cellular disruption. The quality of the DNA has been shown to be at par with DNA obtained with the aid of liquid nitrogen, when run in agarose gel electrophoresis and used in cloning experiments. Liquid nitrogen is a very scarce chemical especially in Third World countries, including the Philippines, requires great care in storage and handling, and is relatively expensive. Thus, an additional benefit of using this protocol is cost reduction in generating genomic DNA for various molecular biology applications.

**Keywords**: nucleic acid, liquid nitrogen, genomic DNA, *Penicillium chrysogenum*, *Saccharomyces cereviseae*, agarose gel electrophoresis

**BSD-4**

# ONTOGENETIC PATTERN OF DOUBLE-STRANDED FREE NUCLEIC ACID (DS-FNA) FROM THE WATER OF COCONUT (*Cocos nucifera* L.)

**Marni E. Cueno*, Karlo Mari C. Paulino and Rita P. Laude**

Institute of Biological Science, College of Arts and Sciences
University of the Philippines Los Baños, College, Laguna 4031
Tel: 495362893

Previous reports have indicated that the mRNA transcripts involved in fatty acid synthesis in coconut are expressed ontogenetically in the coconut solid endosperm. In an attempt to determine whether a similar ontogenetic pattern of mRNA transcripts occurs in coconut liquid endosperm or coconut water, free nucleic acid (FNA) samples from leaf rank (LR) 14-22 drupes were extracted and concentrations of each FNA samples were also quantified. Initially, the presence of double stranded free nucleic acid (DS-FNA) was established using FNA samples obtained through ammonium acetate extraction. DS-FNA was detected in LR 15 but absent in LR 20. DS-FNA from crude coconut water of LR 14-22 were extracted and showed that only LR 19 sample gave the highest concentration estimated to be 1ng/iL. To properly establish the ontogenetic pattern of DS-FNA, concentrated coconut water from LR 14-22 were used. A gradual increase in DS-FNA was observed from LR 14 to LR 19, with an estimated amount of 0.4 ng/iL and 9.0 ng/iL, respectively. After reaching its peak (LR 19), a sudden decrease at LR 20 (0.4 ng/iL) was noted but no DS-FNA was detected in LR 21-22. These novel results indicate for the first time that DS-FNA is present in coconut water and the amount of DS-FNA is affected by the ontogenetic development of the drupe.

**Keywords**: free nucleic acid (FNA), double stranded-free nucleic acid (DS-FNA), coconut water, ammonium acetate extraction, *Cocos nucifera* L..

**BSD-5**

# CORONA AND POLLINARIA DIVERSITY IN PHILIPPINE HOYAS

**Simeona V. Siar, Edwin E. del Rosario and Jennelyn M. Carandang**

Crop Genetics and Plant Breeding Division,
Crop Science Cluster-Institute of Plant Breeding,
College of Agriculture, University of the Philippines Los Baños,
College, Laguna 4031,
Tel: 049 5363304; Fax: 049 5363438; Email: moninasiar@yahoo.com

The Philippines possesses one of the richest and most diverse range of hoya species in the world. Following the 2003 Angiosperm Phylogeny Group, hoya belongs to family *Apocynaceae* (Gentiales, Asterids). The plant is characterized by shiny waxy leaves, hence the common name 'wax plant'. Most of the hoya species have a climbing or viny habit, however some species are short and bushy. The flowers are so striking and beautiful resembling a star with sweet lemony fragrance especially at night.

Thirteen (13) Hoya species were characterized for genetic diversity in terms of some floral traits. Mature inflorescence were collected from each species and examined under the microscope. Sample flowers were measured for the following characters: corona length and width, pollinarium length and width and retinaculum length and width. These floral traits are used by taxonomists and botanists in identifying and delineating hoya species.

Results showed wide variation as well as close relationship among species in terms of the parameters tested. *Hoya pubicalyx* and *Hoya coriacea* had the largest values for corona, pollinium and retinaculum measurements. The lowest values for most traits were observed in *Hoya obscura*. A dendogram was generated illustrating the clustering of hoya species into distinct genetic groupings. *Hoya coriacea* and *Hoya obscura* were the most genetically distinct pair of Hoya species, while close genetic similarity was observed between *Hoya bicolor* and *Hoya crassicaulis*. The results have provided additional information for research workers and hobbyists useful for breeding, taxonomic identifications and future investigations.

**Keywords:** *Apocynaceae*, hoya, genetic diversity, variation, cluster analysis, dendrogram

**BSD-6**

# ELLIPTIC FOURIER SHAPE ANALYSIS OF THE LEAVES AND LEAFLETS OF THE FAMILY LEGUMINOSAE: IMPLICATIONS IN THE SYSTEMATICS AND EVOLUTION OF THE SPECIES

**Cesar G. Demayo, Mark Anthony J. Torres, and Muhmin Michael E. Manting**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Leaf and leaflet shape variability was assessed in a total of forty-one (41) species of legumes, belonging to twenty-four genera and three subfamilies using the method of Elliptic Fourier Analysis. Digital images of the leaves were used, which were converted to black and white using an image processing software. The outlines of the leaves and leaflets were then summarized using chain codes. Mathematical algorithms were applied on the chain code data to generate a total of eighty shape variables which were used to reconstruct the mean leaf and leaflet shapes for all species. On the other hand, the extent and degree of leaf shape variability within and between species belonging to the same subfamily was assessed using the method of Principal Component Analysis. Results showed that the major shape variations observable within all species of legumes were associated with changes in the length-to-width ratios and curvatures of the middle part of the leaves and leaflets among others. Ordination of the different species showed that some of the families are composed of species with varying leaf and leaflet shapes such as that of the subfamily Caesalpinioideae. This result is in congruence with previous studies asserting that this subfamily is a heterogeneous unit and is not a proper phylogenetic unit. This is because some species have leaves and leaflets that are similar in shape with those of particular members of one of the other subfamilies, than they have with the other members of this subfamily. The results of this study are further discussed in the light of the diversification and evolution of this group of plants as well as with the taxonomic classification of already known and unknown species included in this study.

**Keywords**: Elliptic Fourier analysis, legumes, evolution, Systematics

**BSD-7**

# APPLICATIONS OF FRACTAL DIMENSIONS IN ASSESSING VARIATIONS AMONG TWENTY-FIVE SPECIES OF LEGUMES FROM ILIGAN CITY, PHILIPPINES

**Cesar G. Demayo, Mark Anthony J. Torres and Muhmin Michael E. Manting**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

In this study, the geometry of the leaves of twenty-four (24) species of legumes including three unknown species collected from Iligan City, Philippines were compared and quantified through Fractal analysis using the box counting method. Using this method, images of the leaves and leaflets were covered by a sequence of grids made of squares of ascending sizes. For each grid, two values were recorded: the number of squares intersected by the image, $N(s)$, and the side length of the squares, $s$. The regression slope (D) of the straight line formed by plotting $\log[N(s)]$ against $\log(1/s)$ indicating the degree of complexity, or the Fractal Dimension (FD), the values of which range from 1 to 2. The FD values of the different species were then compared through box-and-whisker plots and analyzed using Principal Component Analysis. Results showed interspecific differences in the geometry of the leaves and leaflets as explained by Principal Component 1. The results of this study showed that the different species have varying levels of interspecific and intraspecific morphological diversity.

**Keywords**: Fractal Dimension, legumes, box-counting, Principal Component Analysis.

**BSD-8**

# LEAF VENATION ARCHITECTURE OF TWO VARIETIES OF *Lantana camara* L. FROM CAMIGUIN ISLAND, PHILIPPINES

**Mark Anthony J. Torres, Cesar G. Demayo, Muhmin Michael E. Manting, Edmar Taray, Shiela D. Obnimaga, Jennifer Dinganon, Joanne Aberilla, Ajquizar T. Baser, and Angela Marie Cariaga**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

The leaves of two varieties of *Lantana camara* L. vary in shape even within a single plant. This feature could have a direct influence on the venation architecture of this species. Owing to its importance for systematic classification, attention is paid largely in this study to the architectural properties among leaves of this species that have different shapes. Such studies are important as venation geometry and density influences the mechanical stability of the leaves and may affect such properties as susceptibility to herbivory. Thus, the aim of this study is determine the extent of intra- and intervarietal variation in venation patterns as well as phenotypic plasticity of some venation properties, such as venation density, vein angles and intervein distances. To do this, leaves from two varieties of *L. camara* L. that are common in an area located several kilometers uphill from Catarman and in Balintawak in Camiguin Island, Philippines were collected. The samples were scanned and several aspects of leaf venation patterns were measured such as the angle between the 1° and 2° veins and intervein distances using the ImageTool software. The data were treated with multivariate methods of statistical analysis such as Principal Coordinate Analysis (PCo) to determine how different the venational properties of the leaves are. The results showed no populational differences in leaf architecture indicating that geographic distance is not a factor affecting the leaf venation geometry. The results of this study, however, showed a high extent of individual variation. The number of secondary veins also differs between leaf samples among the leaves of a single plant which also influences intervein distances. Moreover, certain venational features are shown to be associated with particular leaf shapes. The results of this study are interpreted in the context of ecophysiology and the possible relationship between form and function of the leaf venation system of this species of plant.

**Keywords**: venation, *Lantana camara*, vein angle, intervein angle

**BSD-9**

# SEX DIFFERENCE IN THE SIZE AND SHAPE OF THE WINGS IN THE DAMSELFLY, *Pseudagrion Pilidorsum Pilidorsum*

**Mark Anthony J. Torres, Cesar G. Demayo and Russel T. Yu**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Patterns of distribution of damselflies differ by sex, with males clumped in or near water bodies and the females usually found away from the water body. Previous studies on other species of damselflies have shown that these differences are reflected as differences in the sizes of the wings between the two sexes. In this study, differences in the size and shapes of the wings between the two sexes of the damselfly *Pseudagrion pilidorsum pilidorsum* was assessed using image analysis and landmark-based analysis. To do this, images of the wings were scanned at uniform dpi. Then, the Cartesian coordinates of twenty-five landmarks from around the wing were extracted using an image analysis and processing software. These coordinates were then subjected to two different analyses. Euclidean Distance Matrix Algorithm was applied on the data to generate linear distances between the landmarks. The resultant interlandmark distances were used to compare the sizes of the wings between the sexes. On the other hand, the raw coordinate data was also Procrustes-fitted to generate shape variables. These shape variables were analyzed using Relative Warps analysis to determine sex-differences in the shapes of the wings. Results showed statistically significant differences in the size of the wings between males and females. Also, tests for significant differences of the Relative scores between the sexes revealed dimorphism in wing shapes related to differences in sex. The results of this study are discussed in relation to differences in the flight ecologies of the males and females of this species.

**Keywords:** Euclidean Distance Matrix Algorithm (EDMA), damselfly, *Pseudagrion pilidorsum pilidorsum* relative warps, interlandmark distances

**BSD-10**

## PARTIAL WARP ANALYSIS OF VARIABILITY IN CLAW MORPHOLOGY IN AN ADULT POPULATION OF THE LAND CRAB, *Cardisoma Carnifex*, FROM EL SALVADOR, MISAMIS ORIENTAL

**Cesar G. Demayo, Mark Anthony J. Torres and Abner Paulo Sendad**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

This study was conducted to determine morphological disparities in the shapes of the claws of the land crab, *Cardisoma* canifex from a single adult population. The method of partial warp analysis was employed in this study using landmarks sets that are placed on homologous structures in the claws. Then, descriptors of the shapes of the crabs were generated via a Procrustes-fitting algorithm applied on the landmark data. Scatter plots were generated using the partial warp scores calculated from the Procrustes-fitted coordinate data to be able to determine variations in the shapes of the claw. Transformation grids were also generated to visualize patterns of claw shape variations within this population of crabs. Results revealed the existence of two morphs within the population that differ in the shape of the claws. The result of this study is discussed in the light of differences in the feeding habits of these two morphotypes.

**Keywords**: Partial Warp Analysis, Transformation grids, land crabs, *Cardisoma* canifex, morphotypes

**BSD-11**

## SHAPE AND COLORMORPHISM IN THE SWORDTAIL FISH, *Xiphophorus Helleri* (CYPRINODONTIFORMES: POECILIIDAE): ANY EVOLUTIONARY CONNECTION?

**Cesar G. Demayo, Mark Anthony J. Torres and and Edgar Vincent Quitos**

Department of Biological Sciences, College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

This study was conducted to determine the extent of morphological variation in the common freshwater fish *Xiphophorus helleri* using landmark-based analysis

of the truss network. A total of fifteen landmarks were chosen, the Cartesian coordinates of which were collected using an image analysis software. The fish truss networks were aligned using Procrustes fitting which eliminated size and rotational translation. The shape residuals left after the Procrustes fitting were then subjected to thin-plate spline grid analysis which allowed comparison of the mean shapes of the male and female fishes. The samples collected from Lawis, Burrun, Iligan City showed the existence of two adult color morphs, namely green and red. Thus, shape variation between these two color morphs was also assessed. Ordination of the fish samples was also done using the relative warp scores and partial warp scores computed using the shape residuals. Sizes of the fishes were also measured and compared using the Euclidean distance matrix algorithm which returned a matrix of interlandmark distances. Result showed overlapping of the convex hulls in the shape space after ordination of all samples. However, when the shape and size residuals were separately subjected to multivariate analysis of variance, the result showed significant differences between the males and the females and between the two color morphs. Subsequent tests for significant mean differences using Hotelling's $t^2$ test and discriminant function analysis also gave concordant results. The results of this study revealed sexual dimorphism both in shape and size in this species of fish. Morphological disparity between the two colormorphs is discussed in the light of evolution.

**Keywords:** procrustes, ordination, discriminant analysis, *Xiphophorus helleri*

**BSD-12**

## LANDMARK-BASED ANALYSES OF SEXUAL DIMORPHISM IN SELECTED SPECIES OF *Sardinella*

**Cesar G. Demayo, Mark Anthony J. Torres and Jay B. Mag-usara**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Landmark-based analysis of the fish truss network in three species of *Sardinella* was performed to identify sexually dimorphic features. A total of ten landmarks that are distributed along the length of the fishes were identified. Differences in the shapes of the two sexes were analyzed over the procrustes-fitted data using thin-plate spline grids, relative warps and partial warp scores. Sexual size dimorphism was also assessed using Euclidean distance matrix algorithm. Multivariate methods of statistical analyses were also performed to

supplement the different analyses. Results showed that only a few landmarks are sexually dimorphic. These are the landmarks associated with the caudal fin, dorsal fin and the snout. Also, results of the EDMA analyses revealed sexual size dimorphism among the three species. These results are consistent with the results of other studies arguing for ecological divergence between the two sexes.

**Keywords**: Sexual dimorphism, EDMA, Procrustes, *Sardinella*

**BSD-13**

## PHENOTYPIC PLASTICITY, SEXUAL SELECTION AND THE EVOLUTION OF MALE COLOR PATTERNS IN A POPULATION OF GUPPIES FROM STO. NIÑO COLD SPRING, CAMIGUIN ISLAND, PHILIPPINES

**Mark Anthony J. Torres, , Alfand Dy Closas, Hanna Daud**
**Jessa Mampao, Lois Lumontod, Daryl Sencil and Cesar G. Demayo**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

The guppy, *Poecilia reticulata*, is a live-bearing fish and is one of the most popular freshwater aquarium fish species in the world. There is a great deal of variation in the color patterns in male members of this species across geographic populations. The most common observation is that male guppies that live in populations saturated with predators tend to be dull and subdued in color while those that live in populations with fewer predators are more colorful. This is because two selection regimes operate on populations of guppies – vividly colored guppies are favored by sexual selection while vaguely colored guppies are favored by natural selection through predation.

A pool of cold spring water sprouting from a sandy stratum located 4 kilometers north uphill of Catarman, Camiguin in the Philippines hosts a population of guppies of diverse coloration. The pool which measures 25 m x 40 m makes the population of guppies in it isolated from the rest of the water system. Visual census also showed that the fish community is dominated by guppies. Thus, this reproductively isolated population offers opportunity to study the relative importance of sexual selection through female choice on male guppy coloration.

A total of ninety-two male guppies were examined and the color pattern of which were quantified. Each spot was measured for its size and area and assigned to a color category. Other complementary measures of color pattern were also assessed such as the total number of spots of a given color, the total area of the

body covered by spots of a given color, and the mean relative area of each spot color (MRE). Results showed that male color patterns in this population of guppies vary in color, size and position. The colors fall into three basic categories: carotenoids pigments, melanic pigments and structural colors. Both yellow (MRE of 2.73 $mm^2$; 32.05%) and black (MRE of 3.50 $mm^2$; 41%) colors are dominant among the males indicating that female mate choice in this population of guppies has favored the appearance of such colors. Cluster analysis showed that no two males have exactly the same color pattern which suggests that a mechanism must exist in the population that helps maintain a diverse color pattern among the males.

**Keywords**: guppy, *Poecilia reticulata*, phenotypic plasticity, sexual selection, color patterns

**BSD-14**

## EGG AND PREZOEAL STAGES OF A SAND CRAB, *Emerita* sp. FROM MAGOONG, LINAMON, ILIGAN CITY

**Mark Anthony J. Torres, Siegfried Hector Razo and Cesar G. Demayo**

Department of Biological Sciences
College of Science and Mathematics
*MSU-Iligan Institute of Technology, Iligan City*

The egg and prezoeal stages of sand crabs, Emerita sp., from a population in Magoong, Linamon, Iligan City were collected from gravid females and examined using a stereomicroscope at 3X magnification. Gravid females were held in a large aquarium supplied with salt water and filled with sand collected from the study area. Photographs of samples that were taken from different adults and represented different stages of prezoeal development were examined. Results showed that females are able to produce egg masses that may contain several viable eggs. As the young (larvae) develop, the egg passes through different color stages. The eggs appear orange in color apparently because of the presence of yolk. Then the eggs swell as cells begin to divide and changes from orange to dark brown and finally gray. Several prezoeal stages were found and described. The size and shape of the antennae, endopodites, maxillules, maxillae and second maxillipeds were also documented.

**Keywords**: Sand crab, *Emerita*, prezoeal, egg

**BSD-15**

# SOME OBSERVATIONS ON THE CARAPACE AND TELSON MORPHOLOGY OF A POPULATION OF MOLE CRAB, *Emerita* Sp. FROM MAGOONG, LINAMON, ILIGAN CITY

**Mark Anthony J. Torres, Sigfried Razo, Joey Rey Cartajenas, Emmanuel Boniao, Karen Coronado, Vicky Rodriguez, Kate Villanueva, Sittie Rohanna Pundogar, Kathleen Podiotan, and Cesar G. Demayo**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

The systematics and taxonomy of the mole crab, *Emerita sp.*, a putative bioindicator from Magoong, Linamon, Iligan City is unclear. The problem stems from the widespread variation in carapace color patterns amongst individuals in this population and the lack of literature regarding these species of organisms in the Philippines. Also, correct classification of these organisms is necessary before it can be used as bio-indicator. Thus, mole crabs were collected from the study site and morphometric differentiation among individuals was quantified. Patterns of morphometric variation were examined using geometric morphometrics and multivariate statistics, respectively. Principal component analyses of the carapace shape characters revealed that some gravid mole crabs have morphologically distinguishable carapace and telson shape showing possible relationship between the shapes of the carapace and telson and fecundity. Further genetic studies must be conducted to determine genetic structuring on a micro or macro-geographic scale to confirm the taxonomic distinctiveness of the mole crabs and to determine if variation in the carapace and telson shape possesses some genetic basis or only a product of allometry.

**Keywords**: Systematics, mole crab, *Emerita* sp., geometric morphometrics, carapace, telson

**BSD-16**

# ELLIPTIC FOURIER ANALYSIS OF SHAPE VARIATIONS WITHIN AND AMONG SIX SPECIES OF BIVALVES COLLECTED FROM MURCILLAGOS BAY

**Mark Anthony J. Torres, Cesar G. Demayo, Geneveve Podiotan, Tyrone Enoc, Christian Noel Saporno, Donel Tulog, Hosea Manda, Jun Rey Quinto and Jonathan Sobremonte**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Elliptic Fourier Analysis was used in this study to determine the extent and degree of morphological diversity within and among six species of bivalves collected from Murcillagos Bay. These include *Circe scripta, Anadora inequevalves, Codakia tigerina, Meretrix meretrix, Mytilus smaraginous* and *Pitar* sp. In order to do this, the bivalves were scanned at uniform dpi and the resulting images were binarized using SCIONIMAGE, an image analysis and processing software. The contours of the bivalves were then summarized as chain codes. A mathematical algorithm was used to compute for a total of 20 harmonic modes, with each variable consisting of four shape variables. These shape variables were then used as morphometric variables for Principal Component Analysis. Also, the mean shapes of each species were reconstructed. The extent and degree of variations within each species were then computed and shown as positive and negative standard deviations from the mean shapes. Results of this study showed variations in the shapes of the calcareous valves within each species of bivalves. Ordination of the various species also revealed morphological disparities among the species. The results of this study clearly indicate the usefulness of outline analysis in determining shape variations in bivalves.

**Keywords**: bivalves, elliptic fourier analysis, ordination, harmonic modes, *Circe scripta, Anadora Inequevalves. Codakia tigerina. Meretrix meretrix, Mytilus smaraginous* and *Pitar* sp

**BSD-17**

# GEOMETRIC MORPHOMETRIC ANALYSIS OF THE TRUSS NETWORK IN SEVERAL SPECIES OF BIVALVES

**Cesar G. Demayo, Mark Anthony J. Torres and Romme Ray Sullano**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Variations in shape of the area formed between the anterior and posterior muscle scar, umbo and ligament in the valves and the distances between them were assessed based on the landmark data, which were subjected to various geometric morphometric analyses. A total of 95 samples of bivalves were collected composed of *G. melanaegis* (n=22), *G. tumidum* (n=10), *A.. squamosa* (n=24), *C. orbicularis* (n=16), and *Curbicularia sp.* (n=23) which were subjected to geometric morphometric and statistical analyses. Procrustes fitting of the landmark points allowed for the comparison of truss network of the bivalve, eliminating size and rotational translation. Thin-plate spline grids (TPS) were used to summarize the shapes of the biological structures. Partial warp analysis (PA) was used to identify the position of specific landmarks that vary considerably among taxa. Principal Component (PCA) Discriminant Function analysis (DA) were used to confirm or reject the hypothesis that the shape of the area defined by the anterior and posterior adductor muscle scars, umbo and ligament as defined by the landmark points could be used to discriminate the species of bivalves used in this study and the patterns of size differences across all species were determined by comparing the interlandmark distances between the landmark points generated using Euclidean Distance Matrix Algorithm (EDMA). The results of this study clearly imply that the shape of the area formed between the anterior and posterior muscle scar, umbo and ligament in the valves and the distances between them could be used as a taxonomic character in the classification of bivalves and indicates the usefulness of the various geometric morphometric methods in shape differentiation and variations in selected species of bivalves.

**Keywords**: truss network, Euclidean Distance Matrix Algorithm, Procrustes

**BSD-18**

# MORPHOLOGICAL DISPARITY OF THE PELVIC GIRDLE AMONG FIVE SPECIES OF BATS: IMPLICATIONS FOR LAUNCH

**Cesar G. Demayo, Mark Anthony J. Torres and Gianhope T. Silao**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Previous studies have shown that patterns of skull shape variation among several species bats are related to their feeding ecology. In this study, the shapes of the pelvic girdles of one insectivorous and four frugivorous bats were compared using geometric morphometric methods. In order to do this, the pelvic girdles of the bat samples were scanned at 800 dpi. Then the x and y coordinates of a total of 18 landmark points and 185 outline points were collected from around the contour of the bones, separately, using an image analysis and processing software. For the landmark analyses, the 18 landmark coefficients were used as morphometric variables for multivariate statistical analysis such as partial warps analysis (PWA) and hierarchical cluster analysis in order to assess its shape. The size component was also evaluated by subjecting the raw data to Euclidean Distance Matrix Algorithm. The data obtained were then subjected to the appropriate geometric morphometric analyses. For the outline analyses, the 185 sample points were subjected to Elliptic Fourier Analysis. EFA of these coordinates returned a total of 40 coefficients that were used to reconstruct the shapes of the pelvic bones of each bat sample. The EFA coefficients were also used as morphometric variables for multivariate statistical analysis such as principal component analysis (PCA) and discriminant function analysis. The results echo the morphological disparity between the two groups. The results were also correlated to the feeding ecology and launch mechanism employed prior to flight. The morphological disparity in the shape of the pelvic girdles observed in this study may suggest important differences in the locomotor architecture between the two groups of bats.

**Keywords**: *frugivorous, locomotor architecture, EDMA, Elliptic Fourier Analysis*

**BSD-19**

# PRELIMINARY SURVEY AND ELEMENTAL CHARACTERIZATION OF LICHENS AS POTENTIAL BIOMONITOR FOR ATMOSPHERIC POLLUTION

**Leni L. Quirit[1], Preciosa Corazon B. Pabroa[2], William Gruezo[3] and Karen N. Hernandez[1]**

[1]Natural Sciences Research Institute, University of the Philippines Diliman
[2]Philippine Nuclear Research Institute, Diliman, Quezon City
[3]Institute of Biological Sciences, University of the Philippines Los Baños, Laguna

The two approaches for collecting atmospheric pollution samples are (a) direct collection of airborne particulate matter, precipitation and total deposit, and (b) the use of air pollution biomonitors. Using the first approach is costly (in terms of equipment, personnel and power). The second approach is cheaper (i.e. no expensive technical equipment is needed) and simpler (sampling is relatively easier, generally relying on the common and permanent availability of the bio-species in the field).

Sampling for potential biomonitors was initially done on six sites — the Arroceros Forest Park in Manila; Parks and Wildlife (PW), Quezon City Memorial Circle (QCMC), Natural Sciences Research Institute and the Institute of Chemistry in Quezon City; Mauban, Quezon (a relatively unpolluted forest site) and the Batangas Coal-Fired Thermal Power Plant (BCFTPP) or Calaca Power Plant (CPP) in Calaca, Batangas. Ferns, mosses and lichens were collected during the preliminary surveys but because lichens were found to be the most abundant and ubiquitous, sample collection was later limited to lichens only. Sampling sites for elemental analysis (but not for lichen species identification) were eventually narrowed down to just the PW and CPP sites due to logistics limits.

Identification of the collected lichen samples was done by Dr. William Gruezo of the the Institute of Biological Sciences, UP Los Baños. Nine different species (or genera, for those which cannot be identified down to the species level) were identified. *Pyxine cocoes (Sw.) Nyl.* species was found predominant for all the sites. Lichen diversity comparison among the sites seemed to indicate level of pollution exposure

Due to its abundance and ubiquity, samples identified as *Pyxine cocoes (Sw.) Nyl.* were chosen for elemental analyses. Preliminary levels, trends and correlations in elemental findings will be presented, and a comparison of the two methods used, Inductively Coupled Plasma (ICP) and X-ray Fluorescence (XRF) Spectrometry.

The Zn and Pb correlation was the most interesting, with PW lichens levels generally higher than CPP lichens and the ash samples levels for these two elements. The correlation between these two elements are also much better for the PW lichens compared to the other two types of samples ($r^2$ correlation coefficients **0.24** for CPP, **0.85** for PW and **0.42** for the ash samples).

Graphs show the better Zn and Pb correlations in the PW samples, with the plots for the CPP ash and lichen samples showing a large scatter of data points. Studies on elemental compositions of air particulate filter samples from 2001 to 2004, at the Philippine Nuclear Research Institute (PNRI), show that Zn and Pb are also well correlated in the air particulate filter samples of the DENR Quezon City ambient sampling site station (at the Manila Observatory). Comparison of the Pb vs Zn plots of the ambient site air particulate samples and the PW lichen samples show a striking similarity between the two types of samples.

**Keywords**: air pollution, biomonitors, lichens, XRF, ICP, air particulate filters

**BSD-20**

## DETERMINATION OF THE FUNGAL POPULATION AT THE INDOOR ATMOSPHERE OF A SCHOOL BUILDING

**Erwin P. Elazegui**

College of Science, Technological University of the Philippines, Manila

Fungi are a diverse group of eukaryotic organisms. They reproduce sexually or asexually by means of spores. Fungal spores are an invisible part of our environment. This study was conducted to determine the fungal population at the indoor atmosphere of the College of Arts and Science building at the TUP Manila campus. Collection of samples was done by Gravitation Plate Method in randomly designated areas of the school building. Sabouraud Dextrose Agar (SDA) was used as growth media . Plates were incubated at 30 ℃ for 5 – 7 days . Isolates were identified based on their morphology by slide culture technique and cultural characteristics such as colony color and texture appearance on SDA. Fungal isolates that were observed are pathogenic opportunists and have an industrial significance. These includes *Aspergillus niger* , *Rhizopus sp.* , *Alternaria sp.* and *Penicillium sp.*

**Keywords** : fungi , fungal spores, gravitation plate method , pathogenic opportunists

**BSD-21**

# PREVENTING BIOHAZARD DISASTERS IN PHILIPPINE SCIENCE LABORATORIES

**Franco G. Teves**

Molecular Genetics and Microbial Technology Laboratory, Department of Biological Sciences, College of Science and Mathematics
MSU-Iligan Institute of Technology 9200, Iligan City
Telefax: 063 3516131; Email: franco_teves@yahoo.com

Biohazard and bioterrorism are basically unknown to many Filipino researchers in Philippine colleges and universities and generally very foreign to most students. The stiff competition for best science projects in national and international levels has led to a lop-sided trend in the students' choice of investigatory projects which require manipulation of microorganisms. Yet, most high schools do not have the basic facilities, or the expertise to undertake microbiological experiments, therefore placing high school students at risk of being exposed to potential pathogens for lack of necessary training and knowledge.

Roughly 70% of high school science investigatory projects submitted annually in the life sciences category at least in Northern Mindanao deal with microorganisms. A survey of microbial species commonly used include those with known pathogenic members or are potential pathogens, such as *Escherichia coli, Staphylococcus aureus*, and *Pseudomonas aeruginosa*. These microbial isolates are usually purchased from culture collections of universities or research institutions by the science advisers, which are then either kept in the high school science laboratory or brought to a university where the experiments are conducted. Examination of the materials and methods written by the students generally reveal vague descriptions of aseptic techniques and decontamination procedures. Inability to answer questions during the actual science fairs corroborates the notion that most high school students undertake microbiological experiments without sufficient training and knowledge.

Measures such as policy formulation regulating microbiological experiments below the tertiary level, accreditation of microbiological culture collections and science advisers working with microorganisms, regulating the indiscriminate buying and selling of microbial cultures, and enhancing microbiological education for high school science teachers and students, will have to be in place to prevent an impending biohazard disaster in the country.

**Keywords**: biohazard, bioterrorism, pathogens, aseptic techniques, decontamination

**BSD-22**

# IMPROVEMENT OF METHODOLOGIES FOR GREENHOUSE GAS INVENTORIES OF THE LUCF SECTOR IN THE SOUTHEAST ASIAN REGION

**Damasa B. Magcale-Macandog**

Institute of Biological Sciences, College of Arts and Sciences
University of the Philippines Los Baños

Greenhouse gas emissions inventories are vital for quantifying the release of greenhouse gases into the atmosphere and for assessing the impacts of increasing greenhouse gases in the changing patterns of climate change. Estimations of carbon emissions and sequestration from forest and land-use change are complicated, and often controversial, due to complex biological factors, lack of data or reliable data, and adverse and complex human impacts on forest resources.

A review of the national GHG inventory reports of the Philippines, Indonesia and Thailand revealed a great variability in the values of the annual biomass increment and aboveground biomass used in the different national GHG inventory studies. The major problems in the estimation of GHG emissions or removals from the LUCF sector in the three countries are the lack of activity data and the limited access to sparsely available data. There is a strong need to develop a database to improve the quality of activity data and emission factors. Creation of this database will entail compilation of all existing data and literature; updating of forest resources and land use inventory, and conduct of experimental studies, sampling, survey and measurement for the different activity data and emission factors.

Allometric regressions to predict aboveground biomass for different forest plantations including *Tectona grandis*, *Pinus merkusii*, *Swietenia macrophylla* in Java, *Tectona grandis* in Thailand and secondary forests in the Philippines were developed and improved. Information on wood density plays an important role in improving the estimates of tree biomass for the calculation of greenhouse gas emission and uptake. Information on wood density of Philippine trees was organized in a database. Currently, the database contains 542 entries from 243 species belonging to 59 families.

A geographic information system (GIS)-based model was developed to spatially predict the aboveground biomass of secondary forests in the Philippines. A database of the physical (soil type, slope, elevation) and climatic (agroclimate zone, annual rainfall) properties of the different administrative units (provinces) in the country was assembled from secondary data and existing maps. The relationship of the physical and climatic factors (independent or predictor variables) and the forest aboveground biomass (dependent variable) was determined through

multiple linear regression analysis. The resulting equation was used to predict potential aboveground biomass of secondary forests in the country. Overlaying the potential biomass map to the remaining secondary forest areas resulted to a map of the estimated aboveground biomass of secondary forests.

**Keywords:**

**BSD-23**

## A PRELIMINARY STUDY OF BACTERIAL BIOFILMS IN WATER RESERVOIRS AND WATER DELIVERY LINES

**Wilma T. Cruz**

Institute of Biological Sciences
University of the Philippines Los Baños, College, Laguna
Email: wilmatc@yahoo.com

Water is an effective vehicle for the spread of pathogens and low numbers of opportunistic pathogens can be found in potable water. While chlorination is usually effective in eliminating fecal coliforms and most transient pathogens, bacteria in biofilms can withstand chlorination. This study examined the occurrence of biofilms in a random selection of water reservoirs and water delivery lines of establishments within the University of the Philippines Los Baños (UPLB) campus and determined the identity of the bacteria isolated from the biofilms.

Microscopic examination of glass slides that were submerged in the water reservoirs of two water pumping stations within the UPLB campus revealed the presence of biofilms. Bacteria were also recovered from the swabs taken from biofilms that formed inside running water faucets as well as the faucets and inside walls of water containers and dispensers located in various buildings. The identity of bacteria isolated from the biofilms were determined using the Analytical Profile Index (API) System. The bacterial isolates included both Gram positive (*Bacillus, Micrococcus, Staphylococcus*) and Gram negative (*Aeromonas, Citrobacter, Empedobacter (Flavobacterium), Escherichia, Klebsiella, Pantoea, Pasteurella, Pseudomonas* (*Brevundimonas*), *and Sphingomonas*) species. The predominant isolates were *Micrococcus* (21.4%), *Bacillus* (14.3%), *Pasteurella* (14.3%) and *Staphylococcus* (12%). The different enteric bacteria made up 21.4% of the isolates. Among the isolates were opportunistic pathogens.

**Keywords**: water delivery lines, water reservoirs, biofilms, opportunistic pathogens, enteric bacteria

**BSD-24**

# METAL TOLERANCE AND ANTIBIOTIC RESISTANCE PATTERN OF BACTERIA ISOLATED FROM RIVERS OF CAVITE

**Yolanda A. Ilagan* and Joanne A. Agustin**

Cavite State University
Indang, Cavite, Philippines
Email: yoly_ilagan@yahoo.com

One hundred and one bacterial isolates were obtained by plating samples of river water. These bacteria belong to the genera *Enterobacter, Alcaligenes, Staphylococcus, Micrococcus, Pseudomonas, Proteus, Acinetobacter, Bacillus, Enterobacter* and *Flavobacterium*. They were subjected to varying concentrations of metals and antibiotics.

The isolates exhibited growth decline as the concentration of heavy metals increased. Majority of them exhibited tri-tolerance and bi-tolerance . Iron-Lead-Zinc tolerance was the most observed pattern.

Bi- and tri-resistance were the most common observed patterns of resistance to antibiotic which are Ampicillin–Oxytetracycline and Ampicillin-Kanamycin-Clindamycin, respectively.

High percentage of isolates exhibited tolerance to lead. Combination of Clindamycin-Lead and Erythromycin-Lead resistance were also exhibited by most isolates.

**Keywords**: metal tolerance, antibiotic resistance

**BSD-25**

# PARTICIPATORY INVENTORY AND DISTRIBUTION OF ENDANGERED, ENDEMIC AND ECONOMICALLY IMPORTANT PLANTS IN HAMIGUITAN RANGE WILDLIFE SANCTUARY, DAVAO ORIENTAL

**Victor B. Amoroso, Reyno A. Aspiras* and Janece Jean A Polizon***

Central Mindanao University, Musuan, Bukidnon
088-222-5748; 0917-5495084
amorosovic@yahoo.com

Mt. Hamiguitan Range Wildlife Sanctuary in Davao Oriental is a protected area in Mindanao with pygmy forest in an ultramafic soil. With the participation of *Bantay Gubat* as local researchers, this study was conducted to inventory and determine the distribution of the endemic, endangered, and economically important flora in Mt. Hamiguitan Range and its environs. Transect walk and sampling plots revealed four vegetation types viz. agroecosystem, dipterocarp, montane and mossy forests. The mossy forest consisted of two subtypes, the typical mossy forest and mossy-pygmy forest. It further showed that Hamiguitan Range is a habitat of 843 species, 242 genera and 120 families of plants. Of these, 678 were angiosperms, 29 gymnosperms, 121 ferns and 15 fern allies. It is also the home of 8 endangered species, 27 rare species, 47 endemic species and 165 economically important species. Further assessment revealed nine (9) species considered as new record in the Philippines or in Mindanao. Inventory of trees and shrubs in sampled plots showed high species richness per unit area and high diversity values. Not only that Mt. Hamiguitan exhibited high species richness but it also contained many endemic, endangered, rare and economically important species of plants. The lowland dipterocarp and pygmy forests and their species at lower elevation are highly threatened due to overharvesting of forest products and road expansion for mining activities. The identified habitats of these threatened and endemic species should be given high priority for protection and conservation.

**Keywords**: species, diversity, assessment, vegetation types, Natural Park

**BSD-26**

# ESTIMATES OF CARBON STOCKS IN THE PROPOSED MINE SITE IN MOUNTAIN ECOSYSTEM OF TAMPAKAN, SOUTH COTABATO, PHILIPPINES AND ENVIRONS

**Jan Paolo T. Pollisco[1], Nelson M. Pampolina[1], Dixon T. Gevaña[2], and Jose Sebua[3]**

[1]Department of Forest Biological Sciences, CFNR-UP Los Baños
[2]Environmental Forestry Program, CFNR-UP Los Baños
[3] Sagitarius Mines Incorporated, Tampakan, South Cotabato

Carbon stored in biomass of trees, intermediate layer, herbaceous plants and forest litter was estimated in grassland and forest ecosystems along the gradient in mountain ecosystem within the boundaries of three provinces under the proposed mine sites of the Sagittarius Mines Incorporated in Southern Mindanao. The amount of carbon produced during photosynthesis was computed based on biomass that accounts for approximately 45% of the plant total weight. The diameter of trees measured at breast height was used to compute biomass through allometric equations. The plant biomass was sampled from 10 sampling plots that were equally distributed alternately at 100 m interval along a kilometer transect each in low (400-799 m asl), medium (800-1,199 m asl), and high (1,200-1,600 m asl) elevation gradients. Each sampling plot measured 10x10 m for trees, 1x1 for herbaceous, and 0.3x0.3 m for necromass.

The lower and middle slopes, comprising mostly of grassland, agricultural crops, and patches of secondary forest in contrast to nearly intact primary forest in higher elevation, were relatively disturbed. A total of 52-67 plant species and 46-51 genera were identified in the lower and middle slopes, consisting of ecologically threatened species (*Shorea contorta, Parashorea malaanonan, Dillenia philipinensis, Alstonia macrophylla, Cinammomum mercadoi, Palaqium luzoniense,* and *Neolitsea vidalii*) and bio-invasive *Piper aduncum*. There were 49 species and 33 genera sampled towards the peak in the old growth forest that include endangered species (*Dacrycarpus elatum, D. imbricatus, Syzigium* and *Lithocarpus* spp). Estimated carbon stored in plant biomass aboveground from disturbed slopes varied from 74.9 $\pm$ 64.3 to129.9 $\pm$ 62.2 tons ha$^{-1}$ compared to 608.1 $\pm$ 300.8 tons ha$^{-1}$ in lush primary forest. Carbon stock in the undergrowth herbaceous however, was higher in open gradient than in secondary and primary forest. By contrast, stored carbon from belowground necromass was greater in primary and secondary forest than in open grassland ecosystem.

Overall, the above results indicate the significant role of vegetation in carbon sequestration and the likely impact of denudation.

**Keywords**: carbon stocks, South Cotabato, Endomycorrhiza, mountain ecosystem, Allometric equation

**BSD-27**

# ISOLATION OF ENVIRONMENTAL DNA AND ANALYSIS OF A PARTIAL LIBRARY OF THERMOPHILIC MICROORGANISMS FROM MT. MAKILING MUDSPRING, LOS BANOS, LAGUNA, PHILIPPINES

**Nacita B. Lantican* , J. Jason L. Cantera, Ma. Genaleen. Q. Diaz and Asuncion K. Raymundo**

Institute of Biological Sciences, College of Arts and Sciences
University of the Philippines Los Baños, College, Laguna, Philippines 4031
*Tel: (63-049) 536-3368; Email: nacitalantican@yahoo.com; nbl@gmail.com

The Mudspring at the University of the Philippines Los Banos is a naturally occurring, extremely hot environment located on the mountainside of Mt. Makiling, Laguna. It is a potentially rich source of thermophilic microorganisms with novel properties; but the present status of the diversity of the thermophiles in this environment is not well documented. The extreme environmental conditions and high temperature required for isolating and growing the microorganisms from Mudspring limited the cultivation of the prevailing microflora and its subsequent utilization. Thus, DNA-based approach became the method of choice for analysis and eventual utilization of the wide diversity of microorganisms from Mudspring. Several protocols and DNA extraction kits were tried and considerable amounts of DNA were extracted only from the settled pond water using the Bio 101 Fast DNA Spin Kit. Difficulty in direct DNA isolation was probably due to high sulfur content and low pH. The isolated DNA was digested with *Eco*R1 and ligated into plasmid pBluescript (pBS). A number of clones were obtained and sequenced. Blast results showed that the inserts were less than 1000 kb and most clones showed no significant homology to any known gene, suggesting that the extracted DNA contains unique sequences from uncharacterized microorganisms, thus the absence of significant hits in the databases. This is the first study on environmental DNA, and showed the potential of such kind of approach in the genetic analysis of the diversity of the microorganisms in Mudspring and in other extreme environments in the Philippines.

**Keywords**: Thermophiles, Environmental DNA, Mudspring

**BSD-28**

# AN ASSESSMENT OF THE BENTHIC COMMUNITY STRUCTURE: IMPLICATIONS ON THE INTEGRITY OF LAKE PALACPAQUEN, SAN PABLO CITY, PHILIPPINES

**Hazel Caasi, Jobe de la Torre, Teresita Perez and Claveria Rene Juna**

Deapartment of Environmental Science
Ateneo de Manila University, Loyola Heights
Quezon City, Philippines

Lake Palacpaquen is the shallowest and second largest lake in the Seven Lakes of San Pablo City. The lake is threatened by sedimentation and water quality. The macroinvertebrate community composition of the lake was investigated. The effect of the lake's water quality on the benthic macroinvertebrates was evaluated using the Belgian Biotic Index (BBI) and the Family-Level Biotic Index (FBI). Samples were obtained from four stations in the lake: inlet, pool, periphery and outlet and *in-situ* water quality parameters were measured. Substrate varied from organic litter, to gravel and fine sediments. Dissolved oxygen concentrations and turbidity were generally lower in November 2005 while pH level, temperature and conductivity were lower in December 2005 following a series of heavy rainfall.

The dominance of mollusca genera *Melanoides*, *Tarebia*, *Bellamya* and *Angulyagra* was observed. Six other genera of mollusks were found, including the bivalve *Corbicula* and the foreign species, *Pomacea canaliculata*. Larvae of the Family Chironomidae were abundant in the pool.

Taxa diversity was highest in the periphery and the lake outlet in December 2005 and January 2006. Diversity of the entire lake obtained from composite samples was highest in January (H'= 0.834). BBI scores were lowest in November and highest in January for all sites. Based on the BBI, Lake Palacpaquen was moderately polluted in November and December, and was lightly polluted to unpolluted in January. FBI scores were lowest in January (6 = fairly poor), but this rating is still indicative of the possibility of substantial pollution.

**Keywords** : Biotic Index, Benthic Organisms, Water Quality, Pollution, Lake

**BSD-29**

# DIVERSITY AND ENDEMISM OF VERTEBRATE FAUNA IN MT. MALINDANG, MINDANAO, PHILIPPINES

**Olga M. Nuñeza, Apolinario A. Alicante, Marie Rosellyn C. Enguito and Fritzie B. Ates**

Department of Biological Sciences
MSU-Iligan Institute of Technology, Iligan City
Email: olgamnuneza@yahoo.com

The rapid destruction of tropical rainforest in Southeast Asia that occurred in the 20th century drastically altered the environmental conditions to which many forms of vertebrate life had become adapted (Sodhi et al., 2004). Malindang range is one of the upland ranges where faunal diversity has been severely threatened due to forest loss. This study was geared towards the generation of knowledge on faunal resources through a participatory approach. The prospect would be that a better understanding of the faunal resource diversity, under shared responsibility would lead to better resource management.

Using a combination of mistnetting, trapping, line transect, and opportunistic methods, 257 species of vertebrates fauna including 114 endemic and 25 threatened species were recorded. Fifty-nine herpetofaunal species were recorded comprising 26 amphibians and 33 reptiles with 42% and 48% endemism, respectively. Of the 162 species of birds recorded, 66 (24%) are Philippine endemics. Nineteen species of bats and 17 species of nonvolant mammals (12 endemic, 4 threatened) were recorded. Percent endemism was highest in the mossy forest while the most number of threatened species was found in the submontane dipterocarp forest. TWINSPAN analysis showed that the mossy and montane forest cluster represents a vegetation type different from the other clusters. Translating the cluster data into a biodiversity map revealed that biodiversity value is low in the agroecosystem, moderate in lowland dipterocarp, mixed dipterocarp, mixed lowland dipterocarp and mossy forest, high in almaciga, and very high in montane and submontane dipterocarp forests.

The forest sites at higher elevation appear to be very important for the continued existence of faunal species with critical population. However, despite habitat loss, the lowlands are still able to support a considerable number of endemic species. These results need to be taken into account in the formulation of conservation and management plan for Mt. Malindang.

**Keywords**: vertebrate, fauna, threatened, endemic, species

**BSD-30**

# DISTRIBUTION AND CONSERVATION OF THE AVIFAUNA OF AGUSAN MARSH, AGUSAN DEL SUR, PHILIPPINES

**Milagros P. Sucaldito and Olga M. Nuñeza***

Department of Biological Sciences, College of Science and Mathematics
Mindanao State University-Iligan Institute of Technology, Iligan City
Email: milagros_sucaldito@yahoo.com

Agusan Marsh is identified as the 1009th RAMSAR site as Wildlife Sanctuary which serves as wintering ground for migratory and wetland birds from Southeast Asian regions and Western countries during the winter season. It is considered as one of the most ecologically significant wetland ecosystems in the Philippines. In this study, four habitat types were assessed to determine the distribution and conservation of the birds in the marsh.

Sago, terminalia, mixed swamp and peat swamp forests in Agusan Marsh were surveyed using a combination of mist netting (3,337 net days) and transect walk methods. One hundred twenty-six species of birds were identified consisting of 26 migrants, 69 residents, and 31 endemics (23.81% endemism) of which five species are categorized as threatened. The mixed swamp forest had the highest species richness (S=92) while peat swamp forest had the highest number of migratory birds (S=26). Endemicity was found to be highest in the terminalia forest (20.63%) while sago forest had the least number of bird species. Canonical correspondence analysis (CCA) of the birds' local distribution in relation to environmental variables showed 80.7% variance of species abundance and distribution. The migratory species, Siberian Ruby throat (*Luscinea cyane*) which was recorded only in Luzon as accounted by Kennedy et al., 2000 was found also in Agusan Marsh indicating that this bird may not only be confined to Luzon but could be found in other places in the Philippines.

Five species of birds which include two migratory species were reported to be of socioeconomic importance. Changes in the structural and floristic composition brought about by forest degradation such as conversion of forest into agriculture were seen as threats to the birds in Agusan marsh. Conservation of the different habitats in the marsh appears to be very necessary for the retention of the broadest avifaunal diversity.

**Keywords**: avifauna, distribution, conservation, endemism, species richness

**BSD-31**

# DISTRIBUTION, DIET AND ENDOPARASITES OF AVIFAUNA IN MT. SAMBILIKAN, DIWATA RANGE, AGUSAN DEL SUR, PHILIPPINES

**Rowena B. Caro and Olga M. Nuneza**

Department of Biological Sciences, College of Science and Mathematics
MSU-Iligan Institute of Technology, Tibanga, Iligan City
Email: rwn_caro@yahoo.com

Mt. Diwata is one of the Important Bird Areas of the Philippines. This study investigates the distribution of avifauna in Mt. Sambilikan, using a combination of mist-netting (932 net days) and transect walk methods. Assessment of the Mixed Lowland Dipterocarp Forest, Mixed Dipterocarp Montane Forest and Mossy Dipterocarp Forest showed 97 species belonging to 13 orders and 37 families. Of these, 56 are endemic (39 Philippine Endemic, 9 Mindanao Faunal Region Endemic, 8 Mindanao Island Endemic). The high percentage endemicty (58%) indicates that the area provides a good habitat to a large number of avian species. Sixteen threatened species were recorded (one critically endangered, seven vulnerable and eight near threatened).

Mixed Dipterocarp Montane Forest had the highest species diversity (H'=2.83). Species richness (S = 72) was recorded to be highest in the Mixed Dipterocarp Montane Forest (670 – 750 masl) while the lowest species richness (S=33) was recorded in the Mossy Dipterocarp Forest (1,000 – 1, 050 masl).

Fourteen samples of *Hypsipetes philippinus* and eight samples of *Macronous striaticeps* were dissected to examine diet composition as well as endoparasites. Knowledge on the diet and endoparasites could be helpful in the management of birds in the wild. Results showed that the diet of *Hypsipetes philippinus* includes digested fruit pulp and fibers, seeds, and insects of family hemiptera. The gut of *Macronous striaticeps* yielded seed and fruit pulp of *Ficus minahassae* and seeds. Segmented endoparasites were found in the intestine of birds, however, percent occurrence of endoparasites was higher in *M. striaticeps* than in *H. philippinus*.

Despite the kaingin system of farming and hunting of birds for food, Mt. Sambilikan remains to be the home of many endemic and threatened birds. Proper management and conservation measures appear to be necessary to protect the bird species and other forms of biodiversity in the area.

**Keywords**: Avifauna, Diversity, Endemism, Distribution, Species Richness

**BSD-32**

# DIVERSITY, DIET, AND ENDOPARASITES OF SNAKES IN MT. SAMBILIKAN, DIWATA RANGE, AGUSAN DEL SUR

**Amy G. Ponce and Olga M. Nuòeza**

Department of Biological Sciences, College of Science and Mathematics
Minadanao StateUniversity Institute of Technology, Iligan City
Email: jade_tazz@yahoo.com

Mt. Sambilikan, with an elevation of 1,050 masl is part of the Diwata range in Agusan del Sur which is one of the key conservation sites in the Philippines. A field ecological study on snake fauna was conducted utilizing the opportunistic method, in order to come up with a reliable species assessment including species richness, species endemicity, distribution and abundance. Diet composition as well as endoparasites of the snake species were also examined. Ten snakes were recorded comprising seven species under Family Colubridae, one species under Family Elapidae and two species under Viperidae. Highest diversity (H'=1.039) was recorded in the mixed dipterocarp montane forest while lowest diversity (H'=0.062) was documented in the mossy dipterocarp forest. A relatively even distribution was observed for all sites sampled. *Tropidonophis dendrophops* and *Trimeresurus flavomaculatus* were the only endemic species (20%) recorded..

Diet examination results showed that snake species of Family Colubridae generally feed on lizards and frogs. Viperidae was found to feed on rodents and bats while Elapidae even feeds on snakes, besides rodents. Endoparasites belonging to Order Ascarida were the parasitic nematodes found infesting the digestive tract of the snake species.

No threatened snake species according to IUCN criteria was recorded in Mt. Sambilikan but according to what was locally observed all snake species were threatened due to the local people's practice of killing the snakes immediately when encountered. Some local residents also utilize snakes for food and medicine. The fast rate of human settlement in the area is seen as a threat to the snakes in the area. Enhancing awareness and knowledge of the local people on the importance of the snake species and implementation of conservation strategies could be an important step towards the conservation of the snakes in Mt. Sambilikan, Diwata range.

**Keywords**: snake, diversity, diet, endoparasite, endemic

**BSD-33**

# DIET AND DISTRIBUTION OF BAT SPECIES IN MT. SAMBILIKAN, DIWATA RANGE, AGUSAN DEL SUR

**Berna Lou L. Aba and Olga M. Nuòeza**

Department of Biological Sciences
MSU-Iligan Institute of Technology, Iligan City
Email: lou_heaven@yahoo.com

The Philippines is richly diverse in important flora and fauna species. Mt. Sambilikan of the Diwata Range is home to one of the important fauna, the Chiroptera. Thus, the investigation of the diet, species composition, biodiversity indices, species similarity and environmental variables of bats was done in Mt. Sambilikan, Agusan Del Sur from October 24-Novenber 21, 2006. Three sampling sites with three subsites differing in elevation and vegetation were established. Mist netting and harp trapping were done for a total of 768 net and trap nights. Sixteen species of bats were recorded: nine pteropodids, 1 rhinoliphid, 1 vespertilionid, and five hipposiderids. Eleven species were Philippine Endemic, and five non-endemics. Most of the species captured were of the least concern status except for *Haplonycteris fischeri* that is rated vulnerable (VU) based on IUCN Red List.

Forty guts from *Ptenochirus jagori, Rousettus amplexicaudatus* and twenty from Insectivorous bats were examined. Food items or prey units were categorized into four: Follicle/Cillia/Hair-like substances (F/C/H), partially digested matter (PDM), digested matter (DM), and insect debris (ID). Ten percent of *Ptenochirus jagori* examined appear to have endoparasite. Eighty percent of insectivorous bats contained follicles, cilia, or hair-like substances (F/C/H), and 75% of partially digested matter (PDM). Ninety percent of *Rousettus amplexicaudatus* contained digested matter (DM). Sixty five percent of insect bats contained insect debris (ID). Species composition and abundance among the three sampling sites was not significant probably due to the nearly similar vegetation in the subsites. Instead, the species abundance between subsites was highly significant (0.001) probably due to the variation of habitat per subsite. The species composition was more or less evenly distributed between sampling sites for there was no dominance in any species. Environmental factors such as elevation and vegetation appear to have an effect on the species distribution and diet.

**Keywords**: Bat, diet, distribution, relative abundance, endoparasites

**BSD-34**

# A PHYLOGENETIC STUDY OF PHILIPPINE SPECIES OF TOXOGLOSSATE MOLLUSCS USING mtCOI GENE SEQUENCES

**Glaiza F. Narvacan[1], Angela Clarissa DR Cantalejo[1], Francisco M. Heralde III[1,2], Virginia D. Monje[1]**

Medical Biotechnology and Genome Research Laboratory
National Institute of Molecular Biology and Biotechnology, College of Science
[2]Marine Science Institute, College of Science
University of the Philippines, Diliman, Quezon City 1101

The members of the Toxoglossa Superfamily (*Conidae, Turridae and Terebridae*) possess a specialized feeding mechanism that may involve toxins[1]. Some *Conidae* species have toxins which revealed pharmaceutical potentials[2] which may also be present in their close relatives that can be identified in phylogenetic analyses. In this study, the marker utilized is the mitochondrial cytochrome oxidase I gene (mtCOI). It is popularly used because of its large size and its protein sequences that contain highly conserved functional domains and variable regions[3] DNA from each snail was extracted either by the Xanthogenate-SDS DNA extraction protocol or by the DNA Easy Extraction Kit. The mtCOI gene was amplified by PCR. The gene was directly sequenced and homologous sequences to the ones obtained were searched for using BLAST. Sequence and phylogenetic analyses were performed using the Molecular Evolution Genetics Analysis (MEGA) version 3.1 software[4]

Presently, partial mtCOI gene sequences of two *Turridae* species, *Turridrupa prestoni* and *Lophiotoma acuta*, and one *Terebridae* species, *Terebra babylonia*, were obtained. BLAST results indicated that the obtained mtCOI sequences were homologous mostly to those of other gastropod snails. *Turridrupa prestoni* was at the base of the phylogenetic tree, constructed using the Minimum Evolution Method with Bootstrap Analysis. Moreover, the position of *Lophiotoma acuta* was next to it, indicating the possibility that the *Turridae* family is more ancient than the other two toxoglossate families. Also, *Terebra babylonia* appeared to be more related to *Conidae* species than to *Turridae* species. This may mean that the *Conidae* is more related to the *Terebridae* (and vise versa) than to the *Turridae*. This implies that the biological characteristics of the species within the *Conidae* are more similar to those of the species within the *Terebridae*. Thus, search for toxin-derived drugs using Terebra may be just as promising, if not more, as the Conus snails.

**Acronyms Used:**
mtCOI – mitochondrial cytochrome oxidase I
PCR – polymerase chain reaction
BLAST – Basic Local Alignment Search Tool
MEGA version 3.1 – Molecular Evolution Genetics Analysis Version 3.1

**Keywords:** Toxoglossa Superfamily (*Conidae, Turridae and Terebridae*), molluscs. Conus snails, phylogenetics, mtCOI.

**BSD-35**

## TRANSLOCATION OF COPPER IN NON-MYCORRHIZAL AND MYCORRHIZAL TARO (*Monochoria sp.*) IN MINE SOIL AND GARDEN SOIL AMENDED WITH INCREASING LEVELS OF COPPER

**Nelly S. Aggangan[1], Richard Kenneth V. Ching[2], Allan Vincent C. Miñon[2] and Juveneil Eissyd J. Perez[2]**

[1]National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Baños, College, Laguna 4031
Tel/Fax: 049 536 0563; Email: nea@laguna.net
[2]Pedro Guevara Memorial National High School
Sta. Cruz, Laguna

Taro or commonly known as gabi (*Monochoria* sp.) is a very popular root crop in the Bicol region for the famous "laing" recipe. Gabi is planted in backyard, farms and even in mine waste dumpsites. Mine wastes contain heavy metals that are detrimental to plants, animal and human health. Most of the mining companies in the Philippines mine for Cu. This study aimed to determine the absorption and translocation of Cu by gabi growing in mine waste soil and in Cu-amended garden soil. Soil samples from mine sites in Paracale, Camarines Norte were collected and found to contain 3.51 mg Cu/kg soil. Gabi plants were planted in pots filled with mine soil and garden soil amended with 100, 200 and 400 mg/kg Cu. These were either uninoculated or inoculated with a commercial mycorrhizal inoculant Mykovam. Mykovam consists of different species of endomycorrhizal fungi. The experiment was done in a screenhouse following a Randomized Complete Block Design with ten replicates. Gabi planted in mine sites were also collected and analyzed for Cu.

Results show that inoculated gabi exhibited greater total plant dry weight than uninoculated ones. The corms gave the greatest dry weight compared to other plant parts. Cu tolerance of mycorrhizal plants is 200 mg/kg while that of non-

mycorrhizal plants is 100 mg/kg. Cu concentration of twelve-week old non-mycorrhizal gabi was well distributed in the leaves, roots, and corm and greatest in their stalk. On the other hand, inoculated counterpart had high Cu concentration in the roots. This observation concurred previous findings that Cu is concentrated in the roots of mycorrhizal plants indicating the ability of the latter to filter out heavy metals into the upper portion of plants particularly the edible parts. In the case of gabi, all parts except the roots can be eaten by human. Cu concentration in the stalk of non-mycorrhizal gabi ranged from 53–70 mg/kg, which are beyond the maximum acceptable limit of 36 mg/kg by the Dutch Standards. Mycorrhizal plants had Cu concentrations (from corm to leaves) that are far below the maximum acceptable limit. Gabi grown in mine sites also accumulated high amount of Cu in the edible portions. With these observation, it is highly recommended that studies be conducted to verify the results and determine the accumulation of other heavy metals.

**Keywords**: copper, gabi, heavy metal, mycorrhiza, taro, mine soil, garden soil

**BSD-36**

## THE EFFECT OF PREPARED DIET ON THE SOMATIC AND GONAD GROWTH PERFORMANCE OF THE SEA URCHIN *Tripneustes gratilla* (LINNAEUS, 1758)

**Facundo B. Asia*, Joji Grace Villamor and Jogel C. Faylogna**

MMSU College of Aquatic Sciences and Applied Technology
Currimao 2903, Ilocos Norte, Philippines
Telefax: (077) 793-6916; Email: dong_asia@yahoo.com

Somatic growth and gonad growth and quality of the sea urchin *T. gratilla* fed with prepared diets based on *Sargassum sp.* were studied *in vitro* using plastic basins from February to June 2006. It consisted of three treatments with three equal replications arranged in CRD as follows: I-Fresh *Sargassum sp.* (control), II-Dried pellets, and III-Fresh Extruded pellets.

No significant variations were observed in the somatic growth of *T. gratilla* among the feeding treatments indicating that prepared diet is comparable with fresh diet. Highest growth rates were observed during the first culture month decreasing towards the end of the study. The fresh natural food gave better gonadosomatic index and gonad color than the prepared diets but not for granularity. However, in a follow-up study (Asia, 2006) to optimize feed ration of the organisms, the effect of natural food and prepared *Sargassum sp.* diet at 4.0 to

5.0% BW/day feeding ration on gonadosomatic index and gonad color were comparable ($p<0.05$). Observed water parameters were within the favorable ranges for growth and survival of the organism.

The successful introduction of prepared diets for *T. gratilla* opens opportunities of incorporating gonad color enhancers in the diet that improves quality of the organism for market and consumption. The study likewise demonstrated the viability of land-based culture of the organism using both the fresh natural food and prepared diets important in sustaining a year-round harvest and broodstock source for hatchery and seed stock production.

**Keywords:** *Tripneustes gratilla*, prepared diet, somatic growth, gonad growth and quality

**BSD-37**

## ASPECTS ON THE BIOLOGY AND FISHERY MANAGEMENT OF *Siganus fuscescens* IN PUJADA BAY

**Bernadette J. Nanual[1] and Ephrime B. Metillo[2*]**

[1]Department of Natural Sciences, Davao Oriental State College of Science and Technology, Mati 8200, Davao Oriental; Email: dettenanual@yahoo.com; [2]Department of Biological Sciences, Mindanao State University-Iligan Institute of Technology, A. Bonifacio Ave., Iligan City 9200; Tel: (063) 221 4050 up to 55 local 137; E-mail: ovcre-ebm@sulat.msuiit.edu.ph; ipemetillo@yahoo.com

The white-spotted spinefoot rabbitfish, *Siganus fuscescens*, is an important but overfished species in Pujada Bay, Davao Oriental. In this study, sex ratio, body size, fecundity and gonadosomatic index (GSI) of *S. fuscescens* were determined for a year from three sites in Pujada Bay. The generated population structure and reproductive patterns database became input into the fishery management plan of the species. Sex ratio was generally 1:1. Mean standard lengths ranged from 9.1-12.9cm, significantly much smaller than the expected length at maturity of 20cm and maximum body length of 40cm (FishBase 2005). However, relatively larger individuals were found in the less fished marine reserve site. Mean fecundity was lower than expected (FishBase 2005) and ranged from 10,981.8-39,791.6, and, again, individuals from the less fished site contributed higher values. Spawning occurred from February to April and peaked in March. The species employs an opportunistic life-history strategy (high reproductive effort, early maturity, frequent spawning), but our data suggest that extreme overfishing may have driven the species to mature much earlier and spawn at a much smaller body size with a

much lower fecundity. The less fished site, however, seems to allow individuals to mature at a larger body size and spawn higher number of eggs. Hence, some degree of protection from overfishing may help in the sustainability of populations and fishery of *S. fuscescens* in Pujada Bay. This study has recommended to the local government that the less fished site be declared as a marine reserve.

**Keywords:** fish resources, spinefoot rabbitfish, *Siganus fuscescens*, Pujada Bay, fecundity, gonadosomatic index, fishery

**BSD-38**

## MONSOONAL INFLUENCE ON THE DISTRIBUTION, ABUNDANCE AND ASSEMBLAGE STRUCTURE OF ZOOPLANKTON IN ILIGAN BAY, NORTHERN MINDANAO, PHILIPPINES

**Anelyn L. Dapanas and Ephrime B. Metillo***

Department of Biological Sciences, Mindanao State University-Iligan Institute of Technology, A. Bonifacio Ave., Iligan City 9200
Telephone: (063) 221 4050 up to 55 local 137
Email: ovcre-ebm@sulat.msuiit.edu.ph, ipemetillo@yahoo.com

We conducted a systematic sampling of physico-chemical factors and zooplankton in the upper 25-m surface layer across a 24-station grid in Iligan Bay to determine whether the assemblage structure and abundance of zooplankton differ across stations and between northeast and southwest monsoon months, and to establish correlations between zooplankton parameters and physico-chemical factors. Abundance was estimated by stereomicroscopy, and assemblage structure was analyzed using multivariate and univariate routines available in the E-PRIMER v.5 software (Warwick and Clarke 2001). Abundance across stations and between months was higher during the southwest monsoon months. Assemblage structure were similar in terms of taxonomic composition and dominant taxa (>67% of the total abundance: calanoid copepods, copepod nauplii and copepodites, and tintinnids). Change in assemblage structure were largely attributed to shifting in ranks of taxa (bivalve veligers, ostracods, gastropod veligers, fish eggs, larvaceans, chaetognaths, and cyclopoid copepods) that contribute <7% relative abundance. Assemblages consist of high, moderate, and low levels of relative abundance, and taxonomic richness and diversity, but the very crucial are those that had low diversity and abundance in the southeastern sector of the bay during the northeast monsoon, and those with low diversity but high abundance in the southwestern sector during the SW monsoon. The former

assemblages could be associated with areas with pollution stress while the latter with a possible micro-upwelling event. Salinity, temperature, and total dissolved phosphorus and nitrogen were weakly correlated with zooplankton spatio-temporal variations, but contrasting monsoonal patterns and associated hydrodynamic processes are also important in structuring zooplankton assemblages in Iligan Bay.

**Keywords:** zooplankton, disturbance, northeast monsoon, southwest monsoon, multivariate analysis, Iligan Bay

**BSD-39**

## SPECIES IDENTIFICATION AND GENETIC DIVERSITY ANALYSIS OF YEAST ISOLATES FROM PHILIPPINE RICE WINE STARTERS BY DNA FINGERPRINTING

**Elaine Y. Lim[1], Vivian Panes[1], Gabriel O. Romero[2*]**

[1]Biology Department, Ateneo de Manila University, Quezon City
[2]Plant Breeding and Biotechnology Division, Philippine Rice Research Institute
Science City of Muñoz, Nueva Ecija Email: goromero@philrice.gov.ph

In the Philippines, considerable variation in rice wine quality is often observed among and within wine producers. Microbial composition of rice wine starters is critical to maintaining the wine quality. To better understand the microbial ecology, yeast strains were isolated from starters obtained from three areas in the Ifugao province for morphological and molecular characterization. DNA analysis was done using modified RAPD using 20-mer SRILS Uniprimers. Three of 12 SRILS primers revealed the highest level of polymorphism of DNA bands among the yeast isolates. SRILS 1 was the most discriminatory primer, differentiating between closely related *Saccharomyces cerevisiae* strains 2103 and 2104. With SRILS 9, isolate K2 from Kiangan showed identical pattern with *Hansenula anomala* strain 2063, while both SRILS 6 and 9 revealed that isolates B3 from Banaue and K3 were very similar to *Saccharomycopsis fibuligera* strains 2076, 2077, 2081 and 2109. The unknown isolates and the corresponding genetically similar reference strains also showed comparable morphological characteristics. These results demonstrate the utility of RAPD with SRILS primers in yeast species identification and classification, and present a major step towards achieving a better control of starter constitution and rice wine quality.

**Keywords:** *bubod*, NTSYS, polymerase chain reaction, SRILS, tapuy

**BSD-40**

# ISOLATION AND SCREENING FOR BACTERIA FROM ROOTS OF SELECTED EPIPHYTIC ORCHIDS FOR GROWTH ON NITROGEN-DEFICIENT MEDIUM, PLANT GROWTH-PROMOTION, AND ANTIBIOTIC PRODUCTION

**Mary Grace Melendres Palayan and Noel G. Sabino***

Microbiology Division-Institute of Biological Science, College of Arts and Sciences, University of the Philippines Los Baños, College, Laguna

Epiphytic bacteria were isolated form the roots of five orchid species, three of which belong to the genus *Dendrobium*, one under *Phalaenopsis*, and the other under *Cymbidium*. Out of the 50 isolates observed growing on Nutrient Agar (NA) and Burk's Medium (BM) plates, 22 were Gram positive and the rest were Gram negative. Only 11 of the 20 bacterial isolates growing on Burk's Medium, a medium without nitrogen, were shown to grow on Nitrogen-Deficient Combined C (NDCC) medium and considered as potential nitrogen fixers. All isolates were screened for plant growth promotion by coating monggo (*Vigna radiate* var. *pag-asa7*) seeds with bacterial cell suspension, and then allowing them to germinate in water agar medium. Increase in height of the seedlings was used as index of growth promotion. Among the 50 isolates, only 3 isolates namely, $De_1BM8$, $DE_3SsBM4$, and $De_3IBM7$, showed statistically significant growth-promoting activity. All bacterial isolates were screened for antibiotic production. Isolates $De_2IBM6$ and $De_3SsNA5$ consistently yielded a 1-mm diameter zone of inhibition against the test organism *Bacillus subtilis*. None of the isolates had the ability to produce an antimicrobial substance against the test organism *Escherichia coli*. Preliminary characterization of the isolates capable of growing on NDCC medium and/or promoting plant growth suggest that the aerobic Gram negative con-endospore-forming rod-shaped isolates namely, $De_1SsBM6$, $De_1SsBM7$, $De_1IBM8$, $De_2SsBM3$, $De_2IBM5$ and CySBM1, may be tentatively placed under the Family Psedomonadaceae, Azotobacteriaceae, or Rhizobiaceae. Isolate $De_1SBM1$ which is a Gram positive non-endospore-forming aerobe, on the other hand, can be tentatively classified as a member of either the genus *Kurthia, Renibacterium, or Caryophanon*. Isolate PhSsBM4, a budding Gram positive non-endospore-forming obligate aerobe, may be a species of the genus *Hyphomicrobium*. Whereas the Gram positive endospore forming rods namely, $De_3SsBM4$ and $De_3IBM7$, may be tentatively identified as members of the genus *Bacillus*.

**Keywords**: epiphytic bacteria, orchids, plant growth promotion, antibiotic production, nitrogen fixation

**BSD-41**

## EFFECT OF PLANT PRESERVATIVE MIXTURE (PPM) ON CONTAMINATION RATE AND GROWTH OF *Vanda sanderiana* Reichb.F. SEEDLINGS (ORCHIDACEAE) IN VITRO

**Alexander B. Quilang*, Norberto R. Bautista, Gale B. Taylan and Rachel F. Madera**

Plant Biotechnology Project, Research & Development Center
Rizal Technological University, Boni., Ave., Mandaluyong City
Tel: 534-8267 loc 123; Fax: 534-9710; Email: plantbiotech_rtu@yahoo.com

Plant Preservative Mixtureä (PPM), a proprietary broad-spectrum preservative or biocide was studied to determine its effectiveness and optimum level/ concentration in reducing microbial contamination in orchid culture bottles. Different levels of PPMä (0, 0.125, 0.25, 0.50, 1.0, 2.0 and 4.0 ml/l media) were added to Knudson C. Unsterilized *Vanda sanderiana* seeds were inoculated on the media for each treatment. Contamination was observed for each treatment and results were converted to percentile. Percentage contamination decreased as preservative mixture concentration in basal media increased. Therefore, the preservative mixture appeared to be effective in minimizing microbial contamination in culture bottles.

**Keywords**: *Vanda sanderiana*; orchids; PPM; biocide; anticontaminant

**BSD-42**

## MYKOVAM AND PLANT GROWTH PROMOTING RHIZOBACTERIA FOR GROWTH ENHANCEMENT OF *Jatropha curcas*.

**Jocelyn T. Zarate* and Lilia M. Fernando**

National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Baños, College, Laguna
Email: joytzarate@yahoo.com and limafe226@yahoo.com

*Jatropha curcas*, a non-edible oil bearing and drought-hardy shrub is a potential renewable alternative source of biodiesel. Massive planting is currently on-going in many areas of the country. Most of these areas are acidic, infertile and unsuitable for good plant growth. The economics of the industry depends signifi-

cantly on production yields that should not only rely on application of expensive, imported chemical fertilizers. The effect of mycorrhizal inoculant "Mykovam" and plant growth promoting Rhizobacteria (PGPR) on the growth of Jatropha seedlings grown in unsterilized field soil was investigated.

Results showed that inoculation with Mykovam and PGPR at transplanting time, either singly or combined, significantly promoted taller height, wider stem diameter, larger leaf area, longer root length and heavier biomass of Jatropha seedlings after three months in the nursery. Root length and total leaf area were significantly longer and larger when both biofertilizers are present, as compared to when inoculated singly. Similarly, nitrogen and phosphorus uptake of seedlings was higher with both biofertilizers present. The phosphorus and nitrogen nutrition of the seedlings was greatly enhanced, due to the synergistic interaction of the Rhizobacteria and mycorrhizal fungi. Survival and growth of seedlings in the field are being monitored to determine if this good growth in the nursery will translate to early plant maturity and increased seed yield.

**Keywords**: *Jatropha curcas*, Mykovam, plant growth promoting bacteria, mycorrhiza

**BSD-43**

## EVALUATION AND CHARACTERIZATION OF OIL CELLS IN SEEDS OF *Jatropha curcas* L.

**Vivian S. Tolentino*, Patricia Cruz, Carlo Santos, Vivian Panes, Wilberto Monotilla**

Department of Biology, Ateneo de Manila University
Loyola Heights, Quezon City
Telefax: (632) 4261034; Email: vtolentino@ateneo.edu

The oil from *Jatropha curcas* L., commonly called "tubang bakod" is a promising alternative source of energy, specifically biodiesel. However, efficient extraction of oil is yet unattainable due to the undetermined location of oil cells. This study focuses on the characterization oil cells in seeds at different developmental stages based on cell type, cell wall, form and shape. Determining the exact location of cells in the different tissues of the seed may aid in efficient extraction and cost effective production of oils. Preliminary test for the presence of oils was done by determining the percent composition of the different tissues in the seed This was done in order to ascertain which tissue in the seed may possibly contain the greatest volume of oil as may be correlated in the number of oil cells. It

was observed that the outer seed coat and endosperm greatly composed the seed weight. The outer seed coat and endosperm were later pounded using a pneumatic clicker and applied on oil control films to test oil yield. It was observed that the outer seed coat was devoid of oil while the endosperm has oil. Middle-aged and mature endosperms were also sectioned with a sliding microtome, and stained with Sudan rot B and viewed under a CH-20 Olympus light microscope and CK-2 Olympus inverted microscope. It was observed that oil cells appeared red with Sudan Rot B. The endosperm of the seeds showed oil cells interspersed with circular dark staining parenchyma cells, with foamy cytoplasm and a three-layered cell wall, outer and inner cell wall and a middle suberin layer.

**Keywords**: oil cells, Sudan Rot, parenchyma, suberin, cell wall

**BSD-44**

## ISOLATION, SCREENING AND IDENTIFICATION OF SULFATE-REDUCING BACTERIA AND EVALUATION OF THEIR ABILITY TO PRECIPITATE COPPER FROM WASTEWATER SOLUTION

**Lorele C. Trinidad [1]* and Rhea G. Abisado[2]**

[1]BIOTECH and [2]Institute of Biological Sciences
University of the Philippines Los Baños, College, Laguna 4031

Concern for health and environmental hazards posed by heavy metal contamination led to the elucidation of the potential use of sulfate-reducing bacteria (SRB) as bioremediation agents in copper-contaminated water, soil or sediments. Eight $H_2S$-producing bacteria were isolated from an abandoned mine site in Mogpog, Marinduque. Among the eight bacterial isolates, RA-4 exhibited the highest (14.72 mg/100ml) $H_2S$ production which was quantified using the iodometric titration method. A decline in $H_2S$ production was observed for all isolates after nine days of incubation except for isolate RA-3 with 12.13 mg/100 ml $H_2S$. Partial morphological and biochemical characterization of the local isolates temporarily placed them under subgroup 2 or subgroup 3 of the dissimilatory sulfate-reducing bacteria.

Flame atomic absorption spectrophotometric (FAAS) analysis of copper-containing sulfate reducing medium (SRM) inoculated with the selected isolates showed that isolate RA-4 exhibited the highest amount (75.85%) of copper precipitated from solution. This proves that indigenous SRB could be used as an effective agent for bioremediation for copper-contaminated wastewaters.

**Keywords**: Sulfate-reducing bacteria (SRB), bioremediation, copper precipitation

**BSD-45**

# OFF BOTTOM CULTURE OF *Caulerpa lentillifera* AGARDH IN THREE DIFFERENT WATER LEVELS IN THREE DIFFERENT SITES USING DIFFERENT CULTURE MEDIA IN THE MARINE WATERS OF SAN FRANCISCO, CEBU, PHILIPPINES

**Serapion N. Tanduyan, Ricardo B. Gonzaga, and Virginia D. Bensig**

Cebu State College of Science and Technology- Fishery and Industrial College
6050 San Francisco, Cebu Campus
Telefax: 032-4970318; Email: standuyan@yahoo.com

*Caulerpa lentillifera* has been reared traditionally in bottoms of fishponds. This was first reared in Mactan Island, Cebu Philippines in ponds and considered as one of the export commodities because of its high demand. Conversion of mangroves into ponds has been banned in the Philippines and the off bottom culture of this alga was studied in order to find its growth in an open and natural body of waters cultured at three different water levels and different culture sites.

This study used the Randomized Block Design (RCBD) with four culture media as treatment. Treatment 1 used plastic screen cage: Treatment 2, tubular plastic screen: Treatment 3 nylon screen cage and Treatment 4 tubular nylon screen. The culture media were placed in a bamboo raft where this was divided into three layers representing the surface, midlayer and the bottom layer and placed in different sites which are muddy, rocky and sandy bottom. Sampling was done every15 days for 3 months taking wet weight of the plant as factor.

Results show that as to the efficiency of each culture medium based on the water level it was found out that on the surface level the *Caulerpa lentillifera* placed in plastic screen cage has the highest growth rate in Site 1 (muddy site) and tubular nets ranked first in site 2 (rocky) and site 3 (sandy).

For the middle layer based on the mean weight of the plant it showed that tubular nets has the highest in site 1 (muddy) and plastic screen cage got the highest in site 2 (rocky) and 3 (sandy).

For the bottom layer of the marine area the tubular plastic screen dominates the highest growth rate of all the culture medium used from site 1, 2 and three.

Analysis of Variance (ANOVA) revealed that there is no significant difference on the growth rate of *Caulerpa lentillifera* placed in plastic screen cage, tubular nets with the different water levels in the three culture sites.

**Keywords**: *Caulerpa lentillifera*, off bottom culture, Water levels and San Francisco, Cebu Philippines.

**BSD-46**

# ASSOCIATED BACTERIA IN *Kappaphycus alvarezii* THALLI EXHIBITING "ICE-ICE" AND NORMAL PHENOTYPES FROM THE KOLAMBUGAN AREA OF PANGUIL BAY, LANAO DEL NORTE

**Wanda Andriene D. Aguja, Franco G. Teves*, Faith B. Amorado and Henry I. Rivero**

Molecular Genetics and Microbial Technology Laboratory,
Department of Biological Sciences,
College of Science and Mathematics, MSU-Iligan Institute of Technology
9200 Iligan City
*Telefax: (063) 351 6131 Email: franco_teves@yahoo.com

"Ice-ice" is a coined term describing the white, icy appearance of seaweeds affected by a disease of still undetermined etiology. Panguil Bay in Northern Mindanao, which is formed by shorelines extending from the coastal areas of Lanao del Norte to areas in Misamis Occidental, has been the site of recent "ice-ice" devastation, endangering its dollar-earning industry.

Bacterial profile of both "ice-ice" affected and normal *Kappaphycus alvarezii* thalli were examined by comparing total bacterial load and bacterial genera that grow under aerobic conditions using nystatin-supplemented nutrient agar prepared with sterile filtered seawater.

Results show apparent higher average bacterial load in thalli with "ice-ice" phenotype ($2.58 \times 10^5$ colony-forming units/ gram sample, CFU/g) compared to those with normal phenotype ($8.5 \times 10^3$ CFU/g) from three sampling periods.

Bacterial genera present in the healthy thalli include *Bacillus, Listeria*, and *Lampropedia*, while those present in thalli with "ice-ice" symptoms are *Pseudomonas, Staphylococcus, Proteus, Listeria, Erwinia*, and *Xanthomonas*. The presence of *Bacillus* sp. most probably indicates soil contamination. The presence of *Listeria* sp., *Staphylococcus* sp., and *Proteus* sp. gives some indication of contaminants from human or animal sources. The genus *Lampropedia* indicates the presence of high organic content of the aquatic environment. Both *Erwinia* and *Xanthomonas* have species that are plant pathogens.

Although it is difficult to assign a particular bacterial group as the etiologic agent of "ice-ice", the bacterial profile obtained already provides vital information on the hydrologic conditions in the environment where the seaweeds are cultivated. However, the possible direct pathologic activities of *Pseudomonas, Erwinia*, and *Xanthomonas* isolates could not be ruled out, since members of these Gram-negative genera are known to be plant pathogens.

A logical proactive approach to seaweed cultivation therefore would be to ensure good water quality in shallow water seaweed farming, or to adopt deep water farming techniques for seaweeds, where hydrologic physicochemical parameters are comparatively better.

**Keywords**: "ice-ice", *Kappaphycus alvarezii*, bacterial profile, colony-forming units, hydrologic conditions

**BSD-47**

## MYCORRHIZA AND BACTERIA AS GROWTH ENHANCER AND AS BIOLOGICAL CONTROL OF NEMATODES IN TISSUE-CULTURED BANANA VAR. LAKATAN

**Paul Jemuel S. Tamayao[1], Nelly S. Aggangan[2] and Teodora O. Dizon[3]**

[1]UP Rural High School, Paciano Rizal, Bay, Laguna
[2]National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Baños, College, Laguna 4031
Tel/Fax: 049 536 0563; Email: nea@laguna.net
[3]Plant Pathology, Institute of Plant Breeding, Crop Science Cluster
University of the Philippines Los Baños, College, Laguna 4031

This study was conducted to determine the potential of mycorrhizal fungi and nitrogen fixing bacteria as growth promoter and as biological control against nematodes in tissue-cultured banana var. Lakatan under screenhouse conditions. This experiment was conducted following a Randomized Complete Block Design with nine treatments and 10 replicates per treatment. Meriplants were potted in cups filled with sterile soil sand mixture, immediately upon arrival. Mycorrhizal inoculant "MYKOVAM" containing mixture of *Glomus* and *Gigaspora* was placed in contact with the roots during potting after the roots were dipped in slurry of Bio-N containing N-fixing bacteria *Azospirillum* spp. Nematodes *Radopholus similis* and *Meloidogyne incognita* solutions were poured into the soil, two months after inoculation with mycorrhiza at concentrations of 1,000 and 5,000 larvae or eggs per seedling, respectively. Height, diameter, leaf length and leaf width were taken every two weeks until four months.

Results show that mycorrhiza and mycorrhiza + bacteria inoculated seedlings grew better than those of the control treatment. Growth of plants treated with *R. similis* alone and *M. incognita* alone was comparable with the control. The effect of *R. similis* was not so pronounced as the root lesions were just starting unlike the effect of *M. incognita* where numerous galls were found in the roots. Neither

*R. similis* or *M. incognita* suppressed the colonization of mycorrhizal fungi in the roots of Lakatan seedlings. By contrast, the two nematodes decreased the bacterial colonies obtained from roots of mycorrhiza + bacteria plants. *M. incognita* gave higher reduction in the number of colony forming units of *Azospirillum* than *R. similis*. In terms of the plant growth, mycorrhiza with or without bacteria + *M. incognita* were taller, had bigger diameter and larger leaf area than the control and the other treatments. This implies that mycorrhizal plants were tolerant to nematodes. There were no significant differences between growth of plants with mycorrhiza alone or mycorrhiza + bacteria. More importantly, mycorrhizal plants gave the highest fine and coarse root dry weights. This is a very critical factor since roots are the water and nutrient absorbing organs of plants that is directly correlated to plant growth and health.

**Keywords**: Lakatan banana, mycorrhiza, nitrogen fixing bacteria, nematodes

**BSD-48**

## DIFFERENTIAL ANGIOGENIC MODULATION IN THE CHICK EMBRYO CHORIOALLANTOIC MEMBRANE (CAM) ASSAY BY POLAR AND FRACTIONAL POLYSACCHARIDE EXTRACTS OF *Ganoderma applanatum*

**Franco G. Teves[1*], Michael Cereno M. Bajo[1], Lydia M. Bajo[2]**
**Roberto M. Malaluan[3]**

[1*] Molecular Genetics and Microbial Technology Laboratory, Department of Biological Sciences, College of Science and Mathematics
Telefax: (063) 351 6131 Email: franco_teves@yahoo.com
[2] Department of Chemistry, College of Science and Mathematics
[3] Department of Chemical Engineering Technology
School of Engineering Technology
MSU-Iligan Institute of Technology, 9200 Iligan City

Angiogenesis refers to the formation of new blood capillaries, which occurs in both physiological and pathological processes in humans. It is an important factor in wound healing, growth of adipose tissue, and as a component of the female menstrual cycle. In tumor progression, angiogenesis is a requirement for neoplastic growth and survival.

Angiogenic modulating substances were obtained from the bracket fungus *Ganoderma applanatum* through fractional polysaccharide (FPS) and supercritical carbon dioxide extraction (SF-$CO_2$) protocols. Four crude polysaccharide extracts from the FPS and one polar extract from the SFE using high pressure $CO_2$ (300

atmospheres or atm) at 40æ%C, were tested for angiogenic modulation using the chick embryo chorioallantoic membrane (CAM) assay.

Three out of four crude polysaccharide residues showed significant inhibition on angiogenesis, whereas significant angiogenic stimulation was observed with the polar residue. This was statistically confirmed using a CRD factorial analysis of data obtained from the CAM assay. These results reveal a cocktail of diverse biologically active compounds in the fungal extract with biomedical potential. The documented anti-neoplastic effects of the polysaccharide residues reported in China and other Asian countries may be due to their anti-angiogenic properties. On the other hand, angiogenesis stimulation by the polar residue may be utilized in enhancing transplanted organ survival and as an adjunct treatment for paralysis caused by blood vessel damage.

This is the first study reported in the Philippines and elsewhere on the use of the CAM assay for determining the angiogenic modulation effects of *Ganoderma applanatum* extracts.

**Keywords**: angiogenesis, neoplastic growth, fractional polysaccharide, supercritical carbon dioxide extraction, chorioallantoic membrane assay, *Ganoderma applanatum*

**BSD-49**

## OPTIMIZATION OF PRODUCTION AND PARTIAL PURIFICATION OF PEDIOCIN FROM *Pediococcus acidilactici* PNCM 10289

**Sheila Mae N. Sagpao[1], Francisco B. Elegado[2]* and Agnes F. Zamora[1]**

[1]Institute of Biological Sciences, College of Arts and Sciences
[2]National Institute of Molecular Biology and Biotechnology
University of the Philippines Los Baños, College, Laguna 4031
*Email: fbelegado@hotmail.com

The influence of several nutritional and non-nutritional factors on the fermentative production of pediocin, an antilisterial peptide produced by *Pediococcus acidilactici* PNCM 10289, was studied. Initial results showed that bacteriocin activity of the medium supernatant was optimal (6,400 AU/mL) at 10 h in Tryptose-Glucose-Yeast Extract (TGE) broth incubated at 40 °C with an initial pH of 6.0.

Initial medium optimization, specifically carbon and nitrogen sources in the production of the bacteriocin, was also done. A maximum activity of 12,800 AU/mL was obtained in the base medium with 3% brown sugar as carbon-source and

supplemented with 2% trypticase as nitrogen-source. Results also showed that a bacteriocin titer of 6,400 AU/mL, equal to that obtained using synthetic TGE medium, was obtained using the base medium supplemented with a cheaper N-source which was soybean meal (1%). A maximum bacteriocin activity of 12,800 AU/mL was obtained from the base medium using a cheaper C-source (2% molasses) instead of 3% brown sugar and supplemented with 1% soybean meal. Also, in this base medium, crude yeast extract obtained by boiling baker's yeast was utilized as a substitute for commercial yeast extract.

From 1 L of de Man, Rogosa and Sharpe (MRS) medium used for cell culture, bacteriocin activity of 51,200 AU/ml was recovered in a 50 ml semi-purified extract by adsorption of the bacteriocin on to the bacterial cells at pH 6.0 and desorption at pH 2.0. However, when the cells were grown in the formulated medium, the purification method gave less bacteriocin titer (6,400 AU/ml) due to adsorption on to other solid components of the medium. After the insoluble $CaCO_3$ was removed from the culture medium, a higher bacteriocin activity of the extract (12,800 AU/mL) was obtained.

**Keywords**: bacteriocin, *Pedicoccoccus acidilactici*, pediocin, substrate, optimization

**BSD-50**

## PRODUCTION AND CHARACTERIZATION OF PECTINASES BY *Aspergillus niger* IN SOLID STATE FERMENTATION WITH COCONUT HUSK

**Jennifer D. Saguibo[1], *Veronica C. Sabularse[2], and Chay B. Pham[3]**

[1,3]National Institute of Molecular Biology and Biotechnology (BIOTECH)
[2]Institute of Chemistry, College of Arts and Sciences
University of the Philippines Los Baños, 4031, College, Laguna, Philippines
Telefax: (049) 536-2721; E-mail address: jen-saguibo@yahoo.com.ph

Pectinases are a group of enzyme that attack and depolymerize pectin by hydrolysis and transelimination as well as by de-esterification reaction which hydrolyze the ester bond between the carboxyl and methyl group pectin. They are produced by a variety of microorganisms but the filamentous fungi *Aspergillus niger* is most widely used.

Production and characterization of pectinases, particularly pectin transeliminase (PTE) and polygalactoronase (PG), by *Aspergillus niger* van Tieghem with dried coconut husk as a substrate was studied in solid-state fermentation

system. Strain of filamentous fungi used in research was isolated from rotten young coconut husk and selected for their capacity to produce pectinase. The best fungal strain, MH 29, exhibited the highest pectinase under the optimum conditions: pH 6, 30°C and 80% moisture content. The result of SDS -PAGE showed that pectinase obtained from extract of fermented coconut husk contained both PG and PTE with 45 KD and 39.5 KD, respectively. Both enzymes exhibited an optimum pH of 4.0 and an optimum temperature of 50 °C. The activation energy of PG KJ/mol while that of PTE was 1.10 KJ/mol. Km and Vmax were 8.86 mg/ml and 0.027733 min/umole reducing sugar, respectively, for PG. PTE was found to have a Km of 5.71 mg/ml and Vmax of 0.01665 min/increase in absorbance at 235 nm.

**Abbreviations**: PG - polygalacturonase, PTE - pectin transeliminase, KD - kilodalton

**Keywords**: *Aspergillus niger*, solid-state fermentation, pectinase, polygalacturonase, pectin transeliminase

**BSD-51**

## NATURAL FERMENTATION OF COFFEE PULP: A MICROBIOLOGICAL ANALYSIS

**Yolanda A. Ilagan*, Joyce C. Mojica, Airene C. Panganiban, Randy Capala and Ven Michael U. Feraer**

Cavite State University Indang, Cavite, Philippines
Email: yoly_ilagan@yahoo.com

Coffee pulp was supplemented with forages, ipil-ipil and molasses and allowed to ferment without bacterial inoculum for three months. Proximate and chemical analysis of the fermented product showed that among the treatments, T1 (coffee pulp and molasses) had the highest moisture content, total sugars and reducing sugars; T2 (coffee pulp, molasses and napier grass) gave the highest ash and phosphorus content, sufficient crude fat and lowest pH; T5 (coffee pulp, molasses and ipil-ipil) had significantly high crude protein, calcium and nitrogen free extract; T8 (coffee pulp, molasses, para grass and ipil ipil) had the highest crude fiber content T4 (coffee pulp, molasses and paragrass) gave the highest lactic acid concentration.

Microflora of naturally fermented coffee pulp included 11 bacterial genera, *Bacillus, Propiniobacterium, Staphylococcus, Micrococcus, Enterococcus, Planococcus, Enterobacter, Erwinia, Citrobacter, Pseudomonas* and *Alcaligenes*; seven mold genera, *Aspergillus, Acremonium, Penicillium, Cephalosporium,*

*Helminthosporium, Fusarium, Cladosporium* and the yeast genus *Candida*. Lactic acid bacteria were also isolated but the species were not identified.

In another experimental set-up, coffee pulp plus molasses and ipil-ipil was inoculated with different bacteria ( *Leuconostoc mesenteroides, Lactobacillus plantarum, Pediococcus pentosaceus* and *Pediococcus cerevisiae*) prior to fermentation. Statistical analysis showed insignificant differences (P>.05) among treatments in terms of ash, moisture, crude fat and crude fiber but significant differences (P< .05) in terms of crude protein and nitrogen free-extract. The organisms isolated included the bacteria *Bacillus, Pseudomonas, Enterobacter, Staphylococcus* and *Micrococcus* and lactic acid bacteria; molds, *Aspergillus, Acremonium, Fusarium, Penicillium, Helminthosporium, Goetrichum Alternaria* and yeasts, *Hansenula and Candida.*

**Keywords**: natural fermentation, coffee pulp, proximate analysis, lactic acid

**BSD-52**

## CHARACTERIZATION OF BACTERIOCINOGENIC LACTIC ACID BACTERIA ISOLATED FROM PHILIPPINE FERMENTED FOODS

**Vanessa Marie T. Lim[1], Andrea Therese R. Gervasio[1], Marilou R. Calapardo[2], Jennifer D. Saguibo[2], Marilen M. Parungao[1] and Francisco B. Elegado[2]***

[1]Department of Biology, College of Arts and Sciences
University of the Philippines Manila, Padre Faura, Manila
[2]National Institute of Molecular Biology and Biotechnology
University of the Philippines Los Baños, College, Laguna
*Email: fbelegado@hotmail.com

One hundred sixty putative isolates of lactic acid bacteria (LAB), obtained from twenty fermented foods purchased from public markets in Central Luzon, were screened for bacteriocin production. Boiled and pH-neutralized culture supernatants of the LAB isolates were spotted on to agar plates using *Listeria monocytogenes* (Lm) or *Enterococcus faecium* (Ef) as indicator microorganisms. Thirty LAB isolates showed bacteriocin activities, eight of which had high activity against Lm (e" 6,400 AU/ml) and good activity against Ef (e" 1,600 AU/ml).

The nature of bacteriocin encoding genes was determined through polymerase chain reaction (PCR) assay using primers for pediocin, plantaricin, nisin and lactococcin. The template DNA were aqueous extracts from cells of LAB isolates added with HPLC water and treated in boiling water bath for 10 min.

Results showed that five were positive for pediocin gene, two for plantaricin gene and two for nisin gene. None encoded for lactococcin gene and it was presumed that the remaining bacteriocins were of other types.

Two high bacteriocin-producing LAB isolates, namely strains 3G3 and 4B1, were selected and tested for acid and bile resistance. They were identified as *Lactobacillus pentosus* and *L. fermentum* using API 50CHL id kit, respectively. Both strains were relatively stable upon exposure for 3 hr to pH 3 artificial gastric juice (AGJ) with 0.2% pepsin. At pH 2, both gave more than 60% viability after 3 hr in AGJ. Further incubation for 3 hr in simulated intestinal fluid (SIF), containing 0.3% Oxgall (bile), gave 45% and 72% viability for 3G3 and 4B1, respectively. *L. fermentum* 4B1 had both good acid and bile tolerance. This particular LAB has very good probiotic potential with added high bacteriocin production, properties that are very attractive in the development of new probiotic food and drinks.

**Keywords**: *bacteriocin, polymerase chain reaction (PCR), probiotic lactic acid bacteria*

**BSD-53**

## EXTRACTION AND EVALUATION OF KAPPA CARRAGEENAN FROM *Kappaphycus alvarezii* (SACOL VARIETY) AS SUBSTITUTE FOR AGAR IN MICROBIOLOGICAL MEDIA

**Lorna T. Enerva[1], Monica Marie A. Jocson[2], and Rolando S. Pispis[2]**

[1]SciTech R and D Center
[2]College of Science, Polytechnic University of the Philippines
Email: lorna enerva@yahoo.com

Kappa carrageenan was extracted from *Kappaphycus alvarezii* (Sacol variety), red seaweed that grows widely in almost all parts of the Philippines. Twenty grams of the seaweed was soaked in 700 mL of hot distilled water for one hour, boiled for 1.5 hours, filtered and 95% isopropyl alcohol was used as the precipitating agent. The moisture content 11.89%, ash 25.83% and acid-insoluble ash 0.92% conformed to the specifications set by USPXXII (1990). The value for the gelling property of 5.87 sec is necessary for a gelling agent in microbiological agent. The obtained molar ratio for 3,6 anhydrogalactose and galactose signify a regular structure of the products although the result for the determination of the sulfate content of 11.73 was low. The IR spectrum showed similar absorption curve with the known idealized Kappa Carrageenan. The UV-Vis spectrum showed maximum wavelength at 198 nm with absorbance of 1.458.

A microbiological media was prepared with 2.0% of kappa carrageenan and evaluated by using a reference media which is a commercial bactoagar. Kappa carrageenan showed little difference between the gelling and melting temperatures compared to the big difference shown by agar. The performance of the kappa carrageenan media gave a better acceptability for not exceeding the + or -30.00% difference between the sample and the agar (standards) in the culture of *Escherichia coli* and *Staphylococcus aureus* using the streak plate method and swabbing method.

**Keywords:** microbiological media, seaweed, streak plate method, swabbing method

**BSD-54**

## DEVELOPMENT OF AN ANTIBODY ASSAY FOR *Blastocystis hominis* INFECTION

**Korina Ada D. Tanyu[1] and Windell L. Rivera[1,2*]**

[1]Institute of Biology, College of Science, University of the Philippines Diliman
[2]Molecular Protozoology Laboratory, Natural Sciences Research Institute, University of the Philippines Diliman
Tel No. 920-5471; Email address: wlrivera@up.edu.ph

*Blastocystis hominis* is a common intestinal protozoon found in humans and animals. However, its pathogenicity is still questionable. This study aimed to develop an antibody assay for *B. hominis* using the indirect fluorescent antibody test (IFAT). Stool and serum samples were collected from public hospitals in Metro Manila. The presence of *Blastocystis* in the stool samples were checked using microscopy and polymerase chain reaction (PCR). Results show that not all PCR- or microscopic-positive samples are positive for serum antibodies using IFAT. It is possible that the infection is fairly recent for individuals that were positive for microscopy, PCR, or both but negative for IFAT. There were microscope-negative samples that were positive for IFAT due to the presence of the persisting IgG even after infection is gone. The average titer is 1/22. There were 7 samples with ¼ titer, 7 samples with 1/16 titer, and 4 samples with 1/64 titer. Individuals from this study may be asymptomatic as titers obtained were not high. Chronic exposure to the organism is required to elicit a strong humoral response. *B. hominis* affects individuals regardless of their status as no relationship is observed among age, sex, and microscopic and immunological diagnoses.

**Keywords**: *Blastocystis hominis*; protozoa; indirect fluorescent antibody test (IFAT); polymerase chain reaction (PCR)

**BSD-55**

# COLONY GROWTH OF PHILIPPINE ISOLATES OF *Blastocystis hominis* IN SIMPLIFIED SOFT AGAR MEDIUM

**Ezra M. Valido[1] and Windell L. Rivera[1,2*]**

[1]Institute of Biology, College of Science
[2]Molecular Protozoology Laboratory, Natural Sciences Research Institute
University of the Philippines Diliman
Tel No. 920-5471; Email address: wlrivera@up.edu.ph

*Blastocystis hominis* is a protozoan that is often observed in the human gut and in various animal hosts such as reptiles, amphibians, and some mammals. It is a polymorphic organism both morphologically and genetically. Agar cloning technique of *B. hominis* has been observed in both solid and semi-solid agar using Iscove's modified Dulbecco's medium (IMDM). In this study, Philippine isolates of *B. hominis* were grown by pour plate method in semi-solid agar using Locke's solution. Inoculated plates contained 0.7% agar, 10% horse serum and 0.1% sodium thioglycollate. Plates were incubated at 37 °C in microaerophilic jar for 7-10 days. Biconvex disk-shaped colonies were seen and abound at the bottom half of the medium. Colonies growing at the agar-glass interface were flat and consisted of thin layers of cells. From these colonies, large amoeboid-cells were frequently seen on the periphery while smaller cells were concentrated at the core. Analysis of the SSU rDNA genetically established the identity of the clones to be *B. hominis*. This is the first report on agar cloning of *Blastocystis* in a compound medium.

**Keywords**: *Blastocystis hominis*; protozoa; colony growth; agar cloning

**BSD-56**

# BIOACTIVE COMPOUND/S FROM ETHANOLIC EXTRACTS OF *Cajanus cajan* (Linn.) Mill sp. (Pigeon Pea)

**Manilyn R. Rodriguez*, Agapito D. Castillo,Jr.*,Joyve Charisma E. Dapito*, Darlene A. Macaraig* and Teofila O. Zulaybar****

*Batangas State University, Batangas City
** National Institute of Molecular Biology and Biotechnology
University of the Philippines Los Banos, College, Laguna, Philippines
Telefax No. (063-049) 5362724:E-mail-teofilazulaybar@yahoo.com

Natural products, mainly of plant origin, have been used for the treatment of diseases. World Health Organization estimated 80% of the world's population rely mainly on traditional medicines for primary health care. In the Philippines, more than 300 medicinal plants were traditionally used as substitutes for modern cures in healing illnesses. One of the medicines which had been used as remedy for variety of ailments such as cough, sore gums, bronchitis is *Cajanus cajan*. Different plant parts the roots, stem and leaves were extracted with ethyl alcohol (95%). Preliminary screening of the crude extracts was done by paper disc method using *Staphylococcus aureus* 1823, *Bacillus subtilis* 1514, *Escherichia coli* 1824, *Salmonella typi* 1756, *Candida albicans* 2219 and *Aspergillus parasiticus* 3055 as test organisms. Streptomycin (1000 ppm) was used as positive control for bacteria, Nystatin (100,000 units/ml) for yeast, cycloheximide (1000 ppm) for molds and ethyl alcohol as negative control. The active extract was dried in rotary evaporator and diluted with ethyl alcohol at 10000 ppm concentration. MIC and bioautography were done using *S. aureus* and *B. subtilis* as test organisms.

Paper disc assay showed that only crude leaf extract is effective against *S. aureus* and *B. subtilis* (16 mm and 18.7mm dia. zone of inhibition, respectively ) which is significantly different against the control antibiotic (22.0 and 32.7 mm, respectively) by DMRT but not effective against the other test organisms. Leaf extract also showed inhibitory activity against *S. aureus* and *B. subtilis* with MIC of 62.5 and 31.25 ppm, respectively. Several spots were observed on TLC viewed under 366nm UV. Bioautography showed 1 very big active spot against *S. aureus* and *B. subtilis*. Results showed that the leaf extract of *Cajanus cajan* can be a potent source of bioactive compound that may replace some of the synthetic drugs being used today.

**Keywords**: *Cajanus cajan*, *S. aureus*, *B. subtilis*, mic,tlc

**BSD-57**

## PCR-BASED DETECTION OF BANANA BUNCHY TOP VIRUS IN *Pentalonia nigronervosa* Coquerel

**Kristine Ace F. Quirante, Maria Armila D. Ruiz, and Vermando M. Aquino***

National Institute of Molecular Biology and Biotechnology
University of the Philippines - Diliman, Quezon City
Tel: (632) 927-7516; Email: vmaquino@up.edu.ph

*Pentalonia nigronervosa* or banana aphid is the insect vector for the banana bunchy top virus (BBTV), which infects members of the Musaceae family such as banana and abaca. A reliable and sensitive detection system for the virus in its insect vector is important in the study of virus replication and movement. This study reports on the development of a polymerase chain reaction (PCR)-based detection system for BBTV in whole and dissected components of *P. nigronervosa*. Specific primers were designed based on the movement protein gene of BBTV and tested using several PCR profiles. Upstream conditions, such as total DNA extraction, were also varied in order to improve the amplification of the target sequence. Aphids were dissected and DNA extraction and PCR amplification were performed separately for the head, thorax, and hemolymph. Using the optimized conditions of DNA extraction and PCR primer-profile combination, PCR was able to detect BBTV in the whole and dissected components of the aphid.

**Keywords**: aphid, banana bunchy top virus, movement protein, *Pentalonia nigronervosa*, polymerase chain reaction

**BSD-58**

## OPTIMIZATION OF ABTV DNA-4 EXPRESSION IN *E. coli*

**Maria Armila D. Ruiz and Vermando M. Aquino***

National Institute of Molecular Biology and Biotechnology
University of the Philippines Diliman, Quezon City
Tel: (632) 927-7516; Email: vmaquino@up.edu.ph

Abaca bunchy top nanovirus (ABTV) is the most important viral pathogen of abaca. The virus causes stunting and significant reduction in fiber yield. ABTV is an 18-20 nm isometric virus that has a multicomponent genome of at least six circular single stranded DNA. In this study, heterologous expression of the DNA-4 component that codes for the movement protein was optimized. Isolation and characterization of the component were performed. Total DNA was obtained using the CTAB extraction method. PCR amplifications produced a 380-bp fragment which was cloned in pEXP5-NT/TOPO vector and expressed in *Escherichia coli* BL21(DE3) strain. Conditions such as IPTG concentration, incubation period, and temperature were varied. The expression of an 11.8-kDa movement protein was analyzed through SDS-PAGE. Expression has been observed to increase with increasing IPTG concentration and incubation period. Optimum expression was obtained at 30 °C.

**Keywords**: abaca, abaca bunchy top virus, *E. coli*, heterologous expression, movement protein

**BSD-59**

# ANTAGONISTIC STUDY OF *Agaricus blazei* MURILL IN PATHOGENIC FUNGAL ISOLATES

**Roma May D.G. Garcia[1], Maria Marah L. Rodriguez[1] and Angelita P. Medalla[1,2]***

[1]Biology Department, College of Arts and Sciences,
[2]Mushroom Biotechnology Laboratory, Research and Development Center
Rizal Technological University
Boni Avenue, Mandaluyong City 1550
Tel No.: 534-8267 loc 123; Fax No.: 534-9710
Email: angie_p_medalla@yahoo.com

Solid and submerged culture conditions were used to investigate the antagonistic properties of *Agaricus blazei* Murill against five test fungi namely *Aspergillus niger, Fusarium moniliforme, Trichoderma spp., Penicillium spp., and Rhizopus spp.* The cultural and morphological characteristics of the microorganisms; the development of mycelia and spores; and the color and appearance at different incubation times were observed. Interaction of the five test fungi was evaluated using the method of Bell et al. (1982). The incubation period was observed on the seventh and fourteenth day of competing. Minimum Inhibitory Concentration (MIC) and Mycelial Free Culture (MFC) determination in 24 and 48 hours were also tested. Mycelial free culture fluid (MFCF) was used to test the antagonistic activity of *A. blazei* in submerged culture condition. A parallel comparison was compared having three incubation periods in determining antagonistic property of *A. blazei* in five test fungi. From the different culture conditions that have been acquired, test fungi had overgrown *A. blazei* in both Potato Dextrose Agar (PDA) and Malt Extract Agar (MEA) in fourteen days of incubation periods. In MFC Fluid, the growth of test fungi in MEA was negative compared with the positive growth in PDA. Generally, *A. blazei* was colonized by the test fungi in two culture conditions tested while a negative zone of inhibition were observed in all the techniques used. Beta D-glucan in the mycelium of *A. blazei* was found to be not as active as those in the fruiting bodies. Hence, the use of fruiting bodies is recommended.

**Keywords**: antagonistic activity, *Agaricus blazei* Murill, Minimum Inhibitory Concentration, MIC, Mycelial Free Culture, MFC, Malt Extract Agar, MEA, beta D-glucan

**BSD-60**

# A RANDOM AMPLIFIED POLYMORPHIC DNA MARKER AS SOURCE OF PRIMER SEQUENCES FOR PCR-BASED DETECTION OF *Escherichia coli* O157:H7

**Maria Teresa M. Perez* and Susana M. Mercado**

National Institute of Molecular Biology and Biotechnology
University of the Philippines Los Banos
College, Laguna 4031
Telefax: (049) 5362721; Email: mtmperez14@yahoo.com.ph

*Escherichia coli* O157:H7 is considered the most virulent strain among the enterohemorrhagic strains of *E. coli* (EHEC). It has been isolated from fecal matter of cattle, wild birds and domestic animals. Infection of humans arise from fecal contamination of milk products and the water supply, contact of intestinal contents with meats in slaughterhouses, contamination of fresh produce with animal manure, and direct contact with an infected animal or human. Early identification of contaminated foods, water and beverages will ensure disease prevention, thus, the importance of a reliable, speedy and sensitive means of detecting the strain.

The study aimed to test the applicability of a single 0.85 kb DNA marker obtained from amplification of *E. coli* O157:H7 by a random 10-base primer, BIOTECH code 12, as source of specific primer sequences for polymerase chain reaction (PCR)-based detection of the pathogen. Three *E. coli* O157:H7 reference strains, four confirmed rectal fecal isolates from cattle, two enteropathogenic *E. coli* (EPEC), two enteroinvasive *E. coli* (EIEC), two non-pathogenic *E. coli*, two *Shigella* sp., four *Salmonella* sp., three *Staphylococcus aureus*, one *Enterobacter aerogenes*, *Listeria monocytogenes*, *Yersinia enterocolitica*, *Proteus vulgaris*, and *Bacillus cereus* were subjected to PCR using primer BIOTECH code 12 and DNA hybridization analysis to determine homology of the 0.85 kb *E. coli* O157:H7 sequence with other bacteria tested. The 0.85 kb amplicon generated from the three reference strains were submitted for DNA sequencing and the partial sequence information subjected to DNA homology analysis using the Basic Local Alignment Search Tool (BLAST). Significant alignments of *E. coli* O157:H7 (10084) and (TWO2302) partial sequences showed 92% and 93% homology respectively, with O157:H7 complete genome. Two forward primers and one reverse primer were designed and tested in genomic DNA of *E. coli* O157:H7, EPEC, non-pathogenic *E. coli* and *Shigella* sp. Primer sets Ec-07f / Ec-08r and Ec-09f / Ec-08r each amplified a single 350 bp and 300 bp amplicon in all seven *E. coli* O157:H7 strains tested at 52°C annealing temperature. The randomly amplified DNA marker generated PCR primers that could specifically detect *E. coli* O157:H7.

**Keywords**: *E. coli* O157:H7, polymerase chain reaction, pathogen detection, designed primers, random amplified polymorphic DNA, sequence analysis

**BSD-61**

# OVER- EXPRESSION OF THE PHOSPHOLIPASE C GENE IN *Ralstonia solanacearum* AND ITS IMPLICATION TO VIRULENCE

**Jocelyn T. Zarate,[1] Asuncion K. Raymundo[2*] and Caitlyn Allen[3]**

[1]National Institute of Molecular Biology and Biotechnology (BIOTECH)
Email: joytzarate@yahoo.com
[2]Institute of Biological Science, College of Arts and Sciences
University of the Philippines Los Baños, College, Laguna
Email: akr@laguna.net
[3] Department of Plant Pathology, University of Wisconsin- Madison, USA
Email: cza@plantpathwisc.edu

Bacterial wilt disease caused by *Ralstonia solanacearum* is a serious and devastating disease affecting more than 200 plant species including tomato, potato, and banana. Disease control has been difficult due to its heterogeneity and the emergence of hypervirulence in existing virulent strains.

Phospholipase C was studied as it is one of the many virulence factors secreted by animal pathogens that may also contribute to plant pathogenesis, through its effect on intracellular signaling. The *R. solanacearum* wild type strain T523 was transformed with a plasmid containing *plcN* gene to determine if the introduction of such gene will result to an increase in virulence. The mutant strain (T523PlcN) with over-expressed *plcN*, grew as well as the wild type in culture, both in rich (CPG) and in minimal media (BMMG). Phospholipase C activities were determined by growing the bacteria in low phosphate medium (Hepes medium) for three days until stationary phase. The release of the yellow chromogen, p-nitrophenol after hydrolysis of the synthetic substrate p nitrophenylphosphorylcholine (NPPC) was monitored. Phospholipase assay showed that the wild type strain produced $1.85 \times 10^{-12}$ U PlcN/cfu, while the mutant strain gave 27 fold higher PlcN activity at $4.93 \times 10^{-11}$ U PlcN/cfu. Virulence testing of the wild type and mutant strains using direct petiole infiltration showed that strain T523PlcN was slightly less virulent than the wild type on susceptible tomato variety Bonny Best but both were not able to wilt the resistant variety Hawaii 7996. Phospholipase C may play a role in the signaling response of the host to the pathogen and this needs further elucidation.

**Keywords**: *Ralstonia solanacearum*, bacterial wilt, phospholipase C, virulence factors

**BSD-62**

# PHILIPPINE ACTINOMYCETES AGAINST *Erwinia carotovora*

**Irene A. Papa*, Teofila O. Zulaybar and Bernardo C. Mercado**

National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Baños (UPLB), College, Laguna 4031
*Email: iwapapa@yahoo.com

Major diseases of potatoes like blackleg and soft rot are caused by bacteria of the genus *Erwinia* (*Pectobacterium*). Since chemical pesticides are not successful against these diseases, a good alternative is the use of biological control agents to control plant pathogens. This method has gained increasing interest as a result of public concern about the ill-effects of continued chemical use in the environment and the need to find alternatives to chemical treatment.

The potential of locally isolated actinomycetes as biocontrol agents against *Erwinia carotovora* was investigated. A total of 348 actinomycetes isolated from different soil samples were screened against *E. carotovora* NRRL B 134 (BIOTECH 1752) using agar plug method. Fifty six (56) actinomycetes showed inhibition against the growth of *E. carotovora*. The ability of these isolates to produce the bioactive compounds was evaluated in two fermentation media, yeast malt broth (YMB) and Croatian fermentation medium (CFM) by cylinder cup assay. Among these isolates, Actinomycetes 63, 9B and 67, all cultured in CFM exhibited the highest zone of inhibition (ZOI) of 30.45 mm, 26.60 mm and 26.45 mm against *E. carotovora*, respectively, compared with the positive antibiotics used (erythromycin, 15 ug/ml and kanamycin monosulfate, 1000ppm) with 8.30 mm and 14.5 mm ZOI, respectively. Actinomycetes 37B, 9B and AC 43 grown in YMB, on the other hand, showed high growth inhibition of 22.20 mm, 21.60 mm and 20.25 mm, respectively. These actinomycetes with higher ZOI than the control antibiotics have the potential as biocontrol agents against *Erwinia carotovora*.

**Keywords:** Actinomycetes, *Erwinia carotovora*, agar plug assay, cylinder cup assay, biological control agents

# *CHEMICAL, MATHEMATICAL, PHYSICAL SCIENCES DIVISION*

**CMPSD-1**

## ON ANTI-CONVEXITY AND FORCING CONVEXITY IN GRAPHS

**Lyndon B. Decasa [1] and Sergio R. Canoy, Jr. [2]**

[1]Department of Mathematics
Northern Mindanao State Institute of Science and Technology, Butuan City
E-mail: lyndon_decasa2003@yahoo.com
[2]Department of Mathematics, College of Science and Mathematics
Mindanao State University - Iligan Institute of Technology, Iligan City
e-mail: csm-src@sulat.msuiit.edu.ph

This study seeks to define the anti-convexity and forcing convexity concepts in graphs and give some characterizations of graphs with a specified anti-convexity number and forcing convexity number. Furthermore, it aims to show that the anti-convexity number of a connected graph G consisting of k extreme vertices is equal to k, and determine the anti-convexity numbers of some graphs. Also, we show that the forcing convexity number of a connected graph $G$ of order $n \geq 1$ is $n-1$ if and only if it is complete graph $K_n$. Moreover, we characterize those connected graphs $G$ such that $fcon(G)=con(G)$.

The study obtained the following results:

1. If $G$ is a connected graph with $k$-complete vertices, then $acon(G)=k$.
2. Let $G$ be connected of order $n$. Then $acon(G)=n$ if and only if $G=K_n$.
3. Let $F_{m,n}$ be the generalized fan of order $m+n$. Then
   (a) $acon(F_{m,n})=2$ if $m=1$ and $n\geq 3$ or $m\geq 2$ and $n\geq 3$ or $m=n=1$;
   (b) $acon(F_{m,n})=m$ if $m\geq 2$ and $n\geq 1,2$;
   (c) $acon(F_{m,n})=3$ if $m=1$ and $n=2$.
4. Let $W_{m,n}$ be the generalized wheel of order $m+n$, where $m\geq 1$ and $n\geq 3$. Then
   (a) $acon(W_{m,n})=\frac{n}{2}$ if $n$ is even;
   (b) $acon(W_{m,n})=\frac{n+1}{2}$ if $n$ is odd;
   (c) $acon(W_{m,n})=4$ if $m=1$ and $n=3$;
   (d) $acon(W_{m,n})=m$ if $m\geq 2$ and $n=3$;
   (e) $acon(W_{m,n})=2$ if $m\geq 2$ and $n>3$.

5. Let $G$ and $H$ be non-complete graphs such that $acon(G+H)\neq 1$. Then $acon(G+H)=2$.
6. If $G$ is any graph with $Ext(G)=o$, then $acon(G+H)=|Ext(G)|$.
7. Let $G$ be a connected graph. If $S$ is a maximum convex set in $G$, then $S$ is a forcing subset for itself. In particular,
8. Let $G$ be a connected graph. If $G$ has a unique maximum convex set $S$, then the empty set $\phi$ is a forcing subset for $S$. In this case,
9. Let $G$ be a connected graph with $k$-complete vertices ($k\geq 1$).
Then $fcon(G)=k-1$.
10. Let $K_n$ be the complete graph of order $n\geq 1$. Then $fcon(K_n)=n-1$ if and only if $G=K_n$.
11. Let $G$ be a connected graph of order $n\geq 3$. Then $fcon(G)=con(G)$ if and only if for every maximum convex set $S$ of $G$, $\langle S\rangle$ is complete and $fcon(S)=|S|$.

**Keywords:** graph, convex, anti-convexity number, forcing convexity number, complete, join, set of extreme vertices

**CMPSD-2**

## INDUCED CYCLE ACCESSIBILITY NUMBER OF A GRAPH

**John Benedict T. Ayawan, Kimberly Hazel B. Camino*, Marve Ann A. Echavez, Meldren C. Garong, Joan B. Ybañez, and Rosalio G. Artes, Jr.**

Department of Mathematics, College of Science and Mathematics
Mindanao State University - Iligan Institute of Technology
Andres Bonifacio Avenue, Tibanga, 9200 Iligan City
Email: *misyr_khbc@yahoo.com.ph

Given a connected graph $G$, we define the distance $d_G(u,v)$ between two vertices $u$ and $v$ in $G$ as the length of a shortest path joining $u$ and $v$ in $G$. For any positive integer $m$ greater than 2, we define an $m$-cycle of $G$ as a cycle in $G$ of order $m$ induced by a subset of $V(G)$. We say that $G$ is an $m$-cycle $k$-accessible graph if $G$ contains an $m$-cycle $C_m$ such that for every vertex $v$ in the vertex set of $G$, there exists a vertex $u$ in the vertex set of $C_m$ such that the distance between vertices $u$ and $v$ in $G$ is at most $k$. The $m$-cycle accessibility number of $G$ is given by $h_m(G)=\min\{k: G \text{ is an } m\text{-cycle } k\text{-accessible graph}\}$. We use the convention that whenever a connected graph $G$ has no cycle of order $m$, then we denote by positive infinity its corresponding $m$-cycle accessibility number.

We have shown in this study that for every pair of positive integers $m$ and $k$ where $m$ is at least three, there exists a unicyclic graph $G$ with $m$-cycle accessibility

number exactly equal to $k$. In addition, for every pair of positive integers $m$ and $n$ with the property that $m$ is at most $n$ and $m$ is at least three, we developed an algorithm in generating a connected graph $G$ of order $n$ with $m$-cycle accessibility number equal to $n$-$m$. We have also characterized graphs which have $m$-cycle accessibility number equal to zero and those with $m$-cycle accessibility number equal to one. Lastly, the induced cycle accessibility number of some special graphs and graphs resulting from some binary operations are generated.

**Keywords:** distance, induced cycle, $k$-accessible, cycle accessibility, unicyclic

**CMPSD-3**

## INDUCED CYCLE COVERING OF GRAPHS

**Frances Mae C. Dumalagan, Euler Yoland B. Guerrero**
**Gillian Sofia L. Samson*, Thea Lynn P. Coronel**
**and Rosalio G. Artes, Jr.**

Department of Mathematics, College of Science and Mathematics
Mindanao State University - Iligan Institute of Technology
Andres Bonifacio Avenue, Tibanga, 9200 Iligan City
*Email: misyr_gsls@yahoo.com

Let $G$ be a connected graph such that for every vertex $v$ in the vertex set of $G$, the degree of $v$ in $G$ is at least 2. An induced cycle of $G$ is a cycle in $G$ induced by a subset of $V(G)$. A family $\mathcal{S}=\{S_1,S_2,\ldots,S_k\}$ of subsets of $V(G)$ is an induced cycle cover of $G$ if for every $i=1,2,\ldots,k$, the subgraph induced by $S_i$ is a cycle in $G$ and for every edge $e$ in the edge set of $G$, there exists $r$ in the set $\{1,2,\ldots,k\}$ such that $e$ in an edge of the graph induced by $S_r$. The induced cycle covering number of $G$ is given by $icc(G) = \min\{|S|: S \text{ is an induced cycle cover of } G\}$.

We have shown in this paper that for every pair of positive integers $n$ and $k$ where $n$ is at least 4 and $3k$ is at least $n$, there exists a connected graph $G$ of order $n$ with cycle covering number equal to one more than $k$. We also established sharp bounds for the induced cycle covering number of a graph. Moreover, we characterized graphs with induced cycle covering number equal to one. In addition, we determined the induced cycle covering number of cycle, fan, wheel, platonic solids, complete graph, complete bipartite graph, and graphs resulting from the join and corona of two non-empty graphs.

**Keywords**: induced cycle, induced cycle covering number, platonic solids

**CMPSD-4**

# INDUCED PATH ACCESSIBILITY AND DECOMPOSABILITY NUMBERS OF GRAPHS

**Dexter J. Resullar, Mary Joy F. Luga*, and Rosalio G. Artes, Jr.**

Department of Mathematics, College of Science and Mathematics
Mindanao State University - Iligan Institute of Technology
Andres Bonifacio Avenue, Tibanga, 9200 Iligan City
*misyr_mjfl@yahoo.com

An $m$-path of a graph $G$ is a path in $G$ of order $m$ induced by a subset of $V(G)$. For a connected graph $G$, the distance $d_G(u,v)$ between two vertices $u$ and $v$ in $G$ is the length of a shortest path joining $u$ and $v$ in $G$. We say that $G$ is an $m$-path $k$-accessible graph if there exists an $m$-path $P_m$ of $G$ such that for every vertex $v$ in the vertex set of $G$, there exists a vertex $u$ in the vertex set of $P_m$ such that $d_G(u,v)$ d" $k$. The $m$-path accessibility number of $G$ is given by $g_m(G) = \min\{k: G \text{ is an } m\text{-path } k\text{-accessible graph}\}$.

A subset $S$ of $V(G)$ is an $m$-path decomposable set if there exists a collection $C = \{S_1, S_2, S_3, ..., S_r\}$ of subsets of $S$ such that for each $i = 1, 2, 3, ..., r$, the subgraph induced by $S_i$ is an $m$-path in $G$, $S_i$ "$S_j = \emptyset$ for $i$ '" $j$, and the union of the elements of $C$ is the set $S$. The $m$-path decomposability number of $G$ is given by $\Gamma_m(G) = \max\{|S|: S \text{ is an } m\text{-path decomposable subset of } V(G)\}$.

In this study, we provided necessary and sufficient conditions for a graph $G$ to have an $m$-path accessibility number equal to one and those with $m$-path decomposability number equal to its order. We also established results on the $m$-path accessibility number and $m$-path decomposability number of path, cycle, wheel, fan, complete graph, complete bipartite graph, and graphs resulting from the join and corona of two connected graphs. Moreover, we have shown that for every pair of positive integers $m$ and $k$, there exists a graph $G$ such that $g_m(G) = k$. Further, we have shown that for any pair of positive integers $n$ and $m$ where $m$ d" $n$ and $m$ divides $n$, there exists a graph $G$ of order $n$ with $\Gamma_m(G) = n$.

**Keywords**: distance, induced path, $k$-accessible, accessibility number, decomposable set, decomposability number

**CMPSD-5**

# ON THE SPAN AND EXTENT OF UNIT-DISTANCE GRAPHS IN THE PLANE

**Severino V. Gervacio[1], Hiroshi Maehara[2], Joselito A. Uy[3]***

[1]Mathematics Department, De La Salle University, Manila
[2] College of Education, Ryukyu University, Okinawa, Japan
[3]Mathematics Department, MSU-Iligan Institute of Technology, Iligan City
Tel: 0632214050 loc 140; E-mail: jauy@math1.msuiit.edu.ph

A unit-distance graph in the plane is a graph whose vertices can be represented by distinct points in the plane such that the distances between pairs of points representing adjacent vertices are all equal to 1. For each unit-distance representation of a finite unit-distance graph $G$, there is a smallest circumscribing circle. The infimum of the diameters of these circles, taken over all unit-distance representations of $G$, is called the span of $G$. On the other hand, the supremum of the diameters of all such circles is called the extent of $G$.

It is natural to think that the span and the extent of a unit-distance graph are related to its diameter. We show here that for any given real number $\varepsilon > 0$, there exists a unit-distance graph $G$ in the plane such that the ratio of the span of $G$ to the diameter of $G$ is less than $\varepsilon$. Also, we prove that the extent of $G$ does not exceed $2\sqrt{3}/3$ times the graph-theoretic diameter of $G$. We show further that for every integer $d \geq 1$, there exists a unit-distance graph $G$ in the plane with diameter $d$ and extent equal to $2d\sqrt{3}/3$.

**Keywords**: unit-distance graph, span, extent, diameter of a graph

**CMPSD-6**

# MISSING TERMS OF RELLICH INEQUALITY

**Alnar L Detalla[1], Toshio Horiuchi[2], Hiroshi Ando[2]**

[1]Department of Mathematics, Central Mindanao University, Musuan Bukidnon
[2]Department of Mathematical Science, Ibaraki University, Mito City, Japan
Email: al_detalla@yahoo.com

Consider the Rellich inequality

$$\int_{\Omega}|\Delta u(x)|^{p}\,dx \geq \left(\frac{n-2p}{p}\right)^{p}\left(\frac{np-n}{p}\right)^{p}\int_{\Omega}\frac{|u(x)|^{p}}{|x|^{2p}}dx \tag{1}$$

for any $u \in W_0^{2,p}(\Omega)$, where $\Omega$ is a bounded domain in $\mathbb{R}^n$ with $0 \in \Omega$, $n \geq 3$, and $1 < p < \frac{n}{2}$. We improve this inequality by adding terms with singular weight of type $\left(\log\frac{R}{|x|}\right)^{-2}$ in the right hand side. We also show that this weight function is optimal in the sense that the inequality fails for any other weight function more singular than this one. As an application, we use the improved inequality in solving weighted eigenvalue problem for the operator

$$L_{\mu}u = \Delta\left(|\Delta u|^{p-2}\Delta u\right) - \frac{\mu}{|x|^{2p}}|u|^{p-2}u$$

**Main result**

**Theorem.** *Let $n \geq 3$, $0 \in \Omega$ and $\Omega$ is a bounded domain in $R^n$.*

*(1) Noncritical case* $\left(1 < p < \frac{n}{2}\right)$

*Assume* $\gamma \geq 2$, *then there exist* $K = K(n) > 0$ *and* $C = C(n) > 0$ *such that if* $R > K \sup_{\Omega} |x|$

*then*

$$\int_{\Omega} |\Delta u(x)|^p \geq \left(\frac{n-2p}{p}\right)^p \left(\frac{np-n}{p}\right)^p \int_{\Omega} \frac{|u(x)|^p}{|x|^{2p}}\, dx + C \int_{\Omega} \frac{|u(x)|^p}{|x|^{2p}} \left(\log \frac{R}{|x|}\right)^{-\gamma} dx$$

*(2)*

*for any* $u \in W_0^{2,p}(\Omega)$.

*(2) Critical case* $\left(p = \frac{n}{2}\right)$

*Assume* $\gamma \geq \frac{n}{2}$, *then there exist* $K^* = K^*(n) > 0$ *and* $C^* = C^*(n) > 0$ *such that if*

$R > K^* \sup_{\Omega} |x|$ *then*

$$\int_{\Omega} |\Delta u(x)|^{\frac{n}{2}} \geq \left(\frac{n-2}{\sqrt{n}}\right)^n \int_{\Omega} \frac{|u(x)|^{\frac{n}{2}}}{|x|^n} \left(\log \frac{R}{|x|}\right)^{-\gamma} dx + C^* \int_{\Omega} \frac{|u(x)|^{\frac{n}{2}}}{|x|^n} \left(\log \frac{R}{|x|}\right)^{-\gamma-1} dx$$

*(3)*

*for any* $u \in W_0^{2,\frac{n}{2}}(\Omega)$.

**Keywords:** Rellich inequality, Sharp constant, Eigenvalue, p-laplacian.

**CMPSD-7**

# NON-SINGULARITY OF THE COMPLEMENT OF STARPATHS AND COMBS

**Helen M. Rara and Mathithias S. Aviles II**

Mathematics Department, MSU-Iligan Institute of Technology, Iligan City
Telefax: 063 2214068; Email: helenrara@yahoo.com;
csm-hmr@sulat.msuiit.edu.ph

The adjacency matrix of a graph $G$ having vertices $v_1, v_2, ..., v_n$ is the $n$ x $n$ matrix $A(G)=[a_{ij}]$ where $a_{ij}=1$ if $v_i$ is adjacent to $v_j$ and $a_{ij=0}$ otherwise. We say that a graph is singular if its adjacency matrix is singular, i.e., det $A(G) = 0$; otherwise we say that it is non-singular. Formulas for the determinant of the adjacency matrix of the complement of starpaths and combs are shown in this paper and from these formulas the non-singularity of the complement of these graphs was determined.

The following results are obtained in this study, where $\overline{Cb_n}$ and $\overline{S_nP_m}$ denote the complement of comb and starpath graphs respectively:

1. $$\det A\left(\overline{Cb_n}\right)=\begin{cases}0 & \text{if } n \text{ is odd}\\ (-1)^{n-1}(n-1) & \text{if } n \text{ is even}\end{cases}$$

2. For $n > 2$ and $m \geq 1$,

$$\det A\left(\overline{S_nP_m}\right)=\begin{cases}0 & \text{if } m \equiv 0 (\text{mod } 3)\\ \left(\frac{m-1}{3}\right)n & \text{if } m \equiv 1 (\text{mod } 3)\\ (-1)^{n-1}\left[\frac{n(n-1)(m-2)}{3}\right] & \text{if } m \equiv 2 (\text{mod } 3)\end{cases}$$

3. *The comb $Cb_n$ has non-singular complement if and only if n is even.*
4. *The complement of a starpath $S_nP_m$ is non-singular if and only if $m \neq 2$ and m is not divisible by 3.*

**Keywords:** adjacency matrix, non-singular graph, starpath, comb

**CMPSD-8**

# TRIMMED MEAN AS AN ADAPTIVE ROBUST ESTIMATOR OF A LOCATION PARAMETER FOR WEIBULL DISTRIBUTION

**Carolina B.Baguio**

MSU-Iligan Institute of Technology, Iligan City
Tel: 090635434077; Email: cbbaguio@yahoo.com

One of the purposes of the robust method of estimation is to reduce the influence of outliers in the data on the estimates. The outliers arise from gross errors or contamination from distributions with long tails. The trimmed mean is a robust estimate. This means that it is not sensitive to violation of distributional assumptions of the data. It is called an adaptive estimate when the trimming proportion is determined from the data rather than being fixed a "priori'.

In this paper , the efficiency and robustness of an adaptive trimmed mean was examined, where the trimming proportion is determined by a ratio of two trimmed means and compare the efficiency with fixing the trimming proportion. The ratio is taken to be a measure of the tail lengths of the Weibull Distribution when the scale parameter is set to ½. This distribution was chosen because of its versatility in approximating an exponential, a normal, or a skewed distribution depending on the parameter values.

It was found that the Ratio of tail lengths of the Weibull distribution increases in magnitudes as the trimming proportion increases. On the other hand, the asymptotic variances decrease as the trimming proportions increase. It was also revealed empirically that the standard error of the adaptive trimmed mean using the ratio of tail lengths is relatively smaller than when the trimming proportions were fixed a 'priori'.

**Keywords**: adaptive robust estimate, L-estimates, tail length, location parameter, Weibull distribution

**CMPSD-9**

# SOME TREES WITH DIAMETER 5 AND NON-SINGULAR COMPLEMENT

**Severino V. Gervacio[1] and Helen M. Rara[2]**

[1]Mathematics Department, De La Salle University-Manila
Email: gervacios@dlsu.edu.ph
[2]Mathematics Department, MSU-Iligan Institute of Technology, Iligan City
Email: csm-hmr@sulat.msuiit.edu.ph, helenrara@yahoo.com

The *adjacency matrix of a graph G* having vertices $v_1, v_2, ..., v_n$ is the $n$ x $n$ matrix $A(G)=[a_{ij}]$ where $a_{ij}=1$ if $v_i$ is adjacent to $v_j$ and $a_{ij=0}$ otherwise. We say that a graph is singular if its adjacency matrix is singular, i.e., det *A(G)* = 0; otherwise we say that it is non-singular. We shall consider here trees with diameter 5 having the additional property that every nonpendant vertex has a constant degree $\Delta$. Such a tree will be called a $T_\Delta(5)$-tree. We shall show an infinite class of (5)-trees with non-singular complement.

The following results are obtained in this study:

1. *Let be disjoint complete graphs, where t 1. Form a new graph G by joining each vertex of to a new vertex* $x_i$, *I = 1, 2,...,t. Let n =* $n_1 + n_2 + ... + n_t + 1$, *the order of G. Then .*
2. *The graph G in result 1 is non-singular if and only if* $n_i = 1$ *for at most one value of i.*
3. *The maximal* (5)*-tree has a non-singular complement if and only if* > 2.

**Keywords:** adjacency matrix, non-singular graph, complement of a graph, trees of diameter 5

**CMPSD-10**

# A HELLER-TYPE BOUND FOR THE HOMOGENEOUS FREE DISTANCE OF CONVOLUTIONAL CODES OVER GALOIS RINGS

**Virgilio Sison**

Institute of Mathematical Sciences and Physics
University of the Philippines Los Baños
College 4031, Laguna, Philippines
Tel: (049) 536-2355, Fax: (049) 536-6610
E-mail: vpsison@up.edu.ph

The distance of a code is one of the most important parameters that measure its ability to detect and correct transmission errors in a noisy communication channel. Among codes of a fixed rate, the larger the distance, the better is the code. Let $R$ be the Galois ring $GR(p^r,m)$ of characteristic $p^r$ and cardinality $p^{rm}$, which is a Galois extension of the integer ring $Z_{p^r}$ by a root of a monic basic irreducible polynomial of degree $m$ over $Z_{p^r}$. Galois rings have been the subject of much interest in coding theory because they admit a homogeneous distance with isometric properties, a far reaching generalization of the Lee metric on $Z_4$. Let $R[D]$ be the ring of polynomials over $R$ in the delay operator $D$. We consider a rate-$k/n$ convolutional code $C$ over $R$ to be an $R[D]$-submodule of $R[D]^n$ which is the rowspan of a $k \times n$ polynomial encoder matrix $G(D)$ with linearly independent rows. A homogeneous weight with average value $\Gamma$ is applied on $R$ and extended naturally to $C$. We prove that the homogeneous free distance of $C$ is bounded above in terms of $\Gamma$, the encoder memory and the parameters of R. This bound generalizes the well-known Heller bound for the Hamming free distance of binary convolutional codes.

**Keywords**: Galois rings, convolutional code, free distance, Heller bound, Plotkin bound

**CMPSD-11**

# CONSTRUCTION OF LOW COST PC AND MICROCONTROLLER-BASED LOGIC CIRCUIT ANALYZER

**Archieval G. Briones and Alvin Joseph J. Faustino***

Physics Division, Institute of Mathematical Sciences and Physics
University of the Philippines Los Banos, College, Laguna 4031
Tel: 63 49 5361841; Fax: 63 49 5366610; Email: ajjfaustino@uplb.edu.ph

This study aims to construct a low cost logic analyzer that analyzes and displays digital signals and state transitions of medium scale logic circuits. A logic analyzer acquires and stores digital data from a digital circuit and displays it so a user can locate and determine the faults and behaviors of a certain digital system under test. It allows the user to look at more lines in a digital circuit which an ordinary oscilloscope cannot do. One big problem with the commercially available logic analyzers is its high cost. The low end version costs around half a million pesos. An electronic enthusiast or hobbyist cannot afford to have this tool at home. The solution is to provide a low cost version of logic analyzers.

A ZiLOG microcontroller was programmed to enable it to acquire data from the circuit under test and transfer the data to the computer through the serial port. The main user-interface software was created using a Graphical User Interface tool and was able to show sufficient amount of data to view the transitions of the signals of the circuits under test.

The analyzer was calibrated by testing it on different signal frequencies using a function generator. The maximum acquisition frequencies derived on this test were 1.46 MHz, 1.11 MHz, 1.06 MHz, and 876 kHz for the 8, 16, 23, and 28 channels respectively. The computed maximum signal frequencies were 146 kHz, 111.8 kHz, 106.9 kHz, and 86.7 kHz for the 8-channels, 16-channels, 23-channels, and 28 channels timing mode respectively. Also a set of medium speed logic circuits was tested and their logic analysis and graphs were recorded and studied.

Results showed that the logic analyzer timing mode was able to analyze medium scale digital circuits that have typical frequencies of around 500Hz to 100 kHz. Although frequencies above this range would still exhibit recognizable transition patterns, the more acceptable signal frequencies must be 10 times the acquisition frequency in order to get more accurate number of samples.

**Keywords**: Logic Analyzer, Microcontroller

**CMPSD-12**

# FABRICATION OF PERCHLORIC-DOPED POLYANISIDINE FILM USING POLYVINYLACETATE (PVA) AS BINDER

**Francis M. Emralino*, Marvin U. Herrera**

Materials Physics Laboratory, Physics Division
Institute of Mathematical Sciences and Physics
University of the Philippines Los Baños, College, Laguna 4031
Tel: 63 49 5361841; Fax: 63 49 5366610; Email: fraulin_06@yahoo.com

The authors were successful in drawing the perchloric acid-doped polyanisidine (PAnis) powder into films using the polyvinyl acetate (PVA) as binder. Polyanisidine is a conducting polymer; they are plastics that exhibit metallic behavior. Perchloric acid ($HClO_4$) was used as dopant since it known to improve the electrical properties of polyanisidine. Polyvinyl acetate is a low-cost binder. The authors want to emphasize that PVA was included to serve as binder and not to improve its electrical properties. It is however expected that the inclusion of PVA would decrease the conductivity of the samples since it has lower conductivity than perchloric-doped polyanisidine. It is desired to draw powder polymer into films to increase the manageability of usage which includes conducting straps and coatings. Polyanisidine was synthesized using oxidative polymerization. The resulting polyanisidine powder was mixed with different ratios of PVA to produce the films. It was shown that it is possible to draw PAnis film from using the following mass ratios (PAnis:PVA):1:1, 1:2, 1:3, 1:4, and 1:5. Two sets of the mixtures were casted into silicon oxide and sensitized film which acted as substrates. The silicon oxide substrates were rigid substrate while the sensitized films were flexible substrate. This paper also aims to determined the conductivity of the film from the current-voltage graph using four-point probe.

**Keywords:** Polyanisidine, Conducting Polymer

**CMPSD-13**

# POLYMER ENTANGLEMENT WITH A MAGNETIC FLUX

**Mark Nolan P. Confesor* [a], Jinky B. Bornales [a], Christopher C. Bernido [b], M.V. Carpio Bernido [b]**

[a] Physics Department, MSU – Iligan Institute of Technology, Iligan City 9200, Philippines
[b] Research Center for Theoretical Physics, Central Visayan Insitute Foundation, Jagna, Bohol 6308, Philippines

In this paper we consider the entanglement problem of a polymer interacting with a magnetic flux confined along a second polymer oriented along the z-axis. We take the first polymer to lie on a plane subjected to a potential, $V = q\vec{A}\cdot\vec{r}$, where $q$ is the net charge of the repeating unit of the polymer, and $\vec{A}$ the vector potential due to the magnetic flux $\Phi$ confined along the straight polymer. Following the differential equation approach of Wiegel, we then calculate the entanglement probability $W_n$ for the first polymer to wind $n$ times around the straight polymer and obtain the result,

$$W_n = R\sqrt{\frac{4\pi}{Nl^2}}\exp\left(-\frac{1}{Nl^2}\left\{2\pi nR + \frac{Nl^2}{2R}\Phi\right\}^2\right),$$ where $N$ is the number of repeating units, each of length $l$, and $R$ is the distance of the polymer on the plane from the origin. Our result agrees with the earlier result obtained using white noise functional approach.

**Keywords:** entanglement, winding probabilities

**CMPSD-14**

# TRANSIENT SURFACE PHOTOVOLTAGE ANALYSIS OF SILICON MOSFET TRANSISTOR

**Arvin Tan* and Marvin U. Herrera**

Physics Division, Institute of Mathematical Sciences and Physics
University of the Philippines Los Baños, College, Laguna 4031
Tel: 63 49 5361841; Fax: 63 49 5366610; Email: rvintan@yahoo.com

The surface band gap states of silicon in Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET) were determined by the technique of Surface Photovoltage (SPV) Spectroscopy under ambient temperature and pressure. The silicon substrate was illuminated with varying photon wavelengths ranging from 400 nm to 1998 nm to monitor the band bending in Metal-Oxide-Semiconductor (MOS) structure. This was done to find surface states position by which the contact potential difference is proportional to the band bending. Illumination of the sample with varying energies reveal two surface states, one at 0.97 eV and the other at 1.05 eV above valence band maximum. These states appeared to be bulk states appearing in the surface, their energy positions are comparable to the impurity binding site energy. The transient measurements in between the surface states were determined from the SPV versus time plots. This was done by illuminating the sample with single light wavelength in accordance with the surface states energy positions by which both has identical distribution of energies between them. The surface photovoltage transient measurements were used in the calculation of the surface stares parameter.

**Keywords**: Surface Photovoltage Spectroscopy, Metal-Oxide-Semiconductor

**CMPSD-15**

# THE HARMONIC OSCILLATOR IN A UNIFORM ELECTRIC FIELD: A WHITE NOISE FUNCTIONAL APPROACH

**Enrico B. Gravador and Normilah D. Lindao**

Physics Department, MSU-Iligan Institute of Technology, Iligan City

The Harmonic Oscillator in a uniform electric field is solved using White Noise Path Integration. Streit and Hida (1983) interpret the Propagator as the expectation value of the Feynman Functional,

$$K(x_1, x_2; 0, t) = E\{\exp[\, iS(x)/\eta]\}$$

Operationally, this is given as the T-transform of the Feynman Functional. By a change of variable, the Lagrangian of Harmonic Oscillator in uniform electric field is transformed into the Lagrangian of Harmonic Oscillator plus a constant term.

To implement a White Noise Functional approach, the path is parametrized as Brownian Fluctuations about the sure path, $x(\tau) = y(\tau) + (\eta/m)^{1/2} B(\tau), \quad 0 < \tau < t.$ $\omega = B^{\&}$ is interpreted as a generalized function on an infinite dimensional space. The collection $\{B^{\&}(\tau); \quad \tau \varepsilon R\}$ of generalized functions forms a continuum coordinate system. The action containing the quadratic term in x can be expanded in Taylor series about the sure path $y(\tau) = 0$. Parametrization of the path leads to

$$K(0, x_2; 0, t) = E^{\omega} N \exp\left[(i+1)/2\langle \omega, \omega\rangle - i/\eta\langle \omega, S''\omega\rangle + \frac{iq^2E^2}{\eta 2m\Omega^2}t\right] \quad \delta^{\omega} B(t) - (m/\eta)^{1/2} x_2 \, ;$$

$$K(0, x_2; 0, t) = \left(\frac{m\Omega}{2\pi i\eta \sin \Omega t}\right)^{1/2} \exp\left(\frac{iq^2E^2}{\eta 2m\Omega^2}t + \frac{im\Omega[x_2 - qE/m\Omega^2]^2}{2\eta \tan \Omega t}\right).$$

Getting the T-transform yields the propagator of Harmonic Oscillator in uniform electric field:

$$\Psi_n = (2^n n!)^{-1/2} \left(\frac{m\Omega}{\pi\eta}\right)^{1/4} H_n(\sqrt{m\Omega/\eta}\,(x_2 - qE/m\Omega^2)) \exp(-m\Omega/2\eta\,(x_2 - qE/m\Omega^2)^2)$$

$$\sigma^2 E^2$$

wavefunctions are

We realize that the energy spectrum and wavefunctions agree with those found by solving the Schrödinger equation.

**Keywords:**

**CMPSD-16**

## GEOMORPHOLOGICAL CHARACTERIZATION OF THE NOVEMBER 2004 DEBRIS FLOW AND FLOODING IN INFANTA, QUEZON: UNDERSTANDING HAZARDS AND MANAGING RISKS

**Ada Liezl Maria C. Lim, Rene Juna R. Claveria*, Teresita R. Perez**

Department of Environmental Science, Ateneo de Manila University
Telefax: 02 4264321; Email: rclaveria@ateneo.edu

The Philippines is one of the countries vulnerable to disasters caused by natural calamities due to its geologic setting and geographic location. Flooding, landslides, earthquakes and volcanic eruptions are most common. Calamities due to natural disasters have seemingly been more frequent world wide. The municipality of Infanta, Quezon experienced debris flow and flooding in November 2004, which resulted in the loss of lives and damage to properties.

Characterization of the debris flows, landslides and flooding in Infanta was done to understand better events leading to the November 2004 disaster. Geomorphologic studies were utilized to appreciate better the mechanisms leading to the disaster. Secondary data from the technical studies conducted in Quezon and Aurora were used.

Infanta is a flood plain of the Agos watershed. Geomorphic changes in the Agos River Delta through time had shaped the Infanta landscape. Precipitation in November 2004 was recorded 2400% higher than the long term average rain fall. This contributed to the increase in pore-water pressured and over saturation of the soil. These led to mass movements and debris flows. Artificial dams were formed in both Kanan and Kaliwa Rivers. The breaching of the dams resulted in the high volume of water flow carrying debris and mud. This inundated Infanta.

There were no historical records available on floods, landslides and debris flows in Infanta and neighboring municipalities. However empirical data indicated similar events had happened before.

A portfolio of risk management options was proposed to prepare the local people to the hazards of floods and debris flows. With a better understanding of the natural processes and consequences, integrated floodplain strategies are to be implemented. Sustainable development, ecology and economy should complement the strategies. These will hopefully help Infanta develop, implement and monitor risk management programs.

**Keywords**: geomorphology, debris flow, flooding, natural hazard, risk assessment, Infanta, Quezon, Agos River

**CMPSD-17**

## GPS-DERIVED PRECIPITABLE WATER VAPOR AT A TROPICAL LOCATION

**Lorenzo de la Fuente[1*], Daniel McNamara SJ[2] and Harold Ritchie[3]**

[1]Department of Environmental Science, Ateneo de Manila University
Tel: 63 2 4254321; Email: ldelafuente@ateneo.edu
[2]Manila Observatory, Tel: 63 2 4265921; Email: daniel@observatory.ph
[3]Department of Oceanography, Dalhousie University
Tel: 1 902 4543371; Email: hal.ritchie@ec.gc.ca

Zenith Wet Delay (ZWD) is a nuisance component embedded in Global Positioning System (GPS) measurements from which meteorological water vapor (WV) equivalent may be derived. Station PIMO of the International GPS Service (IGS) has operated since 1998, but multi-annual analysis of these records has not previously been done. In this study hourly averages for ZWD and WV equivalent are compiled for monthly, seasonal, annual and multi-annual periods, which should be comparable to standard meteorological moisture observations. Monthly averages are also compiled for seasonal, annual and multi-annual periods with particular focus on the 1999-2000 La Nina, and should reflect above average moisture levels characteristic of the event. Hourly GPS data are also used to calibrate derived WV equivalents against rain gauge measurements during significant storms such as Typhoons Xangsane and Cimaron in 2006, which may provide useful predictors relevant to storm track and intensity.

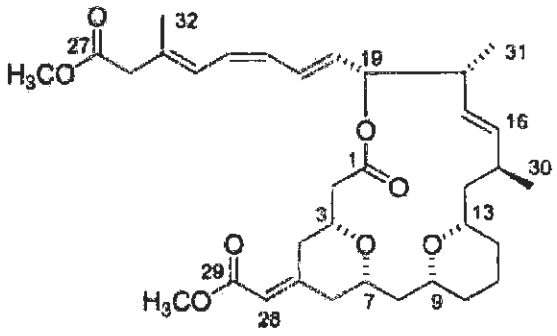
**Keywords**: GPS meteorology, water vapor, remote sensing, La Nina, typhoons

**CMPSD-18**

## EXIGUOLIDE, A NEW MACROLIDE FROM THE MARINE SPONGE *Geodia exigua.*

**Mylene M. Uy[a*], Shinji Ohta[b*], Mihoko Yanai[c], Emi Ohta[b], Toshifumi Hirata[d] and Susumu Ikegami[b]**

[a]Department of Chemistry, MSU- Iligan Institute of Technology
9200 Iligan City, Philippines
Tel.: (063) 221-4051 loc 123; e-mail: csm-mmu@sulat.msuiit.edu.ph
[b]Nagahama Institute of Bio- science and Technology, 1266 Tamura-cho,
Nagahama, Shiga 526-0829, Japan; E-mail: s_ohta@nagahama-i-bio.ac.jp
[c]Natural Science Center for Basic Research and Development &
[d]Department of Mathematical and Life Sciences, Graduate School of Science,
Hiroshima University, 1-3-1
Kagamiyama, Higashi-Hiroshima
739-8526, Japan.




Marine sponges have provided a seemingly inexhaustible supply of bioactive metabolites. In the course of our continuing search for inhibitors on echinoderm fertilization from marine sponges, we isolated a new macrolide designated exiguolide (**1**) from the MeOH extract of the sponge *Geodia exigua* Thiele (order Astrophorida, family Geodiidae).

The gross structure of **1** was determined by interpretation of spectroscopic data. Its relative stereochemistry was elucidated on the basis of NOESY correlations and vicinal $^1$H couplings. Conformational searches were performed for all possible stereoisomers of **1** using CAChe CONFLEX program with the MM2 force field for energy minimization field (CAChe version 5.5; Fujitsu Co., Tokyo, Japan) to give the only conformational model with 3*R**, 7*S**, 9*R**, 13*S**, 15*S**, 18*R**, 19*R** configuration whose calculated proton distances and dihedral angles were in full agreement with the observed NOE correlations and vicinal $^1$H couplings. The relative stereochemistry of **1** was supported by the *J*-based configuration analysis method.

Although many biologically active macrolides have been obtained from marine organisms, there are very few compounds having the methoxycarbonylmethylidenetetrahydropyran ring system among them. Exiguolide possesses this unique chemical feature which is also found in the antineoplastic compounds, bryostatins.

Sea urchin (*Hemicentrotus pulcherrimus*) gametes were treated with 1 to investigate its effects on fertilization and egg activation. Concentrations at or higher than 21 μM of 1 prevented fertilization. However, 1 at 100 μM did not affect the development of fertilized eggs up to the gastrula stage.

**Keywords**: biologically-active compounds; natural products; marine sponges; macrolide; sea urchin

**CMPSD-19**

## BIOTECHNOLOGICAL PRODUCTION OF STRUCTURED LIPIDS: A study on the Triglyceride Species and Fatty Acids of Some Fungal Oils

**Laura J. Pham* and Precy M. Rasco**

Food, Feeds and Specialty Products Biotechnology Program
BIOTECH, U.P. Los Baños, College, Laguna, 4031
Email: laura@lgn.csi.com,.ph

Structured lipids or tailored fats are being developed now to meet the needs of today's consumer. The enzymatic process of modification is one of the advances in the fats and oils biotechnology which gives an additional level of flexibility in controlling and designing structured lipids or interesterified oils. Our research work in BIOTECH targeted the incorporation of omega-3 fatty acids such as DHA, EPA, α-linolenic acid and omega-6 fatty acid such as γ-linolenic acid and linoleic acid into coconut oil so that a structured lipid containing both medium chain fatty acids providing a dense source of calories which the body can readily use and omega-3 and 6 for important biological functions is prepared through enzymatic interesterification. The current interest in the nutritional role of these fatty acids has stimulated research into their production by a number of fungal sources which are active in the synthesis of polyunsaturated fatty acids.

The present study looked at the oil content and lipid molecular species of oleagineous fungi obtained from the BIOTECH Microbial Culture Collection.Potential oil yielding fungal isolates investigated were originally twenty-four (24) strains but trimmed down to seven (7) strains based on the biomass and

percent oil content. Lipid class analysis of the fungal oils by thin layer chromatography and quantification by the BIOSOFT quantiscan program showed the presence of triglycerides, diglycerides, monoglycerides, free fatty acids, sterols and cholesteryl esters with triglycerides being the major class.

The fatty acid profile of the isolates showed high unsaturation, the highest being that of *Trichosporon inulinum* (BIOTECH strain 2090) at 50.51%. The presence of the omega-6 fatty acid linoleic acid ranged from 0.19 to 18.24% in the fungal oils. Minor polyunsaturated fatty acids detected were γ-linolenic and eicosapentaenoic (EPA) acid.

The triglyceride molecular species were of the USU, SU2 and U3 types (S-saturated; U-unsaturated) which are considered of nutritional importance. Dominant triglyceride molecules are that of PN46 and PN48 and the lowest being PN40.Results of this study showed the promise of fungal oils in the production of structured lipids, the fats of the future.

**Keywords:** Modification, interesterification, triglyceride, fungal isolates, fatty acids

**CMPSD-20**

## PERFORMANCES AND COLOR EVALUATION OF DYED CROSSLINKED AND UNTREATED COTTON USING ACHUETE (*Bixa orellana*) AND SIBUKAO (*Caealpinia sappam L.*) Dye Powder

**Lorna T. Enerva[1], Elbert C. Carillo[2], Maria Christie A. Cardillo[2], Ryan C. Yutoc[2] and Julius L. Leano Jr.[3]**

[1]SciTech R and D Center & [2]College of Science
Polytechnic University of the Philippines
[3]Philippine Textile Research Institute, DOST, Bicutan, Taguig Manila
Email: lornaenerva@yahoo.com

Cotton fabric samples were prepared for dyeing. They were desized, scoured and mordanted. The cotton fabric was dyed using achuete and sibukao dye powder under different conditions, dyeing temperature (room temperature and boiling), liquor ratio (1:20, 1:30 and 1:50) and dye concentrations (4%, 6% and 8%). Half of the cotton fabric samples were subjected to crosslinking and the other half remained untreated. The samples were evaluated for colour fastness performances. The dye absorbed by cotton was analyzed using UV-Vis spectroscopy.

The absorption curves under different dyeing conditions revealed that the higher the dye concentration, higher temperature and lower liquor ratio resulted in higher dye absorption of cotton using both achuete and sibukao powder.

The absorption curves also revealed that the rate of dye absorption of achuete on $CuSO_4$- mordanted cotton was rapid during the first 30 minutes and slowed down after 60 minutes while sibukao, alum and $CuSO_4$ mordanted cotton showed relatively rapid dye absorption during the first 30 minutes which it slowed down with minimal absorption further taking place.

The results of the colour fastness dye exhaustion for achuete and sibukao dyed cotton revealed the effectiveness of crosslinker when applied to cotton. It enhanced the resistance of dyed cotton under different dyeing conditions as shown by colour fastness tests to light and washing.

**Keywords**: mordant, dye, crosslinking, colour fastness, achuete, sibukao

**CMPSD-21**

## SPME—A SIMPLE, SOLVENT-FREE EXTRACTION METHOD FOR FLAVOR COMPOUNDS FROM GLUTEN HYDROLYSATE AND GLUCOSE

**Marissa V. Romero**

Rice Chemistry and Food Science Division
Philippine Rice Research Institute, Maligaya
Science City of Muñoz, 3119 Nueva Ecija
Telefax: (044) 456-0277; -0258; local 245
Email: mvr@philrice.gov.ph; marissa9396@yahoo.com

Solvent extraction is the conventional method in isolating target compounds from a sample matrix. It is, however, plagued with possible health hazards posed by the organic solvents and environment problem due to waste disposal. In this study, solid phase microextraction (SPME) was evaluated as alternative to solvent extraction in obtaining the volatile compounds from enzymatically hydrolyzed gluten and reducing sugar. SPME is a simple, rapid, and solvent-free extraction technique based on the partitioning equilibrium of analytes between the sample matrix and the extraction medium. It is also compatible with common separation techniques such as gas chromatography and high performance liquid chromatography.

To increase the utilization of gluten, a waste by-product of starch processing, it was hydrolyzed with Umamizyme and Glutaminase to obtain substrates for Maillard reaction. The hydrolysates were heated with glucose at 155°C for two hours. The flavor compounds generated were then isolated by SPME and analyzed by gas chromatography. To optimize the extraction efficiency, various parameters such as SPME fiber, sample pH, and extraction temperature were investigated. Polydimethylsiloxane (PDMS), polydimethylsiloxane-divinylbenzene (PDMS-DVB), and carboxen-polydimethylsiloxane (CAR-PDMS) were evaluated as polymer stationary phase of the SPME fiber. Based on the peak areas, CAR-PDMS exhibited the best extraction performance, suggesting that the isolated analytes were mostly bipolar compounds with relatively low molecular weights. Sample pHs 3.0, 6.0, and 9.0 and extraction temperatures 20 °C, 40 °C, and 60 °C were also studied. The most basic pH and the highest temperature gave the best results, indicating the influence of these parameters in the distribution of an analyte in the different phases and the speed of mass transfer. By optimizing the extraction conditions, SPME was found to be a suitable, simpler, and more environment-friendly extraction method for flavor compounds generated from the Maillard products of hydrolyzed gluten and glucose.

**Keywords**: solid-phase microextraction, gluten hydrolysate, Umamizyme, Glutaminase, Maillard reaction, polydimethylsiloxane, polydimethylsiloxane-divinylbenzene, carboxen-polydimethylsiloxane

**CMPSD-22**

## FLAVORFUL RICE WINE FROM LABORATORY PREPARED *Bubod* (STARTER CULTURE)

**Ma. Jophine C. Ablaza, Amelia M. Valerio, Henry F. Mamucod and Evelyn H. Badonill**

Rice Chemistry and Food Science Division, Philippine Rice Research Institute,
Central Experiment Station, Science City of Muñoz
Nueva Ecija, 3119 Philippines
Telefax Number. 044-4560-285/258 local 245
E-mail Address. mjcablaza@philrice.gov.ph

Markets for rice wine become more competitive as rice wine consumption continues to expand. The shelflife of rice wine lies in the quality of *bubod* (starter culture) used for production. The availability of *bubod* manufactured through hygienic and reliable method will therefore provide more income to wine producers.

As such, there is a vital need for the determination of the fermentation efficiency and storage stability of laboratory-prepared (rejuvenated) *bubod* to ensure the production of rice wine with superior and consistent quality in every batch. *Bubod* was rejuvenated fifteen times using commercial mother *bubod* in the first rejuvenation. *Bubod* samples were evaluated for microbial load and efficiency in producing rice wine. Furthermore, the rice wines were assessed for physico-chemical and sensory properties. Despite the large difference in the bacteria ($x10^7$ cfu/g), yeast ($x10^7$ cfu/g) and mold ($x10^5$ cfu/g) count of each of the fifteen rejuvenated *bubod*, the alcohol content (17.95 to 22.15%), pH (3.67 to 3.81), and all sensory properties of the resulting rice wine were comparable to each other. The highest intensity of sweetness, aroma, overall acceptability, total soluble solids and lowest acidity was obtained from the *bubod* rejuvenated for the ninth time. Meanwhile, the yield obtained ranged from 1,095 to 1,350 ml per kg of glutinous rice.

The first rejuvenated *bubod* was also evaluated for its storage stability from 0 to 6 months at refrigerated temperature and rice wine was produced every month. Wine from 3 month old *bubod* had the highest alcohol content and overall acceptability. Bacteria and yeast count decreased as the month of *bubod* storage increased and resulting wine decreased in overall acceptability and sweetness after 3 months.

This study showed that good quality wine can still be obtained even up to fifteen rejuvenations and the first rejuvenated *bubod* can be best stored for 0 to 3 months at refrigerated temperature.

**Keywords**: *bubod* (starter culture), overall acceptability, physicochemical properties, rice wine, sensory properties

**CMPSD-23**

## ANALYSIS OF DISSIPATION OF TOTAL RESIDUAL OXIDANTS (TRO) AFTER ELECTROCHEMICAL TREATMENT OF SIMULATED SEAWATER

**Angelo Carlo Malabanan[1], Catalino Alfafara[1*], Veronica Migo[2], Jovita Movillon[1], and Monet Maguyon[1]**

[1] Department of Chemical Engineering, University of the Philippines Los Banos
[2] National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Banos, College, Laguna 4031
Telefax: (049)-536-2315 Email: linojp@yahoo.com

Dissipation of total residual oxidants (TRO) after electrochemical treatment of simulated seawater was investigated as an initial step for obtaining operating factors that can be applied to large scale shrimp aquaculture ponds that use electrolysis for ammonia removal. (Excess TRO after electrolytic removal of ammonia are usually dissipated in the field by aeration, to reduce them to levels not harmful to shrimp).

Dissipation experiments at varying aeration levels (after electrolysis) and initial TRO concentrations were conducted. Results show that at the range of aeration rates studied, the TRO decreased with time, coupled with an increase in pH . The rate of dissipation was found to increase initially with increasing aeration rates, but eventually leveled off with time. Mathematical analysis was done on the data to obtain engineering relationships that could be used for scale up and operation in large scale aquaculture ponds.

**Keywords**: total residual oxidant, air stripping, electrolysis, dissipation, rate constant

**CMPSD-24**

## CHEMICAL COMPOSITION AND RHEOLOGICAL BEHAVIOR OF PASALENG KAOLINITE CLAY DEPOSITS OF PAGUDPUD, ILOCOS NORTE

**Dionesio C. Pondoc and Fe B. Pungtillan**

Department of Ceramic Engineering College of Engineering
Mariano Marcos State UniversityBatac, 2906 Ilocos Norte
Tel.: +63 77 792 2573 Fax: +63 77 792 2633
Email: dondon_pondoc@yahoo.com

This research study was conducted to determine the chemical composition and to evaluate the rheological behavior of Pasaleng kaolinite clay for its potential utilization in the production of ceramic whitewares. Physical properties such as particle size distribution and chemical composition of the raw clay sample were determined to know the approximate amount of kaolinite clay minerals which governed their rheological behavior. The raw clay samples underwent beneficiation process through sedimentation method.

Three test trials consisted of beneficiated Pasaleng kaolinite clay powder made into fluid suspension (clay slip) with a clay-water ratio of 1:1 and 1:2 and to which was added a deflocculant such as sodium silicate and sodium carbonate. The test clay slips were thoroughly mixed in an electric blender for 2, 3, 5, and 7 minutes. The rheological property like specific gravity was determined using the

specific gravity cup method and viscosity was measured by Zahn-cup method. Methylene blue index (MBI) and cation exchange capacity (CEC) of clay slip were also determined to measure the specific surface area of kaolinite mineral present in the Pasaleng clay deposits.

Results show that the particle size distribution of Pasaleng kaolinite clay consisted of 46.25% retain in 40 mesh, 7.48% retain in 50 mesh, 1.67% retain in 60 mesh, 5.45% retain in 80 mesh, 2.78% retain in 120 mesh, 1.66% retain in 140 mesh, 2.56 retain in 200 mesh and 31.60% passed in 200 mesh. Pasaleng kaolinite clay consisted of 52.58% $SiO_2$, 26.42% $Al_2O_3$, 0.53% $Fe_2O_3$, 0.67% $TiO_2$, 2.49% MgO, 0.43% CaO, 4.52% $Na_2O$, 0.94% $K_2O$ and 10.98% loss of ignition. The calculated kaolinite clay mineral was 40.61%. Increased stirring time increased the specific gravity of the slip. The calculated viscosities of the clay slip with and without defloculants increased as the Zahn-cup orifice diameter became larger.

The results of this study revealed that different deflocculants had different effects on clay properties and therefore controlled rheological characteristics.

**Keywords**: kaolinite clay, chemical composition, and rheological behavior

**CMPSD-25**

## Synthesis of ZN-doped PBTIO via Solid-state Sintering

**Jaypee A. Garcia and Marvin U. Herrera***

Physics Division, Institute of Mathematical Sciences and Physics
University of the Philippines, Los Banos, College Laguna
Tel: 63-49-536-1841; Fax: 63-49-536-6610
Email: muherrera@yahoo.com; Japy42_10@yahoo.com

The authors have synthesized Zn-doped PbTiO (PTO) using solid-state sintering method. To be able to produced PTO, stoichiometric amount of PbO, TiO and ZnO were mixed and ground. The mixtures were then pressed into pellet and calcined at 800°C. After calcining, the samples were again ground and pressed into pellet. After which, the samples were sintered at 1,100 °C. Xray- Diffraction (XRD) were used to verify the existence of PTO in the sample. Differential Thermal Analysis (DTA) shows the thermal profile of the samples. Scanning Electron Microscope (SEM) shows the flattening and fusing of grains of sample with 5% Zn mole fraction. The 5% Zn mole fraction also exhibit the lowest melting point among the different concentration prepared.

**Keywords**: PbTiO, Solid-state sintering

**CMPSD-26**

# MORPHOLOGICAL EVOLUTION OF DIVERSE ZINC OXIDE NANOSTRUCTURES

**Ian Harvey J. Arellano*[,1,3], Eduardo R. Magdaluyo[2], Denis Aquino[3], Roland V. Sarmago[3] and Leon M. Payawan, Jr[1]**

[1] Nanostructures and Surface Chemistry Research Laboratory,
Institute of Chemistry, College of Science
[2] Department of Mining, Metallurgical and Materials Engineering,
College of Engineering
[3] Materials Science and Engineering Program, College of Science
University of the Philippines, Diliman, Quezon City 1101 Philippines
E-mail: iarellano@chem.upd.edu.ph

The morphological evolution of diverse zinc oxide (ZnO) crystal habits was investigated via hydrothermal and carbothermal methods. The mechanism for the hydrothermal growth of ZnO nanowhiskers and its self-assembly to form nanoflowers and nanoblades are presented. ZnO nanoflowers and nanoblades were grown on a copper strip using zinc acetate dihydrate and ethanolamine as precursors at 65°C. Scanning Electron Microscopy (SEM) was employed to deduce the mechanism of growth as a function of substrate's exposure time to the reaction mixture. Flowerlike structures were observed due to clustering at a common seed site to minimize the strain due to lattice mismatch. The shape specificity at higher exposure time is directly attributed to the shape assumed by the nucleation seeds developed at the onset of the reaction. Overexposure of the substrate leads to masking of the ordered nanostructure due to extensive deposition terminating to film formation on the surface. Carbothermal reduction was done on a mixture of ZnO and activated charcoal at varying ratio. Morphological probing using scanning electron microscope (SEM) on the substrate revealed that a specific structure was localized at a certain region on the substrate. This regionalization is due to the difference in the degree of exposure of the substrate to the vapor of the precursor as a result of the vapor current induced by the setup. The presence of a vapor current results to inhomogeneity of the boundary diffusion layer causing the production of various regions in the substrate containing different structures like nanowires, microrods, microtubes and tetrapods. The as-grown nanostructures adapted the hexagonal crystal lattice of ZnO as shown from xray diffraction (XRD) data. The photoluminescence spectra of these structures were taken and a band gap emission at around 390 nm was observed corresponding to a band gap energy of 3.20 eV.

**Keywords:** zinc oxide, carbothermal reduction, hydrothermal, crystal habit

## *ENGINEERING SCIENCE AND TECHNOLOGY DIVISION*

**ESTD-1**

# FOREST FIRE MODELING AND SIMULATION USING NONLINEAR CELLULAR AUTOMATA

**Emmanuel A. Gonzalez[1]* and Martin Christian G. Leonor[2]**

[1,2]Department of Electronics and Communications Engineering
College of Engineering, De La Salle University – Manila
2401 Taft Ave., Malate Manila 1004, Philippines
[1]New Market Merchants Fire Prevention Unit
Association of Philippine Volunteer Fire Brigades, Inc.
Leveriza St. cor. Quirino Ave., Malate Manila 1004, Philippines
Tel: 632 5222222; Email: [1]gonzaleze@dlsu.edu.ph, [2]leonorm@dlsu.edu.ph

Forest fire modeling and simulation have been in the research trend for the past years, especially now with the advent of digital computers and high-speed microprocessors. From manual explicit mathematical model using partial differential equations, forest fire modeling was developed in the form of cellular automata. Since modeling using partial differential equations based on real, continuous-time dynamical properties of forest fires are difficult to simulate, there is a need to have a simple modeling strategy that will be able to incorporate other practical conditions in forest fire modeling such as the effects of wind, non-flat landscape, and having different rates of fire spread, i.e. having a heterogeneous forest. Therefore, cellular automata were used in this study because the models are well-known to be an effective alternative to partial differential equations, which have been used successfully in modeling physical systems and processes. This paper presents a forest fire model using nonlinear cellular automata, more specifically, a nonlinear, two-dimensional square cellular automata with circular fire front treatment. Although other cellular automata models were already available, the consideration of a hypothetical circular fire front is necessary especially for a flat, homogenous terrain with a single ignition source. Simulation results are also presented which then include the effects of external winds, non-flat forest terrain, and heterogeneous landscapes. Discussions involve the mathematical representation of the model and graphical illustrations portrayed by simulation results to further explain a more realistic cellular automaton model as compared to the other existing models.

**Keywords:** Cellular automata, forest fire, fire modeling, fire front, local transition function

**ESTD-2**

# A LOW-COST MACHINE VISION SYSTEM FOR REAL-TIME FIRE DETECTION

**Dieter A. Dizon and Jaderick P. Pabico***

Institute of Computer Science, College of Arts and Sciences
University of the Philippines Los Baños, College 4031, Laguna
Telefax: 049 5362313/049 5362302; Email: jppabico@uplb.edu.ph

Progress in fire detection technologies has been substantial over the last decade due to advances in sensor, microelectronics and information technologies, as well as a greater understanding of fire physics. However, acquiring systems that integrate these technologies is still costly, while most of these systems cater only to fire events that are not common locally. We designed, implemented and tested a system for real-time detection of fire for a wide range of local fire and false alarm events using robust algorithms that integrate state-of-the-art software technologies and running under cheap off-the-shelf hardware. The spectral, spatial and temporal properties of fire events are automatically extracted by the system using color video streams captured from a cheap USB-mounted web camera. The use of color video streams has significant advantages over the traditional ultraviolet and infrared fire detectors due to the former's improved detection and fewer false alarms, while additional descriptive information about fire location, size, and growth rate can be obtained. We used the color probability density of fire pixels to represent the spectral model of fire events. We "trained" a machine vision algorithm by creating, normalizing, and thresholding the color histogram of collected video sequences of fire to produce a color look-up table that will determine the fire-colored pixels. Our spatial and temporal models respectively capture the spatial structure and the temporal signature of a fire region. The ratio between the intersection and difference of fire-colored pixels in consecutive video frames served as a criterion for deciding if the group of fire-colored pixels possess the fire's spatial and temporal behavior. This criterion can be adjusted to improve detection under a specific environment. The system uses an audio stream to output alarm signals of varying loudness appropriate for the detected rate of fire growth. Additionally, the system can record the detected fire events to help decision makers on how to avoid future fire damages and to aid arson and forensic investigators. We tested our system under different local indoor and outdoor fire events consisting of thousands of image frames. Our system detected real fire events and ignored non-fire events 84% of the time. The system detected no-fire events as fire events (i.e., false alarms) 12% of the time and ignored real fire events 4% of the time. The ignored fire events, however, are from controlled fire such as

the blue flame from a torch welder and a motion-less flame from a gas stove. Based on our tests, our vision-based fire detection system from off-the-shelf hardware can be a cheap yet flexible alternative to traditional ones.

**Keywords:** machine vision, real-time fire detection, image processing, fire physics, fire spectral characterisics, fire temporal chracteristics, fire spatial characteristics

**ESTD-3**

## AUTOMATING THE CLASSIFICATION OF TOMATO (*Lycopersicon esculentum*) MATURITY USING IMAGE ANALYSIS AND NEURAL NETWORKS

**Alona V. De Grano and Jaderick P. Pabico***

Institute of Computer Science, College of Arts and Sciences
University of the Philippines Los Baños, College 4031, Laguna
Telefax: 049 5362313/049 5362302; Email: jppabico@uplb.edu.ph

Color in tomato is the most important external characteristic to assess ripeness and postharvest life, and is a major factor in the consumer's purchase decision. The degree of ripening is usually estimated visually by human graders comparing the tomato color to a chart that classify fresh tomatoes into six maturity stages according to the USDA standard classification: Green, Breakers, Turning, Pink, Light Red, and Red. This manual practice of tomato maturity classification often results into errors due to human subjectivitiy, visual stress, and tiredness. We developed a color image analysis procedure and a neural network model to automate the classification of tomato maturity. We captured using a computer-connected digital camera 6,000 color images of locally grown and harvested tomatoes equally representing the six maturity stages (1,000 each). The average classification by five expert graders from a local commercial farm was used as the maturity classification of each tomato. Using the red, green and blue (RGB) spectral values of the captured images as inputs, we trained a neural network-based tomato maturity classifier to indicate the degree of maturity within each stage and to provide a continuous index over the complete maturity range. We trained a 3-layer neural network via the feed-forward, back propagation training algorithm using 70% of the captured images as the training set (4,200 images) and 10% as the test set (600 images), equally representing each maturity stage. The test set was used during training to avoid model over-fitting. Validation results agreed with manual grading in 97% of the remaining tomatoes (1,200 images), while the remaining 3% were classified wrongly but within one maturity stage difference. With this result, an

automatic vision system for tomato grading could be a potent alternative to manual grading.

**Keywords**: tomato grading, neural network, image processing, feed-forward, back-propagation

**ESTD-4**

## CONSTRUCTION OF AUTOMATIC MANGO SORTER

**John Noriel Lumbres and Alvin Joseph Faustino***

Physics Division, Institute of Mathematical Sciences and Physics
University of the Philippines, Los Banos
Tel: 049 5361841; Fax: 049 5366610; Email: ajjfaustino@uplb.edu.ph

A micrometer-based instrument that measures weight of mangoes (*Magnifica indica* L. ) and sort in three different categories was implemented using an Atmel ATMEGA 16L microcontroller. The objective of the study was to design and implement an instrument that used a load cell as a weight sensor and actuators to transfer the mangoes from the platform to a conveyor belt and places them in their respective categories. The study was composed of five main phases namely 1) software development, 2) mechanical hardware design and construction, 3) controller design and construction, 4) sensor calibration , and 5) data gathering and testing. On the software part, the weight in the different categories can be set manually or using the default standard weight classifications of mangoes. All actuators in the sorting instrument were controlled by the microcontroller unit (MCU). An LCD and four buttons were placed for user interface. On the hardware part, a load cell attached to the platform was used to measure the weight of the mangoes. Then a pushing mechanism powered by a DC motor was activated to transport the mangoes from the platform to the conveyor belt powered by an AC speed control motor. Two solenoid motors attached with flippers were used to sort mangoes into their respective category. The calibration of the ADC and the sensor was done using a set of metal weights and a software program. The microcontroller-based automated mango sorter was tested using thirty mangoes and successfully sorted 289 times out of 300 trials thus giving the sorting machine 96.33 % success rate.

**Keywords**: mango sorting, microcontroller

**ESTD-5**

# EFFECTS OF CO-SOLVENTS ON THE TRANSESTERIFICATION REACTION TIME, TEMPERATURE, AND FREE GLYCERIN CONTENT OF CRUDE METHYL ESTER PRODUCED FROM COCONUT (*Cocos nucifera* L.) OIL

**Sixto A. Valencia[1], A.Vijay.Bharat.Sastri, Jovita L. Movillon[1], Rex B. Demafelis[1] and Nicomedes D. Briones[2]**

[1] Chemical Engineering Department, College of Engineering and Agro-Industrial Technology
[2]School of Environmental Science and Management
University of the Philippines Los Baños, College, Laguna 4031
Telefax: 049 5362315; Email: ver_valencia@yahoo.com

Transesterification of coconut oil was carried out with different cosolvents namely hexane, petroleum ether and diethyl ether to investigate their effect on the reaction time and temperature, and free glycerol content of crude methyl ester. This study aimed to shorten the transesterification reaction time and produce a low glycerin content methyl ester from coconut oil using hexane, petroleum ether and diethyl ether as cosolvents.

Reactions were carried out with different cosolvent-to-methanol ratios (1:20, 1:10, 1:6.7, 1:5 and 1:4) at room temperature (30°C) and at 60°C. For all the reactions, methanol-to-oil ratio was maintained at 0.28:1 and sodium hydroxide catalyst added was 0.5% of the amount of oil taken.

Washing of the crude methyl ester by bubble wash and mist wash was done to compare the washing time and amount of water required, respectively, to lower the percentage free glycerol content of crude methyl ester obtained from different ratios of cosolvent to methanol, to the same level, and the effect of salts (sodium chloride, calcium chloride and potassium iodide), glycerol and temperature on the breaking of emulsions formed after washing, were also studied.

The percentage yield of crude methyl ester increased with increase in cosolvent:methanol ratio. It was found that 1:5 cosolvent to methanol ratio was the optimum ratio and the room temperature (30°C) was the optimum temperature. Volume of water required for mist wash and the time required to bubble wash the crude methyl ester reduced with the increase in cosolvent to methanol ratio. Mixing of the glycerol was very effective in breaking of emulsions formed during the washing.

**Keywords**: coconut oil, cosolvent, glycerin, methyl ester, transesterification

**ESTD-6**

# SACCHARIFICATION AND FERMENTATION OF CORN (*Zea mays*) WASTE MIXTURES FOR ETHANOL PRODUCTION

**Jovita L. Movillon*, Sixto A. Valencia, Marilyn C. del Barrio and Gemma M. Tongson**

Chemical Engineering Department, College of Engineering and Agro-Industrial Technology – University of the Philippines Los Baños, College, Laguna 4031
Telefax: (049) 536-2315,
Email: jlmovillon@yahoo.com

The importance of bioethanol production is underscored with the enactment of the Biofuels Act. With such law mandating at least 5% (by volume) blend with all gasoline fuels within 2 years, and 10% blend within 4 years of its effectivity, there is a need to strengthen R & D efforts on the utilization of all possible substrates to produce the large amount of bioethanol for the national biofuel program.

Corn waste mixtures which consist of the residual starch not extracted during milling, the depithed corncobs, and the husks are the substrates considered in this study. Corncobs, together with the husks and the starch contain extractable sugars for fermentation.

This study aimed to evaluate the effect of pretreatment and enzyme concentration on subsequent saccharification and fermentation using corn wastes as raw materials. The effect of pretreatment (hot water; 0.5% $H_2SO_4$) was evaluated on ethanol production of corn waste mixtures. Then the effect of cellulase concentration (10%, 20%) on saccharification of corn waste mixtures was determined, along with the fermentation profile for ethanol concentration, reducing sugar concentration and biomass concentration.

Results showed that the highest ethanol concentration produced was 4.897% (v/v) using hydrolysates from the combination of dilute acid 0.5% (v/v) $H_2SO_4$ pretreatment and the use of 10% cellulase in corn waste mixture hydrolysis. The computed ethanol productivity for dilute acid pretreated corn waste samples that used 10% and 20% cellulase are 0.4192 and 0.4014, respectively. For hot water pretreated samples, using 10% and 20% cellulase treatment during saccharification, ethanol productivity was 0.3889 and 0.3730, respectively.

Results showed that pretreatment using dilute acid (0.5% $H_2SO_4$) and hot water, and saccharification using 10% and 20% (w/w) cellulase were not significantly different.

**Keywords**: bioethanol, cellulase, corn wastes, fermentation, saccharification

**ESTD-7**

# ELECTROLYTIC DECOLORIZATION OF DISTILLERY SEQUENTIAL BATCH REACTOR (SBR) EFFLUENT IN A CONTINUOUS REACTOR

**Carlos Hernandez Jr.[1], Catalino G. Alfafara[1*]**
**Veronica P. Migo[2], Jovita L. Movillon[1], Monet M.C. Concepcion[1]**
**and Masatoshi Matsumura[3]**

[1]Department of Chemical Engineering
[2]National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Banos, College, Laguna 4031
Telefax: 049 5362315; Email: linojp@yahoo.com
[3]Institute of Applied Biochemistry, University of Tsukuba
Tennodai 1-1-1, Tsukuba City 305-0006, Japan

Electrolytic decolorization of saline-supplemented alcohol distillery effluent after passage from a Sequential Batch Reactor (SBR) was investigated in a continuous reactor. The electrolytic system utilizes the concept of indirect electro-oxidation where the chloride ion from the saline supplementation is converted electrochemically into oxidants, which subsequently act to destroy the chromophoric pollutants in the wastewater. The reactor was run at different flow (or color-loading) rates (underload, balanced, overload) and different operating currents. Then the steady-state decolorization efficiencies and other water quality parameters were obtained at each flow rate. Decolorization efficiencies of 95% was achieved under underload condition, 78% under balanced condition and 52% under overload condition. Steady-state temperature values were: overload-56°C; balanced-62°C; and underload-81°C. Steady-state pH values ranged from 7 to 8. An engineering relationship useful for scale up and operation was derived from the steady-state results

**Keywords**: distillery slops, electro-oxidation, sequential batch reactor , continuous reactor, decolorization

**ESTD-8**

# ELECTROCHEMICAL TREATMENT OF SOY SAUCE PROCESSING WASTEWATER

**Efren Elvin A. Peria[1], Catalino G. Alfafara[1*], Veronica P. Migo[2], Jovita L. Movillon[1], Monet Concepcion C. Maguyon[1], and Masatoshi Matsumura[3]**

[1] Department of Chemical Engineering
[2] National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Baños, College, Laguna 4031
[3] Institute of Applied Biochemistry, University of Tsukuba
Tennodai 1-1-1, Tsukuba City 305-0006, Japan
Telefax: 049 5362315; Email: linojp@yahoo.com; acer1@laguna.net

The high salt content and presence of color in soy sauce processing wastewater can be considered one of the reasons why treatment efficiencies are not very high using conventional biological methods (i.e. activated sludge, etc). In this study the application of electrochemical method as an alternative treatment option was explored. The electrochemical method is based principally on the concept of electrooxidation where the chloride ions present in the effluent are electrolytically converted to oxidants for decolorization and organic matter removal. Batch electrolysis experiments were conducted at different operating currents and wastewater parameters like color, total suspended solids (TSS) and pH were monitored. Initially, color was initially used as an index of organic matter content. Results showed high pollutant removals (>80%) for color and TSS. The pH remained stable at about 8, although there was a slight increase in temperature. The results were used to obtain engineering relationships useful for operation and scale up using the concept of charge dose.

**Keywords:** electrooxidation, electrolysis, soy sauce effluent, charge dose

**ESTD-9**

# METAL REMOVAL FROM GOLD SMELTING INDUSTRY WASTEWATER BY ELECTROCHEMICAL DEPOSITION

**Eleazer L. Vivas[1], Catalino G. Alfafara[1*], Veronica P. Migo[2] Jovita L. Movillon[1], and Monet Concepcion C. Maguyon[1]**

[1] Department of Chemical Engineering
[2] National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Banos, College, Laguna 4031
Telefax: 049 5362315; Email: linojp@yahoo.com

Removal of metals from gold smelting industry wastewater (mainly copper) was investigated using electrochemical deposition. Batch electrolysis experiments were performed at an operating current of 4 A. Temperature and pH were also monitored during electrolysis. Results showed high copper removal efficiencies (>85%) could be obtained. The high copper removal verified by the drastic decrease in the blue color of the effluent (indicator of high copper concentration) and the deposition of copper at the cathode. No drastic changes in pH and temperature were observed during the electrolysis experiments. The copper concentration data were used to determine the current efficiency, charge dose, energy requirement and to obtain engineering relationships useful for operation and scale up.

The metal removal efficiencies by electrodeposition were also compared with another method using alkali precipitation as benchmark.

**Keywords**: spontaneous redox reactions, electrolysis, gold smelting industry effluent, charge dose

**ESTD-10**

# BIOSORPTION OF HEAVY METALS FROM GOLD SMELTING INDUSTRY EFFLUENT BY UNTREATED AND TREATED *Azolla filiculoides* WITH $H_2O_2/MgCl_2$

**David S. Renolayan[1*], Catalino G. Alfafara[1], Lorele C. Trinidad[2], Jovita L. Movillon[1], and Clarito P. Geron[1]**

[1] Department of Chemical Engineering
[2] National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Banos, College, Laguna 4031
Email: renolayan_david@yahoo.com

The adsorption of heavy metals from gold smelting industry effluent onto dried milled *Azolla filiculoides*, as a cosmopolitan free-floating water fern, was investigated in the batch biosorption experiment. Copper, as the heavy toxic metal with the highest concentration (>3000 ppm) in the effluent, was analyzed for possible removal. Ten different mass loadings were tested for the uptake time and equilibrium concentration determination in a daily and hourly sampling interval. Higher and lower initial metal concentration were utilized. The pH of the solution was also varied to determine the most effective working condition for the adsorption process. The copper uptake capacity of the biomass was approximately 98 mg/g (dry *Azolla*). The metal removal (>70%) was observed to be moderately rapid at low pH and low initial $Cu^{2+}$ concentrations. On the other hand, the adsorption of heavy metal onto treated *Azolla filiculoides* by $H_2O_2/MgCl_2$ as an activator material (mineral and oxidant agents) was also investigated. Cellulose are important polysaccharides constituent of plant cell walls, made of fragments of polygalacturonic acid chains, which interact with $Ca^{2+}$ and $Mg^{2+}$ to form a three dimensional polymer by $(-COO)_2Ca$ and or $(-COO)_2Mg$ bindings as the ion exchanging bases. Results showed that increased use of $H_2O_2$ in the treatment process had no remarkable effect on the removal of heavy metals. But the increasing use of $H_2O_2$ increased heavy metal biosorption (>80%), remarkably in cases when Mg ions as the exchanger ions were increased proportionately.

**Keywords:** *Azolla filiculoides*, batch biosorption, heavy metals, uptake capacity

## *HEALTH SCIENCES DIVISION*

**HSD-1**

# CLIMATIC FACTOR CORRELATES WITH DENGUE INCIDENCE IN METRO MANILA, PHILIPPINES

**Glenn L. Sia Su**

Department of Biology, College of Science
De La Salle University-Manila
Tel: 02-5360228; Email: siasug@dlsu.edu.ph

Dengue is a serious public health problem in the tropical regions particularly in Metro Manila, Philippines. Dengue infections are caused by a virus categorized in the family of *Flaviviridae* and is transmitted by the *Aedes aegypti* mosquito. The concern over today's increasing dengue incidence has been attributed to climate change. Contradicting reports indicate that climatic factors such as temperature and rainfall considerably increase the toll of infectious diseases like dengue. Such reports show that the relationship of dengue with the climatic factors remains inconclusive. To date, little research has been conducted on how climatic factors influence the burden of ill health particularly on dengue in Metro Manila, Philippines. This study investigates the climatic factors temperature and rainfall influence on the dengue incidence in Metro Manila for the 10-year period of 1996-2005. The information obtained could help bridge the gap on understanding the complex link of the environment and human health. Monthly dengue incidence data for Metro Manila were collected over a 10-year period from the epidemiologic reports of the National Epidemiology Sentinel Surveillance System (NESSS), Department of Health. Monthly climatic factors for Metro Manila were collected at the same period from the Philippine Atmospheric, Geophysical and Astronomical Services (PAGASA). Climatic factors temperature and rainfall were linked with dengue incidence through a multiple linear regression analysis. Results showed that the predictive model equation plots dengue incidence *(Y)* versus rainfall (X), which suggests that climatic factor rainfall is significantly correlated to dengue incidence ($r = 0.337$, $p<0.05$). No significant correlation on the relationship of temperature and dengue incidence was established ($p > 0.05$). Considerable evidence shows dengue incidence in Metro Manila is likely to increase in changing rainfall patterns.

**Keywords**: climate, dengue, rainfall, temperature, Philippines

**HSD-2**

# MOLECULAR INITIATIVES AND BIOINFORMATICS IN THE STUDY OF DENGUE VIRUS IN THE PHILIPPINES

**Ronald R. Matias*, Philippe Noriel Q. Pascua**
**Jhoe Anthony R. Alfon, Xerxes Morgan R. Lozada**
**Maria Terrese G. Alonzo, Carol Z. Tanig, Joyce D. Reyes**
**Cynthia A. Mapua, Mark Pierre S. Dimamay, Corazon C. Buerano,**
**Ma. Luisa G. Daroy and Filipinas F. Natividad**

Research and Biotechnology Division
St. Luke's Medical Center
Quezon City, Philippines
Telephone: 0632-7275540 Email: rrmatias@stluke.com.ph

Research on Dengue hemorrhagic fever in the Philippines has been limited mainly to clinical research, incidence and occurrence. This work aims to show the molecular initiatives and bioinformatics used in our 10-year study of the dengue virus.

From 1995 up to present, we have accumulated a total of 9,062 serum samples coming from different regions in the Philippines now stored in the St. Luke's Dengue Serum Bank. Corresponding patient data, demographics and research results have been encoded in a Dengue Database. Dengue virus was first detected then isolated and cultured from serum using *Aedes albopictus* C6/36 cell lines. Serotypes of positive isolates were identified by reverse transcriptase polymerase chain reaction (RT-PCR). Molecular genetic markers in the virus are currently being probed to associate virulence of the pathogen with severity of the disease. In phylogenetic analysis, our Philippine DEN 1 isolates clustered in a unique group while DEN 2 formed two clusters, where more recent isolates clustered distinctly and separately from earlier isolates. Generation of a homologous 3-D protein structure derived from the entire envelope gene permitted the localization of potential antigenic sites. Sequence alignment allowed the identification of a consensus region of DEN 3 NS1, where LUX-based primers were designed for more efficient detection and quantitation by real-time PCR.

Conventional ways of detecting dengue infection include IgM-capture ELISA, Focus Formation Assay (FFA) and Immunofluorescence Assay (IFA). Virus overlay protein-binding assay (VOPBA) is used to look for putative dengue-binding proteins on the host cell surface. Monoclonal antibodies derived by hybridoma technology, single-chain variable antibody fragments (ScFv) prepared by phage technology, and diagnostic antigens are being tested using flow cytometry and animal immunogenicity test.

These thrusts are valuable components in any research on pathogen genomics as shown by the Dengue Research Group at St. Luke's Medical Center.

**Keywords**: dengue, bioinformatics, database, molecular biology, genomics

**HSD-3**

## MONOCYTES (CD14+) AND B CELLS (CD 19+) ARE THE PRINCIPAL TARGET CELLS OF DENGUE VIRUS

**Michael O. Baclig[1], Leonara T.S. Gervacio[1], Corazon C. Buerano[1]**
**Raymundo W. Lo[2],**
**Atsushi Kumatori[3], Shingo Inoue[4], Futoshi Hasebe[4], Kouichi Morita[4],**
**Ronald R. Matias[1], and Filipinas F. Natividad[1]**

[1]Research and Biotechnology Division and
[2]Institute of Pathology, St. Luke's Medical Center
Quezon City, 1002, Philippines
[3]Chiba Institute of Science, Japan
[4]Department of Virology, Institute of Tropical Medicine
Nagasaki University, Japan

Laboratory diagnosis of dengue virus infection involves techniques such as cell culture, immunofluorescence, immunochromatography, enzyme-linked immunosorbent assay, and polymerase chain reaction. To date, monoclonal antibodies and cell fixation-permeabilization techniques in flow cytometry have been reported for the rapid detection of dengue virus infected cells. In this study, phycoerythrin (PE) labeled anti-CD3, CD14, CD16, CD19 and 6B6C anti-flavirus antibodies were used in conjunction with fixation-permeabilization techniques to examine their possible application in the detection of dengue virus in peripheral blood mononuclear cells by flow cytometry. Cells were collected from suspected dengue-patients and analyzed on a BD FACSCaliburÔ Flow Cytometer. Dimly to brightly positive expression was noted in monocytes and B cells in the blood samples tested. Results suggest that fluorescent activated cell sorter (FACS) can be a powerful tool to detect dengue virus infected cells by flow cytometry.

**Keywords:** Dengue virus, Fixation, Permeabilization, Phycoerythrin, 6B6C, T cells, Monocytes, NK cells, B cells, Flow Cytometry

**HSD-4**

# LUX™-BASED FLUOROGENIC PRIMERS FOR REAL-TIME PCR DETECTION AND QUANTITATION OF DENGUE VIRUS

**Mark Pierre Dimamay*, Irene Tan, Corazon C. Buerano**
**Jhoe Anthony R. Alfon,**
**Carol Z. Tanig, Ronald R. Matias and Filipinas F. Natividad**

Research and Biotechnology Division
St. Luke's Medical Center
Quezon City, Philippines
Tel: 0632 7275540; Email: mpsdimamay@stluke.com.ph

Real-time Polymerase Chain Reaction (PCR) using fluorogenic probes or primers presents many advantages over conventional PCR methods, including sensitivity, speed, and the ability to accurately quantify the amount of template nucleic acid present in a sample. In this study, we developed a real-time PCR assay to detect and quantify dengue virus type 3 (DEN 3) using the novel LUX™ (Light Upon eXtension) fluorogenic technology. Briefly, this platform utilizes a hairpin conformation at the fluorophore-labeled oligonucleotide primer to quench the fluorescence signal. Upon annealing and extension, the primer linearizes resulting in release of fluorescence. The LUX™ designer software from Invitrogen was used to design a FAM-labeled forward primer and a standard reverse primer. This primer pair targets a conserved region within the non-structural 1 (NS1) gene of DEN3 strains. Using the Rotorgene 3000 (Corbett) real-time PCR thermocycler, DEN3 was detected in cDNAs generated from total RNA isolates of DEN3-infected culture fluids. Serially diluted plasmid DNAs containing the DEN3 NS1 gene were used as quantitation standards. The standard curve generated was used for extrapolating quantitative information for targets of unknown concentration. The detection limit of the assay was observed to reach as low as 100 copies/ml. This assay protocol is used to detect and quantify dengue 3 virus in infected culture fluids from C6/36 *Aedes albopictus* cells and Human Pulmonary Arterial Endothelial cells (PAE), and from clinical serum samples of dengue-suspected patients. Our results demonstrate that the LUX-based real-time PCR assay may be utilized as a rapid, convenient, and sensitive screening tool for dengue virus infections.

**Keywords**: dengue, real-time PCR, quantitation, LUX, fluorescence

**HSD-5**

# IDENTIFICATION OF HBV GENOTYPES IN THE FILIPINO POPULATION BY RESTRICTION FRAGMENT LENGTH POLYMORPHISM

**Juliet G. Cervantes[1,2], Joseph C. Bocobo[1], May M. Rivera*[3], Rey Z. Predicala[3], Ronald R. Matias[3], and Filipinas F. Natividad[3]**

[1]Institute of Digestive Diseases, [2]Center for Liver Diseases,
[3]Research and Biotechnology Division, St. Luke's Medical Center, Quezon City
Telefax: 02 7260467; Email: mrivera404@yahoo.com

Hepatitis B virus (HBV) is a DNA virus of the family *Hepadnaviridae*. It contains a small, circular, partially double stranded segment of DNA of approximately 3.2 kb in size. HBV infection is a global public health problem that infects approximately 300 million carriers from which one million die annually from HBV related liver diseases. At least 8 major genotypes have been documented and a significant number of data indicates that HBV genotypes influence HBesAg seroconversion rates, severity of liver disease, development of antiviral drug-resistance and response to treatment. This study aims to identify existing genotypes in the Filipino population by restriction endonuclease cleavage of the PCR-amplified S gene region of the HBV genome. Samples found positive for HBV DNA either by conventional in-house PCR detection or commercially available PCR assays (Amplicor HBV Monitor Test, Roche Molecular Systems, NJ, USA) at the Research and Biotechnology Division, St. Luke's Medical Center were included in the study. DNA from serum or plasma was extracted and PCR was performed in a single tube assay using nested primers based on the conserved nucleotide sequences in the regions of the pre-S1 through S genes of the HBV genome. Restriction digests using (a) *Bsr*I (b) *Sty*I (c) *Hpa*II (d) *Eae*I and (e) *Dpn*I enzymes were carried out on the final PCR products. After electrophoresis through a 10% polyacrylamide gel, restriction patterns were determined by comparing digestion products with that of established genotypes.

Out of 226 HBV DNA samples that were positive by conventional HBV PCR detection or Amplicor HBV Monitor Test, 110 (48.7%) were identified as genotype A, 49 (21.7%) as genotype B and 67 (29.6%) as genotype C. Our ongoing work is designed to correlate the identified HBV genotypes with viral DNA level, serological and biochemical markers.

**Keywords**: Hepatitis B Virus, HBV genotypes, restriction endonuclease cleavage, nested PCR, restriction fragment length polymorphism, Amplicor HBV Monitor

**HSD-6**

# DETERMINATION OF *Helicobacter Pylori VacA* GENOTYPES AND *CagA* GENE FROM GASTRIC BIOPSY SAMPLES IN A SPECIAL *Pylori* TEST PAPER

**Marie Antoinette Lontok[1], Blanquita B. de Guzman*[2], Ma. Luisa G. Juan[2], John Arnel Pangilinan[1], St. Luke's *H. Pylori* Study Group[1,2] and Filipinas F. Natividad[1]**

[1]Institute of Digestive Diseases and [2]Research and Biotechnology Division
St. Luke's Medical Center, Quezon City, Philippines
Telefax 726-0467

*Helicobacter pylori*, attributed to be the major cause of peptic ulcer disease is difficult to detect. Tests to confirm presence of *H. pylori* are mostly invasive in nature, requiring endoscopy.

The special *Pylori* test paper is easy to use and has been found to be reliable. It consists of an agar gel containing urea, phenol red, buffers and bacteriostatic agent in sealed plastic slide. If the urease enzyme of *H. pylori* is present, the resulting breakdown of urea causes the pH to rise and the gel turns from yellow to bright magenta. In this study, gastric biopsy samples were used to determine the *vacA* genotypes and *cagA* gene status in a special *Pylori* test paper. DNA was isolated from gastric biopsies whether positive or negative for the rapid urease test. To confirm presence of *H. pylori*, primers for the *H. pylori* (Hp-specific) *16s rRNA* and *glm* were used and *vacA* genotypes and presence of *cagA* were also determined.

Seventy-two gastric biopsies placed in special *Pylori* test paper were used. Of the 72 gastric biopsies tested, 69 were positive for *H. pylori* using Hp specific *16s rRNA* and 26 were positive for *glm*. Thirty-eight samples were positive for *vacA*: 4 *s1a/m1*; 8 *s1b/m1*; 2 *s1b/m2*; 3 *s1c/m2*; 1 *s2/m2*; 2 *s1a,s1b/m1*; 1 *s1a,s1c/m2*, 5 with *s1b* only and 12 with only *m1*. Thirty-four samples were negative for *vacA* and twenty-four samples were positive for *cagA*.

This study shows that gastric biopsy samples used for the Rapid Urease Tests can be used to determine *vacA* genotypes and presence of *cagA*. This would greatly facilitate genetic studies of *H. pylori* as it does not require additional biopsy samples.

**Keywords**: *Helicobacter pylori*, *vacA*, *cagA*, *16s rRNA*, Special Pylori Test Paper

**HSD-7**

# DECREASED INVASION OF RESPIRATORY PATHOGENS IN HUMAN PHARYNGEAL CELLS DUE TO SUBINHIBITORY CONCENTRATIONS OF CARBOXYMETHYLCYSTEINE

**Ronald R. Matias*, Frederick Dela Cruz, Elena Tuano, Katherine M. Santiago, Leila M. Florento, Rodolfo Pagcatipunan, and Alexander O. Tuazon**

Biological Sciences Department
Medical Affairs Division, United Laboratories Inc.
Tel: 631-8501 local 7423; Email:rrmatias@unilab.com.ph

Adherence of pathogens to cell surface membrane is an essential first step in invasion and successful infection. Pathogens attach to the respiratory epithelial cells avoiding elimination by mucociliary action. Interfering with bacterial adhesion is a novel approach in the treatment of respiratory infections overcoming problems associated with antibiotic resistance. Inhibition of bacterial adhesion is an appropriate early strategy in preventing respiratory infections. The mucolytic agent S-carboxymethylcysteine (S-CMC) is used in the treatment of various respiratory illnesses characterized by abnormal mucous secretions. S-CMC inhibits the attachment of *Moraxella catarrhalis*, *Haemophilus influenzae* and *Streptococcus pneumoniae* to epithelial cells. In this study, the effect on the attachment of *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Escherichia coli* to human pharyngeal cells was investigated. Briefly, bacteria at a cell density of $1 \times 10^6$ cfu/ml were incubated with various concentrations of S-CMC alone, S-CMC with placebo and placebo alone. Bacteria treated with culture medium but without any drug represented the control sample. Treated bacteria were added to the pharyngeal cells and incubated for 2 hours at 37°C with 5% $CO_2$. The unattached bacteria were washed off using sterile PBS. Bacteria remaining in the extracellular environment were killed with antibiotic treatment. The cells were washed and lysed to release intracellularly located bacteria. The lysate was plated in nutrient agar and incubated at 37°C. Thereafter, bacterial colonies were counted and expressed as colony forming units. A significant decrease in the number of bacteria colonies was observed after 1 hr incubation of carbocisteine. Increasing amounts of carbocisteine further decreased the number of colonies. The placebo alone did not decrease the number of colonies. However, co-incubation of carbocysteine and placebo still resulted to a decrease in the number of colonies observed suggesting specificity of binding inhibition.

**Keywords:** bacterial adhesion, carbocysteine, pharyngeal cells

**HSD-8**

# PCR-BASED DETECTION OF MUTATIONS IN THE *katG*, *rpoB*, AND *embB* GENE OF *Mycobacterium tuberculosis*

**Ronald R. Matias*[1], Vivian Silvestre[1], Leila Florento[1], Rodolfo Pagcatipunan[1], Francia Gonzales[2], Juliet Langkay[2] and Alexander O. Tuazon[1]**

[1]Biological Sciences Department
Medical Affairs Division, United Laboratories Inc.
[2]Central Laboratory, Philippine Tuberculosis Society
Quezon Institute Compound, E. Rodriguez Ave. Quezon City
Tel: 7813761; Email: rrmatias@unilab.com.ph

Tuberculosis is a leading cause of death by an infectious microorganism. Rapid detection and early diagnosis specifically of multi-drug resistance are essential for effective treatment and control of *M. tuberculosis*. Current assays for determining antibiotic susceptibility of *M. tuberculosis* require weeks to perform due to the slow growth of the bacilli. Alternatively, PCR-based methods are used in the detection of *M. tuberculosis* and identification of mutations responsible for resistance. In this study, specific mutations in the rpoB, katG and embB codons were detected by Amplification Refractory Mutation System (ARMS) and Multiple allele Specific (MAS) PCR assay. Briefly, genomic DNA was extracted from TB bacilli identified and phenotypically characterized at the Quezon Institute Hospital. Specific primers were used to amplify regions in the rpoB, katG and embB gene. Mutations were identified based on the presence or absence of specific amplicons. Mutations in the katG and embB were further confirmed using PCR-RFLP. 61% were found to be resistant to isoniazid (INH) using culture sensitivity assay. Only 45% of these resistant isolates have mutations in the katG codon 315. 39% were observed to be sensitive to INH by culture. However, mutations in the katG codon were detected in 8 culture sensitive isolates. 28% were observed to be resistant to ethambutol by way of culture. Only 50% of the ethambutol resistant strains have mutations in the embB codon 306 gene. While 72% were observed to be sensitive to ethambutol, mutations in the embB codon 306 were detected in 9 out of the 62 ethambutol sensitive isolates. 39% were found to be resistant to Rifampin by culture. Only 24 out of the 31 resistant isolates have mutations in the rpoB codon. 61% were observed to be sensitive to rifampin. However, 23 out of the 49 culture sensitive isolates have mutations in the rpoB codon. The above results indicate that while mutations in the rpoB, katG and embB are present and can be detected by gene amplification techniques, there are other factors that further contribute to the emergence of drug resistance.

**Keywords:** PCR, mutations, *Mycobacterium tuberculosis*, multi-drug resistance

**HSD-9**

## ASSOCIATION OF *CETP Taq1B* SINGLE NUCLEOTIDE POLYMORPHISM AMONG DYSLIPIDEMIC FILIPINOS WITH THEIR RESPONSE TO SIMVASTATIN TREATMENT

**Leonora V. Autus-Geniston*, Ronald R. Matias, Gerald C. Vilela and Alexander O.Tuazon**

Biological Sciences Department, Medical Affairs
United Laboratories Inc, 66 United St., Mandaluyong City
Tel:632 6318501; Fax: 632 6384961; Email: lageniston@unilab.com.ph

Lowering of cholesterol levels with statins among middle aged-dyslipidemic patients reduces the incidence of coronary heart disease and lowers the risk of death. However, it was observed that a substantial percentage of patients were not protected from myocardial infarction. This variation in response to statin treatment was attributed to genetic factors. An association of the variation in response to cholesterol-lowering strategies and *cholesteryl ester transfer protein (CETP)* polymorphism was reported by a previous study among Dutch patients. *CETP Taq1B* single nucleotide polymorphism (SNP) includes two different variants, *B1* and *B2* alleles characterized by the presence and loss, respectively, of a restriction site for the enzyme *Taq1* in intron 1. The present study determined the *CETP Taq1B* gene polymorphism using polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) in 130 healthy Filipino volunteers. An association study of *CETP Taq1B* SNP with the response to simvastatin treatment of 24 middle-aged dyslipidemic patients for 8 weeks was also carried out. The allele frequencies of *B1* and *B2* alleles were 0.625 and 0.375, respectively. The genotype frequencies were in Hardy-Weinberg equilibrium. The rapid increase in high density lipoprotein (HDL) after 2 weeks and continuous increase in HDL during the 8$^{th}$ week simvastatin treatment were commonly observed in individuals with *CETP B1B1* genotype. The expected HDL elevation among individuals with *CETP B1B2* genotype was observed only after the 8$^{th}$ week treatment. For patients with *CETP B1B1* genotype, twenty (20) mg of simvastatin was adequate to cause an early response and continuous increase in HDL-C level during the 8-week treatment period.

**Keywords:** *CETP Taq1B*, single nucleotide polymorphism, Simvastatin, cholesterol

**HSD-10**

# DETECTION AND ISOLATION OF *Acanthamoeba* sp. FROM THE NASAL CAVITY OF SELECTED FILIPINO POPULATIONS

**Michael Thomas T. Gonzales[1], Corazon C. Buerano [1,2], Ronald R. Matias[2] and Filipinas F. Natividad*[2]**

[1]Institute of Biology, College of Science,
University of the Philippines Diliman, Quezon City 1101
[2]Research and Biotechnology Division, St. Luke's Medical Center
279 E. Rodriguez Sr. Blvd. Quezon City 1102, Telefax 726-0467

Free-living potentially pathogenic and opportunistic amebae especially those belonging to the genera *Acanthamoeba* and *Naegleria* are ubiquitous unicellular organisms. They have been isolated from soil, dust, air, water, sewers, eyewash stations, air-conditioning units, contact lenses and many other common areas. Some *Acanthamoeba* species cause fatal granulomatous amebic encephalitis (GAE), amebic keratitis as well as cutaneous lesions and sinusitis in humans. They may also harbor in their cytoplasm pathogenic bacteria such as *Legionella sp.* In this study, nasal swabs were obtained from volunteers of four different sample populations of diverse occupations to associate the presence of the ubiquitous free-living amebae with occupational risk. The populations were composed of 50 y high-rise office workers, 50 factory workers, and 50 public utility jeepney (PUJ) drivers. An additional 57 street children volunteers were included in the study. The nasal swabs were immediately placed in tubes containing 300 ml of sterile Page's ameba saline and brought to the research laboratory. The tubes were mixed thoroughly and the contents including the cotton swab were placed on the surface of non-nutrient agar plates containing heat-killed *Escherichia coli.* All plates were incubated at 37°C and were observed daily for 2 weeks. No amebae were observed in the plates containing nasal swabs from office and factory workers as well as the street children. However, trophozoites and cysts were observed in the plates inoculated with nasal swabs from 2 PUJ drivers after 2 weeks of incubation. The isolated amebae were further propagated in non-nutrient agar containing heat-killed *E. coli.* The cysts were round to oval and double-walled. The outer and inner walls meet to form the edges of the cyst pore. Trophozoite and cyst morphology suggest they belong to the genus *Acanthamoeba.* This is the first report on the detection and isolation of potentially pathogenic amebae which may be associated with occupational hazard.

**Keywords:** *Acanthamoea*, *Naegleria,* trophozoite, ameba cyst, nasal cavity

**HSD-11**

# MULTIDRUG RESISTANT COMMENSAL *Staphylococcus aureus* AMONG NON-INSTITUTIONALIZED POPULACE

**Marie Johanna L. Cuadra, Lady Jane C. Fanuncio and Lucilyn D. Lahoylahoy***

Department of Biological Sciences
College of Science and Mathematics
Mindanao State University-Iligan Institute of Technology
Iligan City
Tel: 063 2214050 local 137; Fax: 063 2214068; Email: luzlin@yahoo.com

Detection and recovery of non-hospital strains of multiple drug resistant *Staphyloccocus aureus* are increasingly being reported from various regions of the world. The former exclusive nosocomial pathogen has been isolated from both children and adults with no obvious traditional risk factors. The emergence and spread of this multi-resistant strain in the community poses a serious health threat leaving only limited therapeutic options.

Clinical specimens were collected from non-institutionalized children and adult women (114 and 148 individuals respectively) of Iligan City. Seventy-one percent of the study group (70 children and 116 women) were found to be colonized with *S. aureus*. The presumptively identified *S. aureus* were further screened for antibiotic *in vitro* susceptibility profiles. Less than half of the strains recovered from both pediatric and adult carriers (41% and 40%) exhibited multidrug resistance. Four percent of the total 75 heteroresistant strains were found to be no longer susceptible to all five antibiotic agents and an alarming 36% and 96% were resistant to four and three antibiotics, respectively. Vancomycin remained as the antibiotic of choice with the least number of resistant strains (17%). Erythromycin and clindamycin, which are the most commonly prescribed antibiotics showed the least efficacy. The lowered susceptibility to these agents may be attributed to misuse due to self-medication, easy availability and inducible clindamycin resistance by erythromycin resistant strains.

Prevalence of MDRSA was observed to be higher among antibiotic users and those who had current illnesses due to compromised immune systems although there was no significant correlation between colonization of MDRSA and the stated variables.

**Keywords**: multi-drug resistant *Staphylococcus aureus* (MDRSA), heteroresistant strains

**HSD-12**

## HPLC ANALYSIS OF COTININE FROM URINE AMPLES OF ACTIVE AND PASSIVE SMOKERS

**Ma. Cristina B.Portilla*[1], Karina P. Servañez [1,2] and Cherrie B. Pascual [1,2]**

[1]Research and Biotechnology Division, St. Luke's Medical Center
279 E. Rodriguez Sr. Blvd, Quezon City 1102, Telefax: 726-0467
[2] Institute of Chemistry, University of the Philippines
Diliman, Quezon City 1101

Secondhand smoke or environmental tobacco smoke (ETS) is a combination of the smoke from a burning cigarette and the smoke exhaled by the smoker. Inhalation of this dangerous ETS is called passive smoking. ETS exposure can lead to respiratory problems and even lung cancer in non-smokers.

ETS exposure can be detected by analysis of cotinine, a metabolite of nicotine and a better biological marker than nicotine.

Analysis of cotinine was carried out using HPLC with UV detection at 254 nm; a C-18 column and MeOH: 0.1 M $KH_2PO_4$ pH 3.4 (50:50 v/v) buffer. The retention time of cotinine was around 6.3 minutes. Linear response was obtained over a concentration range of 25 ppb to 3.0 ppm while the limit of detection was 5.0 ppb. Solid phase extraction (SPE) with addition of trichloroacetic acid (TCA) was found effective and utilized for pretreatment of urine samples.

The method was tested by analysis of urine samples from three active smokers and three passive smokers. The cotinine levels of active smokers ranged from 683-839 ppb while that of passive smokers were 353-484 ppb.

**Keywords**: cotinine, secondhand smoke or environmental tobacco smoke (ETS), high performance liquid chromatography, solid phase extraction (SPE), passive smoking

HSD-13

# ANODIC STRIPPING VOLTAMMETRY: A SIMPLE AND INEXPENSIVE TECHNIQUE FOR ANALYSIS OF MERCURY IN HUMAN BLOOD

**Jason Paul C. Monlinong[1], Baby Lorielyn T. Dimayacyac[2], Cherrie B. Pascual*[1,2]**

[1]Research ad Biotechnology Division, St. Luke's Medical Center
279 E. Rodriguez Sr. Blvd, Cathedral Heights, Quezon City 1102
Telefax 726-0467
[2] Institute of Chemistry, University of the Philippines
Diliman, Quezon City

Mercury is a toxic heavy metal that damages the central nervous system, endocrine system, kidneys and other organs. Exposure to hazardous mercury levels can result in brain damage and ultimately death. Currently, the most commonly utilized technique to analyze mercury in blood is the coldvapor absorption technique.

In this study, a differential pulse anodic stripping voltammetry (DPASV) is applied for the analysis of mercury. In this simple and inexpensive electrochemical method, the three-electrode configuration consisted of a gold electrode as working electrode , a glassy carbon electrode as the auxiliary electrode and Ag/AgCl electrode as the reference electrode in 0.1 M Nitric acid supporting electrolyte.The stripping peak potential of Hg occurred at +0.60 V. Linear and reproducible response was obtained in concentration range from 5 ppb to 50 ppb.The limit of detection was 0.08 ppb. Mercury spiked in human blood was analyzed using the standard addition method. Using 4 samples, the % recovery obtained ranged from 84.6 % to 99.9 %.

**Keywords:** mercury, differential pulse anodic stripping voltammetry (DPASV), blood, gold electrode, electrochemical method

**HSD-14**

# MORPHOMETRIC GEOMETRY OF THE EDEMATOUS FACE IN DIABETIC PATIENTS

**Cesar G. Demayo, Mark Anthony J. Torres and Corilyn Joy Vena**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

This study is an attempt to explore morphological variations in the face of people with diabetes which may be consequences of facial edema brought about by diabetes mellitus. For data acquisition, digital images of the faces of each patient were taken. For standardization, only pictures of patients with no moustache, no beard, and no eye glasses and with neutral face expression were considered. A total of 43 manually positioned anthropomorphic landmarks were collected, the Cartesian coordinates of which were extracted using an image analysis and processing software, SCIONIMAGE. The faces were then aligned using Procrustes alignment of the Cartesian coordinates to eliminate size differences and rotational translation. The size residuals left after the alignment were then used to reconstruct the face truss network using thin-plate spline grids. Variations in facial morphology were then explored using the methods of relative warps analysis and partial warps analysis supplemented with various multivariate statistical analyses. Results showed drooping of the brow ridge portion of the face in most of the patients, drooping of the chin and bulging of the cheek surface among the affected individuals. Also, facial asymmetry seems to be a common feature among the individuals surveyed as shown by the direction of shape change indicated by the first partial warp. Ordination of the samples based on the shape residuals showed similar shape changes for both sexes as shown by the overlapping of the convex hulls. The results indicate that similar manifestations can be seen in the two sexes as a result of the accumulation of fluid in the underlying tissues of the face.

**Keywords:** morphological variation, edematous face, diabetic patients

**HSD-15**

# CYTOGENETIC FINDINGS IN TWO FILIPINO CHILDREN WITH AMBIGUOUS GENITALIA

**Ma. Luisa Enriquez*[1,2], Remben Talaban[1], Michael Ernesto Arnante[1] Celeste Abad[1], Luisa Manlapaz[3], David Bolong[3] and Filipinas Natividad[1]**

[1] Molecular Cytogenetics Laboratory, Research & Biotechnology Division
St. Luke's Medical Center, Quezon City Philippines
[2] Physics Department, CENSER, College of Science
De La Salle University, Taft, Manila, Philippines enriquezm@dlsu.edu.ph
[3] Deparment of Pediatrics, St. Luke's Medical Center
Quezon City, Philippines

When babies are born and their outer genitals do not conform to the typical appearance of either sex, parents become emotionally troubled. This is because of the unconscious emotional significance we give to these reproductive structures and probably the consequent impact of deformities on future generations. The presence of the Y chromosome dictates the undifferentiated gonad to develop into a testis at about the 8th month of fetal life. At the molecular level, this is the job of the testis-determining factor (TDF), a 35-kilobase pair (kbp) sequence on the 11.3 subband of the Y chromosome, an area termed the sex-determining region of the Y chromosome (SRY). When this region is absent or altered, the gonad differentiates into an ovary. However, reported cases of XX sex-reversed males who have testicular tissue in the absence of an obvious Y chromosome or SRY genetic material clearly require other genetic explanations. Various studies claim that autosomal genes play a role in sexual differentiation. We report two cases of Filipino children with ambiguous genitalia. Chromosomes cultured from peripheral blood of these patients were analyzed using routine G (Giemsa)-banding technique. In both cases abnormalities in chromosome 6 were noted. The first case is a newborn female with very prominent labia majora. Cytogenetic analysis showed a reciprocal translocation between the entire short arm of chromosome 6 and the terminal region of the long arm of chromosome 15. This finding was confirmed by fluorescence *in situ* hybridization (FISH). The second case is a 10-month old baby with immature male external genitalia with big, deformed penile head and cleft palate. Karyotype revealed an additional material of unknown origin attached to the short arm of the chromosome 6. These novel chromosomal mutations may point to the involvement of other autosomal genes in sexual differentiation.

**Keywords**: ambiguous genitalia, Y chromosome, testis-determining factor (TDF), Sex determining region of the Y chromosome (SRY), autosomal genes

**HSD-16**

# ANTHOCYANIN-RICH TAPUY: A NEW AND HEALTHIER WAY TO ENJOY RICE WINE

**Henry F. Mamucod[1]*, Ma. Jophine C. Ablaza[2], Amelia M. Valerio[2], and Evelyn H. Bandonill[3]**

Rice Chemistry and Food Science Division, Philippine Rice Research Institute, Science City of Muñoz, 3119 Nueva Ecija.
Tel: 044 4560113, -0258, -0277 local 243, 245 (fax)
Email: hfmamucod@philrice.gov.ph, hfmamucod@yahoo.com

Dietary antioxidants have attracted considerable interest due to their beneficial effects to human health especially disease prevention. Among various phytochemicals, anthocyanins have been shown to exhibit high antioxidant levels. Substantial amount of anthocyanin is found in pigmented rice. In this study, purple rice from various sources were utilized in the production of rice wine, locally known as tapuy. Four glutinous rice samples prepared in unpolished (U) and polished (P) forms were evaluated namely, *Ballatinao* from Baguio (UBB & PBB), purple rice from Palawan (UPP & PPP), purple rice from PhilRice (UPI & PPI), and NSIC Rc19 (UNI & PNI) also from PhilRice. Physicochemical analysis revealed that among the four samples tested, UBB and PPI had the highest wine yield and alcohol content. The sweetest wine came from UNI and PPP based on physicochemical test and sensory evaluation. In terms of over-all acceptability, wines produced from UPP and PNP were considered the best by the panelists.

UPP was found to have significantly highest anthocyanin content (1512.60 mg/kg) while UNP and PNP significantly produced the lowest with only 11.14 mg/kg and 11.02 mg/kg respectively. The result also showed that UPP and PPP produced the wine with the highest anthocyanin content, 19.95 mg/L and 0.76 mg/L, respectively. These were comparable to cyanidin-3-glucoside content of other types of pigmented wines (red wine, blueberry wine, etc.). Thus, the utilization of purple rice of Palawan especially in its unpolished form has a great potential in the development of anthocyanin-rich wine of high over-all acceptability, making it an excellent source of dietary antioxidants.

**Abbreviations**: NSIC – National Seed Industry Council, PhilRice – Philippine Rice Research Institute

**Keywords**: anthocyanin, brown rice, cyanindin-3-glucoside, physicochemical analysis, pigmented rice, polished rice, rice wine, sensory evaluation, unpolished rice

**HSD-17**

# THE *in vitro* ANTI-TUBERCULOSIS ACTIVITY OF VIRGIN COCONUT OIL

***Delia de Castro-Ontengco,[1,2] Conrado Dayrit,[1] and Nelia Lopez[1,2]**

[1]Medical Affairs Division, United Laboratories, Inc., Mandaluyong City 1501
[2]Graduate School, University of Sto. Tomas, España St., Manila
Email: dcontengco01@yahoo.com

Many testimonials are continuously being heard about the many health benefits of virgin coconut oil (VCO), but none so far has indicated activity against tuberculosis (TB). Since VCO is a safe product readily available in the market for human consumption this study was conceived to know if TB patients would benefit from it. Using the Microplate Alamar Blue Assay (MABA) two commercial samples of virgin coconut oil (VCO-HF and VCO-PM) and two coconut oil derivatives (monolaurin, ML, and ß-monolaurin, BML) were found to exert activity against *Mycobacterium tuberculosis* H37Rv and two clinical isolates (Mtb 22 and Mtb 78) identified as *Mycobacterium tuberculosis* at an MIC (minimum inhibitory concentration) range of 39-1250 µg/ml. Results further indicate that BML had a slightly better activity than ML. If the study can be expanded, duplicated, and VCO passes clinical trials, virgin coconut oil will prove to be a breakthrough pharmacy in a bottle. The product is safe, affordable, and easily available to TB patients, most of whom are in the lower economy class. Problems of non-compliance will be solved, and in the end, tuberculosis might be eradicated.

**Keywords**: tuberculosis, *Mycobacterium tuberculosis*, virgin coconut oil, monolaurin, ß-monolaurin

**HSD-18**

# DETERMINATION OF THE ANTI-FUNGAL ACTIVITY OF FIVE MEDICINAL PLANTS AGAINST SOME MEDICALLY IMPORTANT FUNGI

**Ma. Joan O. Paderon, Lourdes B. Cardenas* and Bernadette C. Mendoza***

Institute of Biological Sciences, College of Arts and Sciences
University of the Philippines Los Baños, College, Laguna
Tel: 049 5362807; Telefax: 049 5362517
Email: lbcsweetsnow@yahoo.com; dettecmendoza@yahoo.com

The activity of five medicinal plants (*akapulko*, basil, caballero, guava and garlic) against selected medically important fungi was determined. Two types of plant preparations, extract and decoction, were tested against 24 cultures which included clinical and non-clinical strains of *Candida albicans, C. parapsilosis, C. guillermondii, C. lusitaniae, C. krusei, C. stellatoidea* and *C. tropicalis*, and the two molds *Aspergillus niger* and *Rhizopus stolonifer.*

Anti-fungal activity was determined using the Disk Diffusion Assay (Kirby-Bauer Method). The initial viable counts of the fungal suspensions prepared were $5.82 \times 10^7$ colony forming units (CFU)/ml for the *Candida* strains and $7.30 \times 10^6$ CFU/ml for the molds. Mycostatin (10,000 units/ml) and sterile distilled water were used as positive and negative controls, respectively.

Of the medicinal plants and preparations evaluated, only the garlic extract exhibited anti-fungal activity and this was against all the organisms tested. The average diameter of the zones of inhibition (ZOI) exhibited by the garlic extract against the 22 strains of *Candida* was 14.7 mm while that for mycostatin was 17.7 mm. A smaller average ZOI diameter of 14.2 mm was noted for the clinical strains of *Candida* compared to 17.4 mm for the non-clinical strains. With reference to the molds, the garlic extract (with an average ZOI diameter of 25 mm) was more inhibitory than mycostatin (with 18.8 mm-average ZOI).

This study found garlic extract to be inhibitory to the species of *Candida, Aspergillus and Rhizopus* tested. It was more inhibitory to the molds than to the *Candida* species, and to the non-clinical strains of *Candida* compared to the clinical isolates. No anti-fungal activity was observed from the garlic decoction probably due to its being more diluted and/or due to the boiling step which could have destroyed its inhibitory properties. The potential active ingredients may have also not been extracted.

**Keywords**: anti-fungal, disk diffusion, medicinal plants, medically important fungi, *Candida, Aspergillus, Rhizopus*

**HSD-19**

# THE INHIBITORY ACTIVITY OF SELECTED PLANT EXTRACTS AND THEIR INTERACTION AGAINST COMMON RESISTANT PATHOGENS BY DOUBLE-DISK SYNERGY TECHNIQUE

**Bernard C. Silvala, Merlyn C. Cruz**

Angeles University Foundation
Mc Arthur Hway, Angeles City; Email address: bsilvala@yahoo.com

Effective drug combinations using synthetic drugs have been experimented to come up with remedy to battle the outbreak of the multi-resistant pathogens. With this technology, a new approach in the use of herbal plants was tried and experimented in an attempt to come up with innovative technique and new knowledge in natural products.A two-plant extract combination from *Daucus carota Linn, Imperata cylindrical, Hibiscus rosasinensis and Anona muricata* was prepared and used to determine possible synergistic activity using the Double-Disk Synergy Test (DDST).The inhibitory effects of each plant extract alone and in combinations were observed against the Extended-Spectrum Beta-Lactamase (ESBL) *Escherichia coli and Klebsiella pneumoniae* and Oxacillin-Resistant *Staphylococcus aureus* (ORSA). Phytochemical screening revealed the presence of the essential biological constituents such as the flavonoids, tannins, saponins, anthraquinones, higher alcohols, steroids and essential oils. Disk diffusion assay of the plant extracts showed that *Hibiscus rosasinensis*, had the greatest inhibitory activity with 25 mm and 26 mm zones of inhibitions against ESBL-producing *E. coli* and *K. pneumoniae* respectively, with the oxacillin-resistant *S. aureus* as the most susceptible with 35 mm zone of inhibition. *Anona muricata* yielded a zone of inhibition of 31 mm against oxacillin resistant *Staphylococcus aureus. Imperata cylindrica* yielded the highest zone of inhibition of 21 mm against Oxacillin resistant *Staphylococcus aureus.*. Finally, Double-Disk Synergy Test(DDST) on the different plant extract-combinations against the common resistant pathogens yielded excellent results revealing the synergistic activities of the plant extracts by revealing an enhancement or bridging at or near the junction of the two zones of inhibition.

**Keywords**: *Anona muricata,* anthraquinones, *Daucus carota Linn,* DDST, ESBL, flavonoids, *Hibiscus rosasinensis, Imperata cylindrical,* higher alcohols ,ORSA, saponins, steroids, tannins.

**HSD-20**

# ANTI-BREAST CANCER ACTIVITY OF LOCALLY GROWN *Annona muricata* L. LEAVES

**Merlyn C Cruz[1], Bernard C. Silvala[2]**

[1]Department of Chemistry, [2]Department of Medical Technology
Angeles University Foundation, Angeles City
e-mail address Merlyn_c@yahoo.com

This study explored the potential anti-cancer activity of the leaf crude extract from the locally grown *Annona muricata* using human breast cancer cell line (ATCC MCF-7), along with a normal cell line from Chinese hamster ovarian cells (ATCC CHO-AA8) for comparison. Breast cancer has been the leading cancer among Filipino women today, and there have been studies showing that the Philippines has the highest incidence rate of breast cancer in Asia and has the ninth highest incidence rate in the whole world. Numerous plants have been valued for their medicinal importance. It is very apparent that in the midst of the advent in science and technology, the natural curative power of medicinal plants still appears to be the best remedy for some illnesses. One family of plants, the *Annonaceae* has been reported to have a potential anti-cancer activity. Culture cells were treated with the test sample at two concentrations: 5 µg/mL and 50 µg/mL. Determination of the cell survival was determined by MTT assay. Results obtained showed that the crude extract has no toxic activity towards normal mammalian cells at both concentrations used. Cytotoxic activity against cancer cells was determined at the 50ug/mL dose, resulting to a relatively small fractional survival value.

**Keywords**: ATCC MCF-7, ATCC CHO-AA8, *Annonaceae*, MTT

**HSD-21**

## CYTOTOXICITY OF $[Bu_3Sn_3(P_2W_{15}O_{59})]^{9-}$ ON ADRIAMYCIN-RESISTANT AND WILD TYPE BREAST CANCER CELLS *IN VITRO*

**Joseph L. Samonte**

Physical Sciences Department, De La Salle University-Dasmarinas
Email: josephlsamonte@yahoo.com

Breast cancer cell proliferation experiments using $[Bu_3Sn_3(P_2W_{15}O_{59})]^{9-}$ showed that the cell interaction of this heteropolyanion differed with the type of breast cancer cells used and whether the heteropolyanion was dissolved in aqueous solution or encapsulated in phospholipid vesicles.

In this study, it was found that when wild type breast cancer cells were incubated with vesicle-encapsulated $[Bu_3Sn_3(P_2W_{15}O_{59})]^{9-}$, the survival rate of the breast cancer cells was only 11% at a concentration of 0.2 μM. On the other hand, incubating breast cancer cells with the same concentration of $[Bu_3Sn_3(P_2W_{15}O_{59})]^{9-}$ but was not vesicle-encapsulated had a survival rate of 91%. These differences demonstrated that encapsulation of heteropolyanions in phospholipids vesicles alter the interaction of polyoxometalates with breast cancer cells.

**Keywords**: heteropolyanion, breast cancer, adriamycin, liposomes, cytotoxicity

**HSD-22**

## *In vitro* CYTOTOXIC ACTIVITY OF DIFFERENT CHEMOTHERAPEUTIC DRUGS AGAINST DIFFERENT HUMAN TUMOR CELL LINES AS A MEANS TO EVALUATE POTENCY

**Leila M. Florento,* Ronald R. Matias, Frederick Dela Cruz, and Alexander O. Tuazon**

Biological Sciences Department
Medical Affairs Division, United Laboratories Inc.
(632) 631-8501 local 7423; Email: lmflorento@unilab.com.ph

Chemotherapy using cytotoxic drugs is the main treatment modality for cancer. Storage and temperature requirements must be strictly monitored and adhered to when transporting these chemotherapeutic drugs from one facility to another. Deviations from the prescribed storage and transport conditions may

impact on the activity of the drug. Chemotherapeutic drugs must be potent to successfully treat tumor tissues or cells. Potency is an expression of activity of a drug in terms of concentrations required to achieve a desired effect. In this study the cytotoxic potency of seven (7) anti-cancer drugs was determined *in vitro* by a high-throughput cytotoxic assay using five different human tumor cell lines. Half-maximal inhibitory concentration ($IC_{50}$) of the different chemotherapeutic agents was obtained from an experimentally derived dose-response curve. Potency of the different chemotherapeutic drugs was statistically calculated using Parallel Line Assay. Tamoxifen and Mitoxantrone were found to be the most cytotoxic having the lowest $IC_{50}$. Different human cancer cell lines showed similar cytotoxic responses to the individual drugs used. *In vitro* cell-based cytotoxicity assay promises to be a useful and reliable method for evaluating potency of chemotherapeutic drugs under storage or being transported from one site to another.

**Keywords**: in vitro cytotoxic assay, chemotherapeutic drugs, potency, tamoxifen, mitoxantrone

## *SOCIAL SCIENCES DIVISION*

**SSD-1**

# COMPARATIVE SOCIO-ECONOMIC AND TECHNICAL IMPACT ANALYSIS OF RICE-MONOCULTURE AND RICE-DUCK FARMING IN THE PHILIPPINES

**Rocelyn M. Barroga[1], Norlito R. Gicana[2] and Antonio J. Barroga[3]**

[1]Department of Agri-Management, College of Agriculture, Central Luzon State University Science (CLSU), City of Munoz, Nueva Ecija, Philippines,[2]Fertilizer Pesticide Authority, Department of Agriculture Visayas Avenue, Quezon City, Philippines, [3]Department of Animal Science, College of Agriculture, CLSU, Science City of Munoz, Nueva Ecija

This research investigated the socio-economic aspect of rice-duck farming system. Data were analyzed using t-test and multiple regressions by Cobb-Douglas production function. The rice- duck farming system had higher net return and was more economically and technically efficient than rice-monoculture. There was higher return to labor in rice-duck farming while technical efficiency was measured by $r^2$ indicating that 36.58% was the level of contribution of the combined inputs that affect crop yield. Seeds and labor largely influence the crop yield. Benefits to farmer were added income, space utilization, waste management and environmental concern. The yield from rice-monoculture was significantly higher ($p<0.05$) than rice-duck farming, however, the net income was significantly higher for the rice-duck farming( $p<0.01$). Above findings showed a promising rice-duck farming system in the Philippines as it is technically and economically efficient.

**Keywords:** rice-duck farming system, rice-monoculture, socio economic analysis

**SSD-2**

# GENERATING PROJECT OUTCOMES THROUGH PARTICIPATORY MONITORING AND EVALUATION: THE CASE OF CASREN PHILIPPINES

**Fe L. Porciuncula[1], Edgar A. Orden[1], Edwin C. Villar [2] and Sonny N. Domingo[2], Marilyn D. Lilagan[3], Aracely B. Robeniol[3] Angelita G. Fabia[3], Alice D. Noche[3], and Richard Dulay [1]**

[1]Central Luzon State University
Science City of Munoz, Nueva Ecija,
Email: fe_porciuncula@yahoo.com
[2] PCARRD, Los Baños, Laguna 4030,
[3]Local Government Units, Pangasinan

Participatory monitoring and evaluation (PME) in which the project implementers with farmer-partners, development workers, local government units, and other stakeholders commit to collaboratively work together in generating project outcomes is important. As used in the Crop-Animal Systems Research Network project in the Philippines (CASREN Philippines), PME was put in place to better account for stakeholders' feedback and project performance. Socio-economic and crop-livestock data were regularly monitored among farmer-partners from project covered areas in Pangasinan. Participatory exchanges through informal interactions, experience sharing and focus group discussions were used along with participatory tools such as spillover maps, season long monitoring form, meta cards, bio-resource flow, technology and benefits ranking and cropping pattern timelines.

The project outcomes generated through PME point to increased technology adoption among farmers in the project sites leading to enhanced crop-livestock productivity. Increased economic benefits were derived as well as positive changes in the acquired knowledge, attitude and practices of farmers and development workers. The stakeholders' active participation in the project policy effort proved fruitful with the shift from position to program-oriented organizational structure in the municipal agriculture offices and providing support structures in institutionalizing CASREN modalities within local governments units.

Participatory monitoring and evaluation was found to be a reflective, action oriented and learning process providing stakeholders with the opportunity to reflect on the project's progress and obstacles; generating outcomes that result in the application of lessons learned and leads to improvements and corrective actions; and helped build capacities of stakeholders enabling them to better understand

their environment and make changes by themselves on those that they have discovered and advocated.

**Keywords:** participatory monitoring and evaluation, participatory tools and techniques, CASREN Philippines, crop-livestock productivity

**SSD-3**

## ENVIRONMENTAL KNOWLEDGE IN SOUTHERN PHILIPPINES

**Lucilyn D. Lahoylahoy*, Muriel S. Alejo, Marie L. Cuadra, Lady C. Fanuncio and Audrey A. Putong**

Department of Biological Sciences, College of Science and Mathematics
Mindanao State University-Iligan Institute of Technology, Iligan City
Tel: 063 2214050 local 137; Fax: 063 2214068; Email: luzlin@yahoo.com

Conservation without the necessary knowledge, skills and desire is useless. Surveillance of the levels of knowledge about the environment will subsequently determine how well-equipped the individuals are to cope up with the increasing environmental responsibilities. The study was carried out to summarize the current state of environmental knowledge of adults in various science-related fields in Southern Philippines. Almost all of the respondents were concerned about the current status of our environment and hold themselves responsible for its protection. Paradoxically, their interest in nature and animals ranked a lowly third after health and current events. Twenty multiple choice questions were crafted to determine basic environmental knowledge. It was formatted in such a way that it would have one correct answer, one plausible but incorrect answer, and two nonplausible answers. A high percentage of Mindanaoans (78%) were able to have at least 10 correct answers. There was no significant difference in the responses of men and women in the study, thus eliminating gender disparity in environmental knowledge.

The most significant single factor in the level of environmental knowledge in this study was the respondents' level of education ($p=.00020587$). Ninety-eight percent of the college graduates passed the literacy exam, while 28% of college students had failing marks. This result suggests that environmental knowledge may be acquired over a lifetime and most probably through the media. The lower environmental literacy of the tertiary students may also imply probable weakness in the current environmental education in our school systems.

The preliminary assessment on the awareness of the locals on simple environmental topics is significantly high indicating that we have an informed citizenry which is very enlightening and hopeful. Organized delivery of

environmental education to this well-informed public would elicit their fullest potential in achieving and maintaining a sustainable environment.

**Keywords**: environmental knowledge, environmental literacy, environmental education

SSD-4

## FROM *Pailis* to *Pasungko*: NEGOTIATING THE PRESENT, ASCERTAINING THE FUTURE (INDIGENOUS KNOWLEDGE SYSTEMS AND OPPORTUNITIES FOR BIODIVERSITY MANAGEMENT AND CONSERVATION)

**L. C. Sevidal Castro, Liwayway S. Viloria, Johanna E. Hanasan Reymund T. Bago**

College of Arts and Social Sciences
Mindanao State University-Iligan Institute of Technology, Iligan City
Tel. 2232346 loc. 193; Email: cass-lsc@sulat.msuiit.edu.ph

This study describes the indigenous knowledge systems, the adaptive strategies, and the traditional resource use practices of the Subanun in Mt. Malindang. The study sites included 6 communities located in the province of Misamis Occidental. It benefited from a triangulation of methods and sources: documentary review and secondary data gathering, focus group discussion, key informant interviews and testimonies, and participant and non-participant observation.

Similar to many indigenous peoples in the Philippines, the Subanun have lived with the vicissitudes of their biophysical environment for ages, moving through river systems, across hills and over mountains punctuating the landscape of their ecosystem. Central to their culture is the belief that human beings are stewards of the vast resources. In the utilization of these resources, they observe certain cultural prescriptions and proscriptions. The Subanun indigenous knowledge system (IKS) has undergone transformations that are contextualized in the circumstances – environmental changes, social pressures, market-driven economy and constraints imposed by law – impinging on their interactions with the biophysical environment and various stakeholders.

The traditional practices are a function of the need for survival. Several elements of Subanun IKS exercise regulatory functions in resource use. Among these elements are: *sal-ang*, *pamuhat*, terracing, use of indigenous materials for fertilizer, *paanuton/pasagbutan*, or fallowing. An appreciation of the ways in

which IKS elements prevent over-exploitation or deterioration is essential in biodiversity management and conservation of the ecosystems in the study sites. These IKS elements may synergize with approaches that are based on formal science and modern technology, articulated in various ways that, while assuming a pragmatism that is cognizant of the demands and pressures of the biophysical, socio-economic environment, are also capable of protecting the natural resource base of the environment.

**Keywords**: Indigenous knowledge systems, biodiversity management, biodiversity conservation, regulatory functions of traditional practices, conservational characteristics

**SSD-5**

## LIVELIHOOD SECURITY AND ENVIRONMENTAL SUSTAINABILITY IN THE MT. MALINDANG NATURAL PARK

**Alita T. Roxas [1] and Aurelia Luzviminda V. Gomez*[2]**

College of Business Administration
Mindanao State University - Iligan Institute of Technology
9200 Iligan City, Philippines; Email: alita_mbm@yahoo.com
[2] School of Management
University of the Philippines in Mindanao
8000 Davao City, Philippines; Email: twin9512@yahoo.com

The study assesses the socio-economic dimension of environmental sustainability in and around the Mt. Malindang Natural Park (MMNP), a protected area in Misamis Occidental, focusing on community ownership of certain assets – natural, human, physical, financial, and social – which can be utilized to generate livelihood options. It also reviews community awareness, acceptance and compliance of environmental policies, particularly the National Integrated Protected Areas System (NIPAS) Act, in the uplands and lowlands, and the Fisheries Code of 1988, along the coasts. The study was conducted in 12 barangays in six municipalities and one city in Misamis Occidental representing upland, lowland and coastal communities.

The study benefits from a triangulation of information sources and data gathering techniques. It applied quantitative and qualitative research methods to provide a meaningful description of livelihoods, resource utilization, and community response to environmental policy enforcement. Quantitative data were obtained

using sampling techniques; key informant interviews and focus group discussions were primarily employed in the qualitative approach.

The people in communities studied across the landscape are deprived socio-economically. They have limited access to social services; they lack skills and cheap credit sources that provide opportunities for higher income. They grapple with poor infrastructure. People-environment interactions were evident. The first settlements, the coasts, have no mangrove forests and protection of marine biodiversity is a major challenge. The lowlands are dominated by plantation forests, planted to monocrops. The uplands, the last settlement frontier and home to indigenous peoples, still have intact – although fast diminishing – forests, the object of protection by laws. Awareness of environmental laws is low; acceptance and compliance is anchored on the perceived positive impact on livelihood.

Findings have various policy implications but point primarily to the strengthening of the communities' capability to meet the increasing demand for survival as a basic requisite for ensuring environmental sustainability.

**Keywords**: livelihood security, environmental sustainability, resource utilization, biodiversity conservation, protected area

**SSD-6**

## SOCIAL STRATIFICATION AND ESTIMATION OF THE SCHOOL, RECREATION AND HEALTH CHARACTERISTICS OF WORKING CHILDREN IN THE PHILIPPINES, 1995 AND 2001[1]

**Gloria Luz M. Nelson and Jovelyn Du-Quiton**

Department of Social Sciences, College of Arts and Sciences
University of the Philippines Los Baños, College, Laguna 4031,
Tel/fax: 049 536-2440; Email: glmnelson2001@yahoo.com.hk
Department of Epidemiology and Statistics,
Arnold School of Public Health, University of South Carolina, USA

The Philippines has an estimated 3.7 million child laborers. Past studies show that child labor robs children of their childhood and has tremendous effect on their health and education. The data are from the 1995 and 2001 sample of working children aged 5 to 17 years old of the National Survey on Working Children (NSCW). Using cluster analysis, the study stratified and compare the working children in the 16 regions in the Philippines in 1995 and 2001 on their socio-economic work and work-related schooling, health, and recreational characteristics.. The study has adopted eclectic perspectives (labor market, social responsibility

and child centered) to analyze the problem of child labor with the aim of developing more effective action policies against abuse of children in and through their work. Results show that the longer the child spent time in work, the lower the odds of school attendance. A more interesting finding shows that the nature of relationship of the child to his employer has a significant effect on school attendance. Heavy physical work like those in the agricultural sector increases the probability of the children becoming a school dropout. Except for Metro Manila, Northern Mindanao and Central Luzon, working children in other regions who are not in school is less than 10% in 1995. In 2001, children in these three regions, who are not studying have decreased. School related reasons rather than family related matters are the main reasons for dropping in 1995 and 2001. Free time hours spent for sleeping have increased for all working children in the different regions in 2001 as compared in 1995. In 1995, children who spent more time sleeping have suffered less from illness or injuries while the children in 2001 data who engaged in activities other than sleeping have suffered less injury and illness. In general, it was found that working children are at risk of being affected by parasites and sustaining injuries. Stratifying children by their schooling, health and recreational characteristics reveals that child who works are not always "children at risk" or "children in crisis".

**Keywords**: child labor in the Philippines, social stratification, cluster analyses, health, education, recreation characteristics.

**SSD-7**

## *DIDANGERS* OF ILIGAN CITY

**Loue Jay S. Domo, Maria Johanna B. Testa and Lucilyn D. Lahoylahoy***

Department of Biological Sciences, College of Science and Mathematics
Mindanao State University-Iligan Institute of Technology , Iligan City
Phone: (063) 221-4050 local 137. Fax: (063) 221-4068. E-mail: luzlin@yahoo.com

Scavengers constitute the dominant fraction of the marginalized population in the Philippines. These are individuals who pick out recyclable elements from mixed waste for its financial value and for personal consumption. Although there are no accurate estimate of the total quantities of materials recovered by waste pickers, the contribution of the recovery of resources to urban economies as well as their role in reducing waste have been often overlooked but cannot be dismissed as unimportant. The scavengers of Iligan City are known as the '*mandidangay*' and the new generation specifically the pediatric scavengers are referred to in a local slang '*didangers*'.

Fifty children (16 girls and 34 boys), of ages four to fourteen, majority of whom are constant street pickers (72%) were interviewed. All were school kids who scavenge for an average of four hours a day, seven days a week. These streetwise youngsters work in groups and sell their collected recyclables to local junk shops. Despite of collective scavenging, harassment was still prevalent particularly from other waste pickers competing for the same recyclables and also for the local residents. Ironically indicators for home environment and socio-economic status showed that these *didangers* do not belong to the poorest of poor for majority of the families of the subjects have their own house with the basic home appliances. However, nutrition-wise, these children were found to be underfed but were not necessarily malnourished. It is quite unfortunate that these *didangers* have been constantly subjected to avoidable work hazards. They lack the necessary protective gear for searching through thrash, though no complaints were reported due to the benefits they can get for scavenging.

A national large-scale study should be conducted in order to properly recognize this neglected sector in order to give them protection and provide other sources of income to liberate the *didangers* from the bondage of waste-picking

**Keywords**: recyclables, waste pickers, scavengers, *mandidangay, didangers*

**SSD-8**

## CHILD PROSTITUTION AS A NEW FORM OF SLAVERY IN MINDANAO

**Nimfa L. Bracamonte**

Sociology Department, MSU-Iligan Institute of Technology, Iligan City
Fax: 063 3516131; Email: cass-nlb@sulat.msuiit.edu.ph

This paper presents the dismal condition of child labor[2] in two cities of Mindanao based on three separate research outputs employing both quantitative (survey) and qualitative (FGD, key informant interviews, case study) tools. Focused on the sexual exploitation of children as a new mode of slavery, in particular it

[2]The empirical information about child labor in this paper is based on three studies in Mindanao, namely: "A Situational Analysis of Child Prostitution in Iligan City," a UNICEF-funded project of DOLE Region 12 and Notre Dame University in 1997; "Street Adolescents in Street Gangs in Davao City: A Participatory Action Research," an NGO-initiated participatory action research of the Center for the Care of the Abused Children-TAMBAYAN, Inc. in 2000 with funding support from Save the Children-UK and UNICEF; and " Participatory Action Research on Working Children in Iligan City," of Hope for Change, Inc. City in 2003 with funding assistance from CORDAID-Netherlands.

attempts to integrate the three research findings and to reinterpret the social phenomenon as a continuing challenge tied to development. Two of these three studies are participatory action researches conducted for NGOs purposely to document the condition of working children, to identify appropriate strategies and effective development interventions, as well as to generate needed information as basis for policy advocacy. In the case of Iligan City, the working children from different work clusters included the entertainers euphemistically called "guest relations officers" or GROs. In another study focused on child prostitution, the other names for those children engaged in flesh trade are "*akyat-barko*" or "*dampa.*" Called "*buntog*" in Davao City, the same social phenomenon also portrays gender inequality. Notwithstanding the local customers, the clients also include foreigners such as Americans, Japanese, Koreans, Greeks, and many more others.

Generally, the study revealed that poverty and dysfunctional families were the main reasons that pushed children to join child prostitution in order to earn at an early age. As a strategic response to poverty, work becomes a source of contribution to family income depriving the children the privileges they are supposed to enjoy. To some extent, the community and global situation reinforced the emergence of child labor.

Once again, it must be made lucid that survival, development, protection and participation rights of the children remain rhetoric without the strong political will of both the agency and the structure. Most importantly, sustainable development for children means expanding their choices and creating the conditions for the realization of their resources, potentials and competencies both at the national and international levels.

**Keywords**: child labor/prostitution, poverty, social dysfunctions

**SSD-9**

## SOCIAL ACCEPTABILITY AND MARKETABILITY OF WELL-FAMILY MIDWIFE CLINICS (WFMCs) IN MUSLIM-DOMINATED AREAS OF MINDANAO

**Nimfa L. Bracamonte and Teresita O. Poblete***

Sociology Department
Mindanao State University-Iligan Institute of Technology, Iligan City
FAX: (063) 3516-13; Email: cass-nlb@sulat.msuiit.edu.ph

This study was mainly conducted as basis for expansion of WFMCs in the

Autonomous Region of Muslim Mindanao (ARMM). Employing a total of 549 respondents, the methodology is a triangulation of the quantitative and qualitative techniques in research. A sample survey was employed with 400 eligible Muslim mother respondents from Marawi (Maranaos). Datu Paglas (Maguindanaoans), Basilan (Yakans) and Jolo (Tausugs). Key informant interviews were also conducted among the 23 religious leaders/scholars. The participants of the focus group discussions were NGO, LGU and community representatives.

Some of the salient findings of the study are as follows: The preferred family planning (FP) method was pills. Permanent methods such as ligation and vasectomy were found unacceptable. The religious leaders expressed preference for natural FP and more than a third were in favor of artificial FP upon medical device whenever the mother child's health is in danger. Availment of health care services shows combination of the modern and traditional health ser vice facilities/personnel. A greater number availed themselves of the services of the traditional health service providers.

On acceptability and marketability of Well-Family Midwife Clinics, the findings showed strong endorsement. The possible major constraints to WFMC expansion are:

- Misconceptions on the notion of FP in Islam
- Low affordability level of Muslim mothers due to poor socioeconomic condition
- Muslim's patronage of traditional health service providers inspite of the presence of the formal health service services
- Unstable peace and order condition in Mindanao

While the challenge of development is to enhance the quality of life, it is imperative to address unmet and urgent needs of Muslim mothers and children to contribute to the general welfare of Muslim communities, as well as to make a difference in the elusive peace and development of Mindanao.

**Keywords**: WFMC expansion, maternal/child health care

**SSD-10**

# WHAT TEENAGERS THINK OF FRIENDSHIPS, ROMANTIC RELATIONSHIPS AND SAFETY IN A VIRTUAL WORLD

**Cesar G. Demayo and Mark Anthony J. Torres**

Department of Biological Sciences
College of Science and Mathematics
MSU-Iligan Institute of Technology, Iligan City

Many young people are actively using the Internet to find information, play games, to meet new people and to make new friends. It is through the internet that many people tend to talk about their lives and to form new relationships with each other. We conducted a survey of 188 student internet users of the university with ages 16-19 to be able to find some of the answers. Results showed 54% of those who use the internet had virtual friends even when they were as young as 10 years old. The ages of virtual friends range from 10 years old although a majority ages 18 and above. Many communicate with their online friends through chat and instant messaging. Of those with virtual friends, 36% had online romantic relationships who liked that they get to meet people outside of the school, are less intimidated by dating someone less often seen, and have less commitment when dating someone less often seen. Those who do not have on-line friends believe that having online boyfriend/s or girlfriend/s is tantamount to cheating. Regarding trust and truthfulness with virtual friends, only 25% agree they like virtual relationships because they can pretend they are someone they are not. Only 6% usually trust what people tell them online. Age, gender, location and names are the common things the respondents lie to online friends they do not know. Likewise, they also believe that the same things are also lied to them by their online friends. A higher percentage (58%) believed it is unsafe meeting virtual friends in person. Friends (27%), school (12%), parents (13%), website (10%), and experience (10%) are the common sources of information how to be safe online. Of all the people they talk to online, 29% were not known before, 30% said they met a few of those, 14% most of those were already known to them and 23% said they met all of them. To those who had virtual relationships, 18% have talked on the phone, 5% met in public, 25% met in private, 19% used a webcam, 9% wrote letters in emails, 9% exchanged pictures, and 15% communicated online. Hobbies, birthday, last name, first name, phone number, email address, favorite book, favorite movie, parent's names, street address, city, province, country, favorite color, what they look like, and name of school are the common information shared to online friends. Only 14% agreed they are closer to

their virtual friends than the friends they see face to face. Fifty-nine (59%) believed it is not easier to be honest in a virtual relationship than in a person-to-person relationship. Only 9% believed it is easier while 29% believed it is easier sometimes. Some of the negative effects revealed in this study include neglect of household chores and irritability. The social redeeming value of the internet however cannot be answered by this study.

**Keywords:** virtual relationships

**SSD-11**

## ABUSE IN A ROMANTIC RELATIONSHIP AMONG COLLEGE TEENAGERS

**Cesar G. Demayo and Mark Anthony J. Torres**

Department of Biological Sciences
MSU-Iligan Institute of Technology, Iligan City

Abuse in a relationship can be confusing and frightening and very difficult at any age much more for teenagers who are just beginning to date and develop romantic relationships. It is therefore the major objective of the study to determine if abuse is common among teenagers who are into romantic relationships. The specific objectives of the study were focused on the behavioral characteristics of the partner (boyfriend/girlfriend) and whether the teenager will stay or not in an abusive relationship. College teenagers ages 16-19 years old (Male = 50, Female = 110) who were into romantic relationships were recruited to participate in the study. They were allowed to answer the survey questionnaire consisting of 19 questions about the characteristics of the boyfriend/girlfriend and 8 questions if they will continue to stay in an abusive relationship. Results of the study revealed that males experienced higher frequencies of abuse from their girlfriends than females with their boyfriends. These were attributed to the fact that there were girlfriends/boyfriends who were jealous and possessive (F=74%,M=55%), controlling and bossy (F=46%,26%), quick-tempered with a history of fighting (F=24%, M=24%), violent towards the partner and other people (F=24%, M=3%), gives orders and make all the decisions (F=22%, M=17%), check up on them all the time (F=64%, M=54%), refuse to allow them normal contact with their family and friends (F=18%, M=8%), try to humiliate them (F=22%, M=5%), call them names including insults (F=8%, M=4%), accuse them of having no sense of humor (F=4%,M=3%), provocation (F=10%, M=5%), force them to have sex when they do not want to (F=8%,1%), use alcohol or drugs and pressure them to do the same

(F=2%, M=0%), pressure them to have unprotected sex (F=6%, M=1%) and like to wrestle 'playfully' resulting to one of them getting hurt (F=8%, M=4%). There were those who threatened to commit suicide if they leave the relationship or do not do what he/she wants (F=16%, M=17%), attempted suicide because they would not do what he/she wanted (8%, M=3%), harassed or threatened them or a former dating partner (F=8%, M=4%), refused to accept the relationship isn't working or is over (F=20%, M=24%). Many studies in the US show that abuse is commonly committed by men to their dates or girlfriends but our study results show the other way around. It seems more women are more prone to abuse their boyfriends as the statistics of this study show. It seems jealousy and being possessive are the major reasons for the higher frequency of abuse committed by women to their boyfriends. It is also very alarming to know from this study that a higher frequency of those who were interviewed would stay in an abusive relationship because they are convinced the bad behavior will stop-because their partner apologizes, gives them gifts, and promises to behave better in future (F=60%, M=40%), they may have been taught to be forgiving or be forgiving by nature (F=72%, M=73%), they may not see the behavior as part of a pattern of abuse (F=34%, M=30%), they may not realize they are not responsible for the behavior (F=38%, M=32%), they love their partner and not want to lose them (F=72%, M=55%), they may fear being left alone with no dating partner (F=44%, M=19%), they know their partner was wrong, but are upset, frightened, and do not know what to do or where to turn (F=46%, M=33%). Abuse whether psychological, emotional, physical, and sexual is bad and it will affect the normal development of young men and women to a healthy relationship. Teenage years are being characterized as a "window of opportunity" to expose young people to healthy relationship development and non-violent conflict resolution. A number of developmental issues in adolescence, such as learning autonomy and control and shifting emotional dependency from parents to peers, make this a particularly important time to provide educational opportunities with respect to non-violent relationships thus schools should provide programs to help young men and women to cope with healthy dating and romantic relationships.

**Keywords**: abusive relationship, young adults

# APPLICATION OF BIOLOGICAL INOCULANTS IN NONI FRUIT WASTE COMPOSTING

**Rex B. Demafelis*, Sixto A. Valencia, Jewel A. Capunitan, and Celestine M. Morito**

Department of Chemical Engineering
College of Engineering and Agro-industrial Technology
University of the Philippines Los Baños, College, Laguna
* Telefax: (049) 536-2315

The effect of biological inoculants in composting of noni fruit waste was investigated. For the first phase, three compost activators; Trichoderma harzianum, IBF compost activator, and Biosec (Novatech), were tested on a mixture of equal parts noni fruit waste and chicken manure material, with pure noni fruit waste as the PNFW. Weight loss, moisture content, pH and degree of decay were monitored through a period of eight weeks, to evaluate which among the compost activator would be most efficient, mainly basing on high degree of decay and low weight loss. Other parameters were indicators of the condition within the composted material.

IBF compost activator (IBF) showed to be the most efficient compost activator and was selected for the second phase based on the observed degree of decay and weight loss in 8 weeks. During the end of the period, IBF compost activator (IBF) obtained the highest degree of decay of 70% among all the treatments and second to the lowest to the PNFW in weight loss of 61.35%. Other parameters indicate that the conditions in all the composted materials after the third week are aerobic and favorable for the microorganisms.

The second phase employed the IBF compost activator in varying ratios of noni fruit waste to chicken manure mixed of raw material. Same parameters with phase one was monitored for a period of seven weeks, and in addition, finished composts were analyzed for CN ratio, carbon, nitrogen, phosphorus, potassium, copper, iron, manganese, and zinc.

Considering lesser weight loss and higher degree of decay, a ratio of 1:3 noni fruit waste to chicken manure was found to be the most efficient mix, obtaining the lowest weight loss of 21.03% on the average, and the highest degree of decay, of 72.84% on the average among all the treatments.

Taking into consideration the macro components of different mixes, PNFW showed highest Carbon and Nitrogen content of 46.34% and 3.11% respectively. All the treatments excluding PNFW exhibited high Phosphorus content of 5.02, 4.63, and 5.2567 for A (3:1 noni to chicken manure mix), B (1:1), and C (1:3) respectively. Greatest potassium content among treatments is exhibited by B (1:1) and C (1:3) of values 5.2733 and 5.55 percent respectively.

**Keywords:** noni, fruitwaste, compost

# COLOR AND COD REMOVAL FROM A SIMULATED TEXTILE WASTEWATER CONTAINING DIRECT COPPER BLUE 2B DYE USING FENTON'S PROCESS

**Sixto A. Valencia*, Catalino G. Alfafara, Jovita L. Movillon, and Viava Jane L. Africa**

Department of Chemical Engineering
College of Engineering and Agro-industrial Technology
University of the Philippines Los Baños, College, Laguna
* Telefax: (049) 536-2315

The textile industry generates millions of gallons of wastewater after disperse dyeing and 15 to 20 gallons per pound is generated for direct and reactive dyeing, including postscouring and rinsing processes. Failure to treat these discharges will harm the environment, more specifically the aquatic life which will eventually lead to a disturbance in the biodiversity.

The oxidation of a simulated textile wastewater containing Direct Copper Blue 2B dye was studied using the Fenton's process. The effect of hydrogen peroxide (5 ml, 10 ml, 15 ml, 20 ml, 25 ml), iron catalyst (1 ml, 2 ml, 3 ml, 4 ml, 5 ml) and simulated textile wastewater concentration (3000 ppm, 4000 ppm, 5000 ppm, 6000 ppm, 7000 ppm) on the color and COD removal was investigated. The highest COD level obtained was 69.83 ppm and the average pH values ranged from 7.0–8.5. Percent COD removal was observed to increase as the volume of $H_2O_2$ was increased and as the simulated textile wastewater concentration was decreased. Highest percentage COD removal (99.59%) was seen in the ratio 1:25:25 (ml iron catalyst : ml $H_2O_2$ : ml simulated textile wastewater) at 3000 ppm. Color was observed to completely decolorize the simulated textile wastewater. A possible degradation mechanism of Direct Copper Blue 2B dye was proposed. The Fenton process was found to be effective in removing color and COD from the simulated textile wastewater containing Direct Copper Blue 2B dye.

**Keywords**: color, COD, textile, wastewater, dye, degradation, hydrogen peroxide

# PRODUCTION OF VIRGIN COCONUT OIL BY MICROBIAL DEMULSIFICATION OF COCONUT (*Cocos nucifera* Linn.) MILK

**Jovita L. Movillon*, Pham Binh Chay, Sixto A. Valencia, Jewel A. Capunitan, and John Paul Y. Orog**

Department of Chemical Engineering
College of Engineering and Agro-industrial Technology
University of the Philippines Los Baños, College, Laguna, Philippines
* Telefax: (049) 536-2315; Email: jlmovillon@yahoo.com

The production of virgin coconut oil by microbial demulsification was investigated. An inoculant prepared by the Foods and Specialty Products Laboratory of the National Institute of Molecular Biology and Biotechnology (BIOTECH) was added to the coconut milk mixture. The reaction time and effects of different pH levels (4.5, 5.5 and 6.5), inoculant concentration (2, 6, and 10mL/L), and volume ratio of coconut water and distilled water (0:1, 0.5:0.5 and 1:0) on oil yield, were evaluated.

The addition of inoculant was effective at about neutral. The addition of coconut water increased the oil yield. The quality of virgin coconut oil obtained met the standards. The virgin coconut oil has a sweet, coconut smell, clear and transparent oil. It had 0.10% moisture and volatile matter content, 0.08% free fatty acid and trace amounts of peroxides.

**Keywords**: virgin coconut oil, coconut, microbial demulsification

# ABOUT NAST

The National Academy of Science and Technology (NAST) Philippines is the country's highest advisory body to the government and the science community on matters related to science and technology. It also has the mandate to recognize outstanding achievements in science and technology made by Filipino scientist in all fields of science.

## VISION, MISSION AND MANDATE

The National Academy of Science and Technology Philippines, founded in 1976, continues to stand today with a firm resolve to faithfully pursue:

Its **VISION**: A PROGRESSIVE PHILIPPINES ANCHORED ON SCIENCE

Its **MISSION:**

1. To recognize exemplary science and technology achievements among the young and among peers
2. To encourage individual Academy members to continue their scholarly pursuits thereby making the Academy the principal reservoir of scientific and technological expertise in the nation
3. To provide independent and science-based advice on problems facing the nation and the world
4. To link the like-minded institutions and individuals in promoting scientific achievement in the Philippines and abroad
5. To promote a strong science culture in Philippine society

Its **MANDATE**:

1. To recognize outstanding achievements in science and technology as well as provide meaningful incentives to those engaged in scientific and technological researches (PD 1003-A)
2. To advise the President and the Cabinet on matters related to science and technology (EO 818)
3. To engage in projects and programs designed to recognize outstanding achievements in science and promote scientific productivity (EO 818)
4. To embark on programs traditionally expected of an academy of science (EO 818).

**The National Academy of Science and Technology Philippines**
Level 3 Science Heritage Building
DOST Complex, General Santos Avenue
Bicutan, Taguig City 1631 Metro Manila, Philippines
Email: secretariat@nast.ph
URL: http://www.nast.ph