



# Transactions

of the National Academy of Science and Technology

Volume 32 Issue No. 1 July 2010 ISSN 0115-8848

## ABSTRACTS of PAPERS

Presented during the  
32nd NAST Annual Scientific Meeting

**MDGs and Beyond: Are We Making Progress?**

**14-15 July 2010**

ISSN 0115-8848

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of the  
NATIONAL ACADEMY OF SCIENCE  
AND TECHNOLOGY  
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**2010  
Volume 32  
Issue No. 1**

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



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ISSN 0115-8848

Trans. Nat. Aca. Sci. Tech. Philippines  
Vol. 32, Issue No. 1 (2010)

Published by the National Academy of Science and  
Technology Philippines  
3<sup>rd</sup> Level Science Heritage Building  
DOST Complex  
Bicutan, Taguig City, Metro Manila 1631 Philippines  
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Tel. No. (63 2) 837-2071 loc. 2170 to 76; 838-7739  
Tel / Fax No. (63 2) 837-3170

Volume Editor: National Scientist Mercedes B. Concepcion  
NAST Staff-in-charge: Rosemarie S. Espino

Printed in the Philippines

## **32<sup>nd</sup> ANNUAL SCIENTIFIC MEETING**

***MDGs and Beyond: Are We Making Progress?***

**14-15 July 2010; The Manila Hotel**

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# **AGRICULTURAL SCIENCES**



AS-1

## **Estimating Solute Transport Parameters from Physical Soil Properties Using Artificial Neural Network Analysis**

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Availability of solute transport parameters is important in understanding the dynamics of contaminants in the subsoil. They are key input for models simulating chemical or contaminant transport in soils to analyze pollution risks and contain a pollution episode. In spite of their importance, these properties are not easily obtainable mainly because measuring them is resources intensive. One approach to address this data gap is through the development of pedotransfer functions. Thus, this study was carried out to develop two pedotransfer functions for predicting contaminant transport parameters from soil physical properties, such as soil texture, bulk density and porosity using artificial neural network analysis. The two solute transport-pedotransfer functions (ST-PTFs) were developed using 80 soil samples and validated using 30 soil samples representing different soil textural groups.

The ST-PTFs developed have great potentials in predicting pore velocity, dispersion coefficient and dispersivity. Both the ST-PTFs developed could account for more than 50% of the total variation of pore velocity. The inclusion of soil porosity in the SSCBDP model had significantly improved its performance over SSCBD model. SSCBDP model accounted for 56%, 55% and 59% of the variation of pore velocity, dispersion coefficient and dispersivity, respectively.

This study suggests that solute transport parameters can be predicted from soil physical properties through the use of pedotransfer functions. The use of artificial neural network analysis proves to be a useful tool and is comparable in developing pedotransfer functions. The newly developed ST-PTFs provide improved relationships for estimating solute transport parameters of Philippine soils from soil properties. As such, it may prove useful in studies dealing with assessment of soil water quality and other contaminant transport problems.

**Keywords:** Artificial Neural Network, dispersion coefficient, dispersivity, pedotransfer, pore velocity, solute transport

## AS-2

### **Predicting Soil Water Retention Curve Using the Extended Nonlinear Regression Analysis**

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Soil hydraulic characteristics, especially the soil water retention curve and hydraulic conductivity, are essential for many agricultural, environmental, and engineering applications. Their measurement is time consuming and thus costly. Hence, many researchers work on methods enabling their indirect estimation. In this paper, pedotransfer functions (PTFs) for predicting soil hydraulic properties from soil physical properties, such as soil texture, bulk density and porosity were developed using linear regression (MLR5 and MLR15) and extended nonlinear regression analyses (MNLR5 and MNLR15). Performances of the four PTFs in predicting soil water retention were compared.

Results showed that PTFs developed using the linear regression analysis did not perform well in predicting soil water retention. However, adjusting their regression coefficients using the extended nonlinear regression through a global optimization approach significantly improved their performances over their linear versions. The coefficient of efficiency (EF) of the nonlinear models, MNLR5 and MNLR15, increased by about 117% and 134% compared to linear version, resulting in an EF of 0.26 and 0.35, respectively. Furthermore, after adjusting the coefficients of the two linear models, the performances of MNLR5 and MNLR15 were comparable. This makes MNLR5 preferable as it requires fewer input variables and less prone to multicollinearity problems.

We conclude that the soil hydraulic properties can be predicted from soil physical properties through the use of pedotransfer functions. The use of nonlinear regression analysis with global optimization algorithm of the defined objective functions proves to be a useful tool and is comparable in developing pedotransfer functions. These PTFs may provide improved

relationships for estimating water retention curves of Philippine soils from soil texture and related soil properties.

**Keywords:** Hydraulic properties, nonlinear regression, pedotransfer

### AS-3

#### **Generation of Gamma Irradiation and EMS-Induced Mutant Lines of the H7996 Tomato (*Solanum lycopersicum* L.)**

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Tomato (L.) is one of most important vegetable crops grown worldwide for the fresh vegetable market and food processing industry. With the completion of the genome-sequencing projects in various crops, the major challenge will be to determine the gene function. One approach is to generate and to analyze mutant phenotypes. The paper reports the generation of gamma-irradiated and ethylmethane sulfonate (EMS)-treated mutant populations, identification and phenotypic characterization of dominant and visible mutations in tomato mutant lines. Mutant populations of tomato H7996 were created using physical (Cobalt 60 gamma ray) and chemical EMS mutagens.

Generally, based on high-throughput phenotypic characterization, mutations were observed on the plant habit, size, morphology, leaf and flower color and morphology and fruit characteristics. Specifically, the most common dominant and visible mutations noted in the M<sub>1</sub> generation were monopodial, compact, short internodes, multi-branch plant type, light yellow and ghost leaf coloration, tiny and long pedicel leaf morphology and small or short plant size. In the M<sub>2</sub> generation, homogeneous and segregating M<sub>2</sub> families were selected to constitute the core set of visible tomato mutants. Initial bacterial wilt resistance (BWR) gene knockouts were also identified.

The mutant lines will be used as a rich source of genetic materials for breeding and functional genomics of tomato.

**Keywords:** EMS, gamma ray irradiation, tomato mutant lines

AS-4

## **Towards Marker-Assisted Introgression of Downy Mildew Resistance in Targeted Maize Breeding Lines**

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Downy mildew (DM) disease caused by *Peronosclerospora philippinensis* Weston (Shaw) seriously reduces corn production and yield in the Philippines and other Asian countries. Despite breakthroughs in chemical control such as metalaxyl seed treatment, the use of resistant maize varieties still remain as the most economical and effective control strategy. Current breeding efforts are now geared towards incorporating downy mildew resistance (DMR) through marker-assisted selection to targeted maize breeding lines to produce outstanding maize lines with improved host resistance and ready for commercial use.

Promising inbred lines, B012 and C01 identified as highly resistant to maize DM were selected as donor of resistance. Maize inbred lines with desirable traits such as good combining ability and high yielding qualities but have differential reaction to DM, were selected as recipient parental inbred lines. The selected parental inbred lines include A01, D17, E31, F12, and HJ12. Using previously identified simple sequence repeat (SSR) markers that represent the ten chromosomes of maize, individual plant purity testing of the parental lines was done before selecting the homozygous plants that were used in hybridization.

The hybridization crosses produced a total of 54 F<sub>1</sub> hybrids generated from the 10 crosses made between the ten donor lines and five recipient parental inbred lines. The desired traits of both parental inbred lines are expected to be exhibited by the F<sub>1</sub> hybrids. Heterosis or increased vigor is the primary phenomenon to be achieved by hybridization. Hybridity testing and DM evaluation of the F<sub>1</sub> hybrids from the ten crosses is underway. The selected hybrids can be used as potential maize lines for future breeding strategies to be conducted such as backcrossing and gene fixation.

**Keywords:** DMR, hybridity testing, introgression, MAS, SSR

**AS-5**

## **Genetic Diversification of Rice Breeding Lines Through an International Evaluation and Exchange Network**

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Diverse germplasm and efficient genetic evaluation are essential in breeding rice varieties that perform well in different ecosystems and show tolerance to abiotic and biotic stresses. The International Network for Genetic Evaluation of Rice (INGER; <http://seeds.irri.org/inger/>) has assembled and evaluated elite breeding lines worldwide since 1975. Elite lines nominated by national agricultural research and extension systems (NARES) for inclusion in ecosystem-oriented and stress-oriented nurseries have been used by plant breeders in their breeding programs, with many being released directly as varieties. For the last three decades, more than 25,000 unique breeding lines have been distributed to 85 countries. To determine the genetic variation of 2009 NARES nominations to different INGER nurseries, we analyzed the genetic diversity of entries for six ecosystem-oriented (irrigated and rainfed lowland) and six stress-oriented nurseries, including those for abiotic (salinity, high temperature, cold temperature) and biotic stresses (resistance to bacterial blight disease, brown planthopper, and stemborer). Two hundred seventy-eight NARES nominations and controls were assayed using 20 polymorphic SSR markers covering the 12 chromosomes. Genetic distance was based on Dice coefficient and clustering analysis was done using unweighted pair-group method of arithmetical means (UPGMA). An average dissimilarity of 0.63 was determined for the 12 nurseries.; hence, these genetically diverse entries distributed by INGER and their potential use in breeding, promise to further increase genetic diversity of rice varieties available on-farm.

**Keywords:** INGER, rice breeding programs, rice genetic variation, rice nurseries

## AS-6

### **Genetic Overlap of Salt Tolerance QTLs at the Seedling and Tillering Stages In Rice**

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Salt tolerance is a complex trait and varies with the growth stages in rice. Understanding the expression and genetic relationships of quantitative trait loci (QTLs) detected at different developmental stages would greatly assist in breeding for enhanced salt tolerance. This study aims to identify and compare QTLs for salt-tolerance (ST) related traits at the seedling and tillering stages in rice. A total of 99 BC<sub>2</sub>F<sub>8</sub> introgression lines (ILs) derived from a cross between IR64 (indica) as a recurrent parent and Binam (japonica) from Iran as the donor parents were used. Salinity tolerance screening was carried out in a phytotron (seedling stage) under highly salinized Yoshida solutions and in the greenhouse (tillering stage). Thirteen QTLs for salt tolerance (ST) related traits were identified at seedling stage and 22 QTLs in tillering stage. QTLs detected at the tillering stage showed obvious differential expression to salt stress and were classified into three types based on their differential behaviors. Comparing the distribution of QTLs detected at the seedling and tillering stages, most (69%) of them were genetically independent. Only four were the same or adjacent regions on chromosomes 1, 2, 8 and 11 harboring ST QTLs detected at the two stages, suggesting that partial genetic overlap of ST across the two stages occurs. It is likely, therefore, to develop ST rice variety for both stages by pyramiding of ST QTLs of different stages or selection against the overlapping QTLs between the two stages via marker-assisted selection (MAS).

**Keywords:** genetic overlap, quantitative trait loci (QTL), rice, salt tolerance (ST)



**AS-7**

## **Submergence Screening of Introgression Lines Preselected for Stress Tolerance Using Phenotypic and Molecular Approaches**

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Global climate change has exerted an increasing pressure on crop production in recent years, as it is associated with a range of biotic and abiotic stress factors that limit crop yields. In order to sustain rice sufficiency, plant breeders have utilized several strategies in enhancing the tolerance and resistance of rice to several stresses. A total of 115 BC<sub>1</sub>F<sub>4</sub> derived from a cross between Huang Hua Zhan (HHZ) and OM 1723 was screened for submergence in a concrete tank, during the 2009 wet season. These materials were first separately raised under 3 stress conditions (irrigated, drought and salinity) during the early generation backcross. Germinated seeds of each line were sown on trays, grown for two weeks and submerged for 14 days. IR49830 and IR42 served as tolerant and susceptible checks, respectively. Percentage survival was determined and submergence tolerant lines were identified and characterized. Variation in response to submergence stress was observed among the 115 lines. About 54 lines (47%) showed higher survival rate than the recurrent parent, HHZ. A total of 7 lines were identified to have a higher survival rate than the tolerant check. All these lines were pre-selected from irrigated condition in the early generation. Molecular characterization was also done using 60 polymorphic markers from a total of 500+ SSR markers. These markers had determined the introgression of the favorable segments from OM 1723 regions using GGT software. With this breeding approach we have also identified lines that were showing multiple abiotic tolerances. However, such lines will be carefully used in designed QTL pyramiding approach of pooling more of the favorable chromosomal segments into elite high yielding backgrounds. By doing so, we can breed varieties that are not only submergence tolerant but also exhibit drought and salinity tolerance.

**Keywords:** backcross introgression, QTL, rice, submergence

## AS-8

### **Molecular Analysis of Elite Introgression Lines Derived from the Cross of Rice (*Oryza sativa* L.) and a Wild Species (*O. longistaminata* A. Chev. et Roehr.) Using Simple Sequence Repeat (SSR) Markers**

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Ten alien introgression lines (AILs) selected from the cross of New Plant Type (NPT) of rice (*Oryza sativa*) and a wild species (*O. longistaminata*) were used in the analysis of yield and yield components. Significant differences were found for number of tillers per plant, plant height, panicle length, grains per panicle, 100-seed weight and grain yield per plant. The introgression lines were superior to the recurrent parent. A set of 66 SSR markers distributed on 12 chromosomes was tested and showed 25.76% introgression. Furthermore, AIL 1, 2, 3, 6, 7, and 10 have introgression in chromosome 1 specifically within the range (66.2-115.2 cM) of yield enhancing loci, *yld1.1*. These lines showed a significant increase in the number of tillers per plant, panicle length, 100-seed weight and grain yield per plant. Thus, wild species of rice particularly *O. longistaminata*, though phenotypically inferior, carry some useful alleles that can improve yield and yield components of rice varieties.

**Keywords:** introgression, new plant type (NPT), wild species, yield

AS-9

## Expression of Papaya Ringspot Virus Coat Protein Gene in Genetically Modified Philippine Papaya

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The concept of pathogen derived resistance was applied in the development of papaya ringspot virus (PRSV) resistant papaya in the Philippines. The coat protein gene of a mild strain of PRSV in the Philippines was inserted in the genome of the local cultivar 'Davao Solo' papaya. In this report, the three candidate events of transgenic papaya were analyzed for the expression of the PRSV coat protein gene (*prsvcp*). The transgenic plants that tested positive for the presence of the 318 bp fragment of *prsvcp* by gene-specific PCR were used in the expression analysis. The partial transcript of the *prsvcp* gene was detected by RT-PCR where amplified cDNA of the 318 bp *prsvcp* gene fragment was obtained from all three events, as well as the full length transcript of 792 bp *nptII* marker gene but the transcript of the 935 bp *prsvcp* gene was not detected. The expression of the transgene at the protein level was detected by Western blot analysis using PRSV antiserum. The detected protein is smaller than the expected 36 kDa viral protein which is consistent with the undetected full *prsvcp* gene and its transcript. The possible sequence of the expressed coat protein was derived from the cloned sequence of the 318-basepair fragment of the *prsvcp* gene in transgenic papaya event 132. Analysis of the protein sequence for potential allergenicity was based on the criteria proposed by the Food and Agricultural Organization of the United Nations and the World Health Organization in 2001 and 2003. The PRSV coat protein sequence showed very low homology to allergenic proteins using full FASTA search and a sliding window of 80 amino acids. The absence of an 8-contiguous amino acid motif identical to allergens in the databases indicates low possibility of the novel PRSV coat protein in transgenic Philippine papaya to be allergenic.

**Keywords:** allergenicity, coat protein, expression, prsv-resistant, transgenic papaya

## AS-10

### **Stability of Protein Expression in BC<sub>2</sub>F<sub>1</sub> Generation of Fruit and Shoot Borer-Resistant Eggplant**

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The eggplant fruit and shoot borer (*Leucinodes orbonalis* Guen.) remains as one of the major factors that limits the productivity and profitability of eggplant production in the country. With the aid of genetic engineering and *Bacillus thuringiensis* (*Bt*) technology, a highly but selectively resistant event of eggplant was produced and subsequently chosen as a donor parent in a local breeding program that uses conventional backcross breeding method. Currently, multi-location trials are about to be conducted.

The Department of Agriculture mandates the establishment of proof of stable protein expression for genetically-modified crops before approval for multi-location trials could be released. One proof for stability of protein expression is the presence of the transgenic protein throughout the growth and developmental stages of the genetically-modified crop. Hence, protein expression in the terminal leaf of backcross-derived populations of eggplant grown in the greenhouse specifically in the BC<sub>2</sub>F<sub>1</sub> generation was analyzed using quantitative enzyme-linked immunosorbent assay (ELISA).

Expression of Cry1Ac protein in terminal leaf tissues sampled during vegetative, early reproductive and late reproductive stages fluctuated in the course of eggplant growth and development. Mean Cry1Ac protein concentration in BC<sub>2</sub>F<sub>1</sub> DLP x EE-1 was 24.53 ppm in the vegetative stage, 11.91 ppm in the early reproductive stage and 12.23 ppm in the late reproductive stage. Mean Cry1Ac concentration in BC<sub>2</sub>F<sub>1</sub> Mara x EE-1 was 15.89 ppm, 20.24 ppm, and 17.83 ppm in the respective stages. A significant difference in Cry1Ac protein expression was observed in the two crosses: DLP x EE-1 and Mara x EE-1, which emphasizes the importance of parental background in Cry1Ac protein expression.

**Keywords:** *Bt* technology, Cry1Ac protein, eggplant fruit and shoot borer, quantitative ELISA, transgenic eggplant

## AS-11

### **Insect Non-Preference and Reduced Virus Multiplication on Irradiated Banana cv Lakatan Resistant to Banana Bunchy Top Virus (BBTV)**

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Gamma-irradiated “Lakatan” bananas have demonstrated resistance against Banana Bunchy Top Disease (BBTD) caused by *Banana bunchy top virus* (BBTV). Resistance of mutant lines to BBTV were characterized and evaluated based on host - insect vector relationship, symptomatology, and virus multiplication. Resistance to the insect vector, *Pentalonia nigronervosa*, was elucidated by artificially inoculating individual lines with 20 viruliferous aphids. Insect preference was determined by counting the number of aphids per plant at a weekly interval. Reaction of the different irradiated lines to the disease was observed through symptomatic expression while resistance to virus multiplication was determined by knowing the titer of BBTV on the different mutant lines through Enzyme-Linked Immunosorbent Assay (ELISA). Results showed that there were differences on aphid preference based on mean aphid colony count on irradiated lines. Disease incidence was significantly higher on lines that were preferred by aphids and lower on those that were not colonized. For example, line 6-30-2 was observed to be most preferred having a mean colony count of 63.9 and disease incidence of 66.67% while line 9-28-2 was not preferred having a mean colony count of 26.3 and disease incidence of 11.11%. Non-irradiated banana cv Lakatan was observed to have a mean aphid colony count of 41.3 and disease incidence of 33.33%. Virus titer was also higher on irradiated lines with high aphid colony count and disease incidence. ELISA absorbance at 405 nm of lines 6-30-2 and 9-28-2 ranged from 0.138 – 0.712 and 0.126 – 0.423, respectively while that of non-irradiated banana cv Lakatan ranged from 0.132 – 0.397. Healthy and infected banana cv Lakatan as negative and positive controls gave an absorbance of 0.145 and 0.680, respectively. Based on the results of the study, non-preference of the aphid vector to colonize and reproduce in irradiated plants contributed to lower BBTD infection and lower titer of the virus in tested materials.

**Keywords:** aphid preference banana bunchy top virus, gamma-irradiated banana

## AS-12

### Laboratory Bioassay of Putative *Bacillus* sp. Against Major Rice Pathogens, *Pyricularia grisea* and *Fusarium fujikuroi*

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Recognizing the enormous important role of microorganisms in plant disease control, *Bacillus* species which are naturally occurring antagonists were collected and tested in the laboratory against two important seed transmitted pathogens of rice causing blast and bakanae diseases, *Pyricularia grisea* and *Fusarium fujikuroi*, respectively.

One hundred thirty isolates of putative *Bacillus* were obtained from healthy rice seeds and roots collected from different PhilRice stations throughout the Philippines. Based on growth diameter of *Bacillus* using a multiple culture method, bioassay results showed that 14 or 10.7% of the bacterial isolates were highly effective and 11.5% were moderately effective in reducing the growth of *F. fujikuroi* on potato dextrose agar medium. These highly effective isolates which exhibited growth of 20 to 30 mm were also found inhibitory to *P. grisea*. Among the isolates, however, only isolate nos. 59, 130, 01, 64, and 13 were consistent in controlling both pathogens in all replications. Except for isolate 130 which was obtained from Los Banos stock culture, the most effective antagonists were isolated from PhilRice seeds of NSIC Rc156 and 158 from Iloilo and PSB Rc18 and NSIC Rc 160 from Nueva Ecija. All potential isolates will be tested *in vivo* under screenhouse and fields conditions. Eventually, the successful candidate(s) will be mass produced, formulated, and commercialized as a biocontrol agents against blast and bakanae diseases of rice.

**Keywords:** *Bacillus* species, bakanae, bioassay, blast, rice

AS-13

## Diversity Within Collections of the Sugarcane Smut, A Major Disease of Sugarcane in the Philippines

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The variability of sugarcane smut, *Ustilago scitaminea* Sydow in the Philippines was evaluated using molecular, pathogenicity and morphological approaches. A total of 96 isolates from 17 sugarcane growing areas were used.

Isolates were analyzed for their polymorphism at 10 microsatellite loci. Cluster analysis showing genetic relationship among isolates was derived using simple matching coefficient. Principal component analysis was also done to structure the different *U. scitaminea* isolates. From both analysis, there were three major cluster groups (A, B, C) observed and clustering based on geographic origin was not evident.

Analysis of Molecular Variance (AMOVA) results for the Simple Sequence Repeats (SSR) data indicated that the within population variance accounted for 76% of the total genetic variation while the among population variance accounted for 21% of the variation. Only 3% of the variation was attributed to among group of isolates.

Highly significant ( $P < 0.01$ ) effect of variety, isolate and variety x isolate interactions were observed for virulence and aggressiveness of eight representative isolates using five differential hosts. Virulence and aggressiveness varied among the isolates studied.

The colony surface of the fungus varied from brown-black to creamy white or yeast-like growth. Teliospores of all isolates were globose to subglobose or ovoid, 6.32 to 7.05  $\mu\text{m}$  in diameter, brown, lighter on one side, minutely echinulated. Sporidia were hyaline, spindle to oval-shaped and tapering toward their extremities. The average length of 11.44  $\mu\text{m}$  and width of 2.20  $\mu\text{m}$  did not differ much among the different isolates.

Based on the three categories established as R (Resistant), I (Intermediate) and S (Susceptible), there were seven distinct groups of isolates producing distinct reaction types on the five differential varieties

indicating that isolates of *U. scitaminea* in the Philippines are highly diverse and races of the fungus probably exist.

**Keywords:** genetic diversity, sugarcane smut, *Ustilago scitaminea*

## AS-14

### **Host-Virus Interaction and Serological Detection of Chlorotic Ringspot Virus Disease of Oil Palm (*Elaeis guineensis*)**

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Chlorotic ringspot virus (CRSV) causing chlorotic ringspot, mosaic and streak in oil palm was identified by electron microscopy, host range experiments, and serological tests. The virus was 700 nm in length and filamentous in shape under electron microscope. Viral infection was transmitted via mechanical inoculation and insect transmission from oil palm to *Zea mays*, *Sorghum bicolor*, *Saccharum officinarum*, and *Aguingay* sp. among twenty host species inoculated. *A. gossypii*, *M. saccharii*, and sorghum aphids were insect vectors able to transmit the virus successfully. There is strong positive reaction on both naturally and mechanically infected plants exhibiting characteristic symptoms against sugarcane mosaic virus (SCMV) antibody using enzyme-linked immunosorbent assay (ELISA) test. Moreover, the CRSV was strongly related serologically to SCMV compared to other potyviruses using indirect ELISA. These results confirmed that the virus is SCMV.

**Keywords:** chlorotic ringspot virus, *Elaeis guineensis*, oil palm



AS-15

## Potential Effects of Using Lemongrass Oil on the Growth of Fungal Pathogens Attacking Gumamela

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Lemongrass (*Cymbopogon citratus* Stapf.) locally known as 'tanglad' is an aromatic tropical plant native to Southeast Asia. It is abundant in the Philippines and believed to have a wide range of therapeutic effects. Fresh or dried leaves of lemongrass, and the essential oil derived from them, are used as a drug, effective as natural antibacterial, antifungal and antiseptic. Lemongrass oil ranging from 10, 20, 30, 50 ul was tested for its antifungal activity against *Colletotrichum* sp., *Fusarium* sp. and *Rhizoctonia* sp. isolated from *Hibiscus rosa-sinensis* *in vitro* and *in vivo*. The efficacy of the extracted oil was compared with benomyl. The *in vitro* assay showed that lemongrass oil, at different concentrations inhibited the mycelial growth of the three fungi. Complete inhibition was observed at higher concentrations (30-50 ul) of lemongrass oil. *In vivo* assay revealed that lemongrass oil suppressed disease development on inoculated plants and is comparable with the performance of the fungicide (benomyl), while the untreated check (sterile distilled water) exhibited typical infection. The bioactivity of essential oil in its vapor phase makes it a possible fumigant for crop protection. Foliar spray is also a possible application method for essential oils. The present study presents lemongrass oil as a cost effective alternative to chemical fungicides.

**Keywords :** antifungal activity, *Colletotrichum* sp., *Fusarium* sp., *Hibiscus rosa-sinensis*, Lemongrass oil, *Rhizoctonia* sp.,

AS-16

## **Bioactivity of Talisay Leaf Extract Against *Ralstonia solanacearum* in Hydroponics: Implication on Agriculture**

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Hydroponics is one of the many ways of conserving and maintaining plant genetic resources. It offers many advantages, but it also has disadvantages. One of these disadvantages is bacterial infection of plants. The study investigates the potential of Talisay leaf extract in inhibiting the growth of *Ralstonia solanacearum* in hydroponics.

Fifteen strawberry plants were grown in hydroponics for three days before being subjected to experimental treatments. In Treatment 1, plants were soaked in Talisay leaf extract for 1 hour, then soaked in water with *R. solanacearum* for another hour. The soaking sequence was reversed in Treatment 2. For the control group, the first positive control was soaked for 1 hour in a chloramphenicol solution before being soaked in water with *R. solanacearum* for another hour. The soaking sequence was reversed in second positive control. The negative control was soaked for 1 hour in water with *R. solanacearum*. After the soaking, treatments were then brought back to hydroponic culture and observed for 12 days.

The Talisay leaf extract inhibited the growth of *R. solanacearum* in hydroponics, with T1 showing the highest inhibition rate among the five treatments. In terms of wilting, significant differences were obtained and T1 was the least infected among the five treatments. There was no significant difference in tolerance rate, survival rate and yellowing among the treatments.

**Keywords:** hydroponics, *Ralstonia solanacearum*, Talisay leaf extract

AS-17

## Variations Among Populations of the Bean Podborer *Maruca vitrata* (Fabricius) (Lepidoptera:Crambidae) in the Philippines

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The bean podborer *Maruca vitrata* (Fabricius) is a major insect pest of grain and vegetable legumes in the tropics and temperate regions of the world. It shows a wide host range and geographical distribution indicating the possibility of genetic variation in *Maruca vitrata* populations.

In this study, podborers were collected from cowpea, pole sitao, mungbean and snap beans in eight bean growing sites in the Philippines. The genetic variations among populations of *M. vitrata* sampled from Isabela (Ilagan), Benguet (Tublay and La Trinidad), Nueva Ecija (Valdefuente), Laguna (Bay), Palawan (Puerto Princesa), Aklan (Julita, Libacao) and Davao (Pagsabangan, Tagum City) were determined, described and compared. The optimized protocol originally used for *H. armigera* was used for DNA isolation in *M. vitrata*. The mitochondrial cytochrome oxidase II (COII) genes from the eight populations were sequenced. The observed sequence divergences of 0.16% - 0.83% showed that the seven populations were closely related to each other. They significantly diverged from the Laguna population. The high divergence between Laguna and the other populations is comparable to those between recognized biotypes in other Lepidoptera species. The nucleotide composition of the different sequences showed a high A-T content (81%) compared to C - G richness, which is typical of other insect species. The results obtained suggest that COII sequence is a suitable basis for inferring phylogenetic relationships in *M. vitrata*. The restriction enzyme digestion by *MseI* resulted to a single polymorphic DNA pattern. The polymorphic band with the fragment size of 257 bp was observed in two populations of Benguet, Nueva Ecija, and Isabela but none in Davao and Laguna. There was no DNA pattern observed on the two populations from Aklan and Palawan.

**Keywords:** cytochrome oxidase, genetic variation, *Maruca vitrata*, polymorphism

AS-18

**Isolation of *Bacillus* from Janitor Fish (*Pterygoplichyts disjunctivus*) Gut and Preliminary Screening for its Antibacterial Activity Against Plant and Human Pathogen: Implication on Health and Agriculture**

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Diseases of plants, animals and humans caused by bacteria pose unique challenges for health care in rural and urban areas. Access to effective and safe broadspectrum topical antibiotics is of paramount importance to address these needs. This study investigated the effectiveness of 90 *Bacillus* isolates from janitor fish (*Pterygoplichyts disjunctivus*) gut against *Staphylococcus aureus* and *Xanthomonas oryzae* using the agar plug assay.

Out of the ninety bacillus isolates, 68 inhibited the growth of *S. aureus* and *X. oryzae* suggesting the potential of using the isolates for production of antibiotics. Mean comparison of zones of inhibition using the Duncan's multiple range test suggest that the isolates were equally effective against the test organisms. Both test organisms were susceptible to the isolates. We recommend that the bioactive compound produced by the isolates be characterized and tested against other bacterial pathogens.

**Keywords:** janitor fish, *bacillus*, *Staphylococcus aureus*, *Xanthomonas oryzae*

AS-19

**Antagonistic Effects of Locally Isolated *Streptomyces* sp, *Bacillus amyloliquefaciens* and *Pseudomonas Fluorescens* to *Xanthomonas oryzae* pv. *oryzicola* Causing Bacterial Leaf Streak on Rice Plants**

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Rice, a staple food in most countries, currently faces production problems due to pathogens such as *Xanthomonas oryzae* pv. *Oryzicola* which causes leaf streak disease. Thus, this study aims to develop biological control agents such as *Bacillus amyloliquefaciens*, *Pseudomonas fluorescence* and 2 locally isolated *Streptomyces* sp. against *X. oryzae* pv. *Oryzicola*.

Antimicrobial assay was examined using the agar plug method and observing the growth of *B. amyloliquefaciens*, *P. fluorescence* and 2 locally isolated *Streptomyces* sp. Commercial fungicide was used as positive control and agar plug without the organism as negative control. Final screening was done by the cup cylinder method using liquid broth of the organisms. Assay plates were incubated for 48 hours to observe zones of inhibition.

The agar plug assay showed that *B. amyloliquefaciens* and *Streptomyces* sp 1 and 2 inhibited the growth of *X. oryzae* (zone of inhibition was 24.8 mm. in diameter for the 3 organisms while *P. flourescens* did not produce any inhibition). However, when the cup cylinder assay was done, the broth of *P. flourescens*, *B. amyloliquefaciens*, *Streptomyces* sp. 1 and 2 inhibited the growth of *X. oryzae* (diameter of the zone of inhibition was 10.9, 17.7 mm, 22.08 mm, 22.2 mm, respectively). The commercial fungicide used as positive control had a 32.96 mm zone of inhibition. Further analysis of the data showed that there is no significant difference between the three antagonists and the commercial fungicide. Thus, *B. amyloliquefaciens*, local *Streptomyces* sp. 1 and 2 can be used as biological control agents against *X. oryzae*. It is highly recommended to use *Streptomyces* sp. 1 and 2 because they could not cause negative effects to the environment.

**Keywords:** amyloliquefaciens, fungicide, oryzae

**AS-20**

**Yield and Oil Content Ideotypes Specification in  
*Jatropha curcas* L.**

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Twenty four trees were selected from an experimental plantation to determine an ideotype for *Jatropha curcas* L. based on seed yield and oil content. Variability was large in all morphological traits such as unbranched stem (CV = 46.51%) and number of first order branches (CV = 33.72%). Seed yield was positively and significantly correlated with basal diameter, length of unbranched stem, and crown diameter. Variability was small in fruit and seed traits. Crown diameter appeared to be a predictor of three seed size parameters ( $P < 0.05$ ), namely: length, breadth and thickness. Among the seed traits, seed length was significantly correlated with oil content. The oil content in the kernel ranged from 41.40 to 59.26%.

The proposed ideotype is described as a relatively short tree with big and circular basal diameter; large first order branches positioned low on stem forming an angle of more or less 50 from horizontal; crown is rounded and compact; large number of fruits per bunch and fruits ripen at the same time or nearly so; bearing large fruits with three seeds per fruit; and long seed length. The ideotype may tolerate some amount of shade and should be spaced 2 m x 2 m or wider.

**Keywords:** Ideotype, *Jatropha curcas* L.

**AS-21**

## **Improvement of Antioxidant of Sweet Pepper Fruit by Manipulation of Plant Nutrients Concentration**

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The dietary intake of plant foods with high antioxidant capacity has been reported to be inversely related to the morbidity of degenerative diseases. Since Filipinos are known to have a low per capita consumption of vegetables, increasing the antioxidant content per unit edible portion of vegetables could be a good strategy for health improvement. This study reports the preliminary investigation on the effects of highly elevated concentrations of the different essential nutrients on the improvement of antioxidant contents of sweet pepper fruits.

Seedlings of a local sweet pepper cultivar were established in Simple Nutrient Additional Program (SNAP) hydroponics under four different concentrations of SNAP nutrient solution. After 3 weeks, the growing solutions were topped with the recommended concentrations for normal vegetable production. Ripe fruits were harvested three months after seedling transplanting. Methanolic extracts of fruit tissues were used in the colorimetric assays for total antioxidant activity, polyphenol and flavonoid contents. The total antioxidant activity was assessed by the ability of the fruit extracts to trap the stable free radical 2,2 diphenyl-1-picryl hydrazyl (DPPH), which can be visualized by the decrease in absorbance at 517 nm.

Fruits from seedlings that were established at doubled concentrations of the plant nutrients iron, magnesium and the trace elements showed consistently higher total antioxidant activity, polyphenols and flavonoid contents. However, doubling all the plant nutrients resulted in fruits with the lowest antioxidant contents. The high concentration could have resulted in toxic effects on overall plant growth, underscoring the need for striking a balance between nutrient concentration and maximum production of antioxidants. Similar studies should be conducted on other vegetable crops to validate the effect of plant nutrient concentration on the improvement of antioxidant contents.

**Keywords:** antioxidants, flavonoids, polyphenols, SNAP hydroponics, sweet pepper

**AS-22**

**Effectiveness of BioGroe® Plant Growth Promoter on  
*Momordica charantia* L. (cv. Sta. Rita)**

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Ampalaya (*Momordica charantia* L.) is a cross-pollinated crop with a big market earning potential in the Philippines. Cultivar Sta. Rita is considered as the “mother-OPVs” in the Philippines and believed to be the source of elite breeding lines of ampalaya in hybrid breeding. A field experiment was conducted to determine the effectiveness of BioGroe® on the production of ampalaya (cv. Sta. Rita). BioGroe is a solid-based microbial plant growth promoter containing plant growth promoting bacteria (PGPB). PGPB are root-associated bacteria which influence root growth by producing plant hormones and provide nutrients in soluble form.

Results show that the application of the recommended rate of BioGroe® increased the total marketable yield by 63 % and the total number of fruits by 50% relative to the control. The potential and actual yields were 42 % and 63 % higher than the control, respectively, with the application of the recommended rate of BioGroe®. These results suggest that the application of BioGroe® can significantly increase the yield of ampalaya.

**Keywords:** ampalaya, BioGroe®, Hybrid breeding, increased yield, Plant growth promoting bacteria,



**AS-23**

## **Effectiveness, Growth and Survival of Plants Growth Promoting Bacteria (PGPB) in Three Soils**

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One of the constraints to the adoption of PGPB technology is the lack of information on crop response to PGPB inoculation in different soils. This study examined the growth and survival of PGPB and their auxin production in sterilized Lipa clay loam [organic matter (OM)-4.7; pH-6.7], Luisiana clay (OM-2.8; pH-4.5), and Binangonan clay (OM-5.7; pH-7.9), and in the lettuce rhizosphere.

One day after inoculation, the number of PGPB increased by 132% and 198% in Lipa clay loam and Binangonan clay, respectively. In contrast, PGPB population decreased by 98% in Luisiana clay. After 19 days, 7.25% of the initial population remained viable in Lipa clay loam and Binangonan clay but only 0.08% in Luisiana clay. Higher indole-3-acetic acid (IAA) concentration was obtained in Lipa clay loam (831.41 ug IAA equivalent/g soil) and Binangonan clay (861.04 ug IAA equivalent/g soil) than in Luisiana clay (128.99 ug IAA equivalent/g soil).

In a growth room experiment, the high R:S ratios in Lipa clay loam and Binangonan clay suggested better root colonization by PGPB in these soils than in Luisiana clay. However, a microscopic examination showed numerous bacterial cells on the surface of roots obtained from Luisiana clay and none on those obtained from the other two soils. The R:S ratio is helpful in determining the rhizosphere competence or the ability of PGPB to colonize the rhizosphere. The number of PGPB in the rhizosphere is denoted by 'R' while 'S' refers to the number of PGPB/bacteria in the non-rhizosphere soil.

In a greenhouse experiment, treatments with inoculation resulted in a 66% increase in shoot fresh weight of lettuce relative to the uninoculated treatments. Inoculation significantly increased NPK content by 10%, 3%, and 14%, respectively and NPK uptake by 57%, 66%, and 66%, respectively.

The N, P, and K content were significantly influenced by the interaction between soil type and rates of fertilization.

Interaction effect of rates of fertilization and PGPB inoculation increased shoot fresh weight, root dry weight, P and K content, and N and K uptake of lettuce.

**Keywords:** auxin, Binangonan clay, inoculation, lettuce, Lipa clay loam, Luisiana clay, PGPB, plant growth promoting bacteria, rhizosphere

## AS-24

### **Nodule Occupancy and Nitrogen Uptake Variability Among Mungbean Varieties (*Vigna radiata* [L] Wilczek) Inoculated with *Bradyrhizobium* sp. Under Field Condition**

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Legumes derive as much as 90% of their nitrogen content from the atmosphere through biological nitrogen fixation. Inoculation with superior strain of rhizobia improved yield and nodulation of legumes grown in low nitrogen soils. However, response to inoculation is influenced by the host's affinity to the introduced strain as well as the level of native rhizobia population.

A field trial was conducted in Ilagan, Isabela to determine the affinity of ten mungbean varieties to *Bradyrhizobium* sp. strain M6 inoculation. The trial was a split-plot experiment involving inoculation, without inoculation, N fertilizer treatment (30 kg N/ha) and ten mungbean varieties as variables. With a low native rhizobia population of 22 cells per g soil, nodule occupancy by the inoculant *Bradyrhizobium* sp. strain M6 differed significantly among the entries tested and ranged from 39 to 62%. Pag-asa 7 had the highest percent of nodules infected by strain M6. Across treatment, the ten entries differed in terms of crown nodule number, crown nodule dry weight and total nodule number. Crown nodule number ranged from 1 to 3 nodules plant<sup>-1</sup> while crown nodule dry weight ranged from 0.96 to 2.64 mg/plant. Taiwan Green had the highest crown nodule number of 3 nodules/plant and highest crown nodule mass of 2.64 mg plant.

A significant variety treatment interaction was observed in terms of nitrogen uptake. Inoculation of mungbean varieties Pag-asa 3 and Acc 12748 with strain M6 significantly improved N uptake compared with the uninoculated plants by 42 and 101%, respectively. Pag-asa 7, the highest grain yielder, showed a 21% increase in N uptake with inoculation. The N uptake of inoculated Acc 12988 and Acc 12748 were found comparable with the N uptake of N-treated plants. The rest of the entries did not show significant differences in N uptake across treatments.

**Keywords:** mungbean, nitrogen uptake, nodulation, nodule occupancy, rhizobia

AS-25

## Screening of Plant Growth-Promoting Bacteria (PGPB) for Acid Tolerance

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PGPB have been shown to enhance productivity in non-acid soils. Very few studies on the effectiveness of PGPB in acid soils have been done. This study was conducted to determine the survival and auxin production of the acid tolerant PGPB 24 and the non-acid tolerant PGPB 6 in acidic liquid medium and in acid soil and their effectiveness in acid soil using corn (*Zea mays* L.) as test crop. Acid tolerant IPB Var1 and acid intolerant Arkansas SWCB-Syn1 were the cultivars used.

In liquid medium, PGPB 24 showed better survival than PGPB 6 at pH 4.7 and pH 7.0. Auxin production by PGPB 24 was also higher than PGPB 6 at both pH values. PGPB 24 showed better survival in both acid and non-acid soils.

Auxin production by PGPB 6 and PGPB 24 at 14 days was 831 ppm and 698 ppm, respectively. In the acid soil, the amount of auxin produced fluctuated. Higher auxin production was observed in non-acid soil for both PGPB 24 and PGPB 6.

The test for effectiveness revealed that, regardless of cultivar, the acid tolerant PGPB 24 performed better than the non-acid tolerant PGPB 6 in acid soil (pH 4.8) in terms of number of roots, available P in the soil and N uptake of the shoot. On the other hand, PGPB 6 had better N and P uptake than PGPB 24 in non-acid soil (pH 6.8). These observations indicate that the acid tolerant PGPB 24 performed better than the acid intolerant PGPB 6 in acidic soil (pH 4.8).

There was a significant influence of the interaction between cultivar and inoculation on the N, P, and K content of roots at 7 weeks after planting. These observations seem to indicate a better affinity of the acid tolerant PGPB with the acid tolerant cultivar.

**Keywords:** acid tolerance, auxin, corn, inoculation, PGPB, plant growth promoting bacteria

**AS-26**

**Enhanced Rooting of Cassava Cuttings Using Plant Growth Promoting Rhizobacteria**

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The demand for planting materials of cassava (*Manihot esculenta* Crantz) has increased in recent years with the identification of cassava as an alternative source of biofuel. Hence, rapid production of cassava planting materials is needed to meet the required volume of materials to plant the target area for food, feed and ethanol production.

Two replicated experiments were conducted to evaluate the response of cassava cuttings to inoculation with plant growth promoting rhizobacteria (PGPR). Rapid propagation was sought by inoculating two-node cassava cuttings variety 'Lakan' with two PGPR formulations (F1 and F3) developed at National Institute of Molecular Biology and Biotechnology, University of the Philippines Los Baños (BIOTECH, UPLB) and maintained for four weeks in styroboxes that were either enclosed in clear plastic bags ('kulob') or left without plastic cover (open condition) along with uninoculated cuttings. Enhanced rooting by PGPR inoculation was observed in terms of root length and plant height at four weeks after rooting. Significant rooting condition by treatment interaction was obtained for both parameters such that 29% increases in root length were obtained with F1 inoculation under open condition while F3 inoculation in the 'kulob' treatment increased root length by 16%. Under open condition, F1-inoculated seedlings were taller than the control and F3-inoculated seedlings by 23% and 30%, respectively. However, only F3 inoculation increased plant height by 36% in the 'kulob' treatment.

Further study compared the effect of PGPR inoculum rate and commercial rooting hormones on germination of cassava. The inoculum rate applied at half the concentration used for vegetable crops was found effective on cassava cuttings in terms of average number of roots and height

of germinated seedlings at 4 weeks after rooting. Cassava seedlings inoculated with 0.5x PGPR were taller than the seedlings rooted with Hormex and Quick Root by 27%.

**Keywords:** Cassava, cassava rooting, kulob treatment, PGPR, rooting hormone

## AS-27

### **Development of In Vitro Selection and Propagation of Pineapple cv. 'Queen' with Resistance to *Phytophthora* Heart Rot**

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Pineapple is one of the economically important fruit crops in the Philippines. The widespread occurrence of *Phytophthora* diseases is one of the main constraints in pineapple production. In vitro selection for resistance to this disease was done using pineapple calli that survived treatment with crude filtrate of *Phytophthora cinnamomi*, the identified causal organism of *Phytophthora* heart rot. Crown meristem tips of 'Queen' cultivar were used as explant in the initial induction of callus. Calli were tested at varying concentrations of the crude filtrate of *P.cinnamomi*. Results showed that crude filtrate of the pathogen were effective in the selection of calli resistant to the pathogen. In pure crude filtrate (1:0 of crude filtrate:water), no callus survived. In 1:1 concentration, severe effect was observed on the calli, and none to very few calli survived. Calli treated with 30% (3:7) crude filtrate of *P. cinnamomi* exhibited 50% survival and had optimum growth and high frequency of regeneration into plantlets. Treated calli became blackish to dark brown or whitish in color and soft in texture, while the untreated calli showed profused growth with semi-hard texture, and cream to creamy-white in color. The toxic effects of the crude filtrate on the calli decreased as the concentrations decreased. This was evident on the ability of the treated calli to grow and develop when transferred into a regeneration medium. High frequency of regeneration of calli into plantlets was observed when grown in MS medium supplemented with 5  $\mu$ M benzene amino purine (BAP) and 1  $\mu$ M gibberellic acid (GA3). Developing plantlets were multiplied in either liquid or solid MS medium with the same growth hormones. Regenerated plantlets were subdivided into single plantlet from a

cluster of multiple shoots of proliferating plantlets. The plantlets will be later evaluated for resistance to heart rot in vivo.

**Keywords:** callus, culture filtrate, 'Queen' variety, *Phytophthora cinnamomi*, pineapple,

AS-28

## Carbon Stock Assessment of Mangrove in Batangas and Quezon Province, Luzon, Philippines

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Mangroves have a significant role in addressing climate change because they serve as sinks of CO<sub>2</sub>. This study aimed to assess the carbon storage potential of mature mangroves of Verde Island Passage (VIP) in Batangas and Tayabas Bay in Quezon Province. A nested plot method and allometric equations developed by Komiyama et al. (2005) and Brown (1997) were employed to estimate the carbon density of these stands. Results revealed that mangroves of VIP and Tayabas Bay are generally comprised of *Rhizophora* and *Avicennia* species. Carbon density of *Rhizophora*-dominated stands in VIP was estimated to be around 115.45 ton/ha. Among the species, *Rhizophora mucronata* and *Xylocarpus granatum* were noted as major contributors to carbon sink. In Tayabas Bay, carbon density of *Rhizophora* stands was recorded to be around 92.36 ton/ha. *Rhizophora apiculata* was observed as the most abundant species in this site. In view of the *Avicennia*-dominated stands, VIP has a carbon density of around 141.71 Mg/ha, while Tayabas Bay has around 139.07 ton/ha. *Avicennia marina* was observed dominant in both sites. Overall, mangroves of VIP and Tayabas Bay exhibit a good carbon storage potential hence proper forest management is essential to sustain and improve its capacity to mitigate climate change.

**Keywords:** carbon storage, climate change, mangrove, mangrove forest

AS-29

## Diversity and Carbon Sequestration Potential of *Avicennia* Mangrove Stand in Verde Island Passage, Luzon, Philippines

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Mangroves help in mitigating the impacts of climate change because they serve as sinks of CO<sub>2</sub> and barriers for tidal surges. This study aimed to assess the diversity and carbon storage potential of mature *Avicennia*-dominated mangroves found along the Verde Island Passage (VIP) in the province of Batangas. *Avicennia* are mangrove species that belong to Family Avicenniaceae which are commonly found in the intertidal zone of estuarine areas. Nested plot method, Shannon-Weiner index, and allometric equations developed by Komiyama et al. (2005) and Brown (1997) were employed to estimate the diversity and carbon density of the stands. Results revealed that diversity at the large plot (20 x 100 m) and small plot (5 x 40 m) layers are low with H'<sub>1</sub> = 1.9222 and H'<sub>2</sub> = 1.0114, respectively. These findings are attributable to very few species recorded where Bongalon (*Avicennia marina*) and Malatangal (*Ceriops decandra*) were listed as the most frequent. In terms of carbon stock, a total of 116.57 ton/ha was estimated for the large plot layer. Bongalon (*Avicennia marina*) was noted to have the largest contribution to this value with 15.46 ton/ha. At the small plot layer, carbon stock was estimated to be around 19.59 ton/ha. Malatangal (*Ceriops decandra*) was noted to have the highest carbon density with 13.98 tons. Overall, the *Avicennia* mangroves of VIP exhibit a good carbon storage potential though its diversity is quite low. Proper forest management and mangrove amelioration projects are therefore essential to sustain and improve its capacity to mitigate the impacts of climate change.

**Keywords:** *Avicennia*, carbon sequestration, climate change, diversity, mangrove

## AS-30

### Paradigm Shift on Mushroom Technology for Ligninolytic Fungi in the Philippines: From Sawdust to Rice Straw

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The Philippines being a tropical country is rich in forest product resources. The most common botanical-based forest products which are oftentimes used by the Filipinos for commercial purposes include bamboo, rattan, dipterocarp – based lumber for furniture making, wild fruits and epiphytes. Though mushrooms in other developed parts of the world serve as one of the primary forest products and are highly considered as prime commodity, these remain to be under utilized in the Philippines. Their scarcity in the local market in their fresh form makes mushrooms a luxury food. With the favorable climatic conditions in the country during rainy season, mushrooms become seasonally abundant. Mushrooms are oftentimes injudiciously collected from the wild by the village people. However, due to the change of habitat as a result of unprecedented deforestation, climatic change and massive collection, occurrence of wild mushrooms is diminishing. To conserve these wild fungal genetic resources, we surveyed a number of wild mushrooms in the country and studied their biophysiology and possibility for domestication. We rescued the cell lines of these wild mushrooms and developed production technologies for *Auricularia polytricha*, *Collybia reinakeana*, *Schizophyllum commune* and *Ganoderma lucidum*. Though these mushrooms are generally known as wood rotters and they are widely and commercially grown on sawdust-based medium, we were able to develop production technologies using composted rice straw as the basal medium. In practice, farmers customarily burn the rice straw in order to easily get rid of this agricultural waste. Understanding fully the biophysiology of these wild mushrooms, we successfully grew and produced higher biological efficiency on this basal medium. The use of rice straw as basal medium would discourage the burning of straw and minimize the dependency on sawdust for mushroom cultivation.

**Keywords:** *Collybia reinakeana*, *Ganoderma lucidum*, *Schizophyllum commune*, Philippine mushrooms



**AS-31**

## **External Parametric Indicators of In Vitro Developmentally Competent Water Buffalo Oocytes**

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External parametric indicators for developmentally competent water buffalo oocytes were determined. Oocytes were retrieved from ovarian follicles and classified based on the density and compactness of the surrounding cumulus cells, the granulation and size of the ooplasm, and the size of the donor antral follicle. Oocytes classified based on these parameters were matured and fertilized in vitro and the nuclear maturation, cleavage and blastocyst development rates were assessed after in vitro fertilization. Results showed that oocytes surrounded by multi-layers (>5 layers) of cumulus cells had highest developmental competence. Oocytes with a compact cumulus required a longer (24 to 26 h) period of in vitro maturization (IVM) and those with loose cumulus required a shorter (20 to 22 h) period of IVM for optimum blastocyst development. Oocytes with a diameter of <100  $\mu\text{m}$  lacked developmental competence which is evident by the failure to develop to metaphase II (MII) after IVM while oocytes with a diameter 100  $\mu\text{m}$  developed to MII and cleaved after in vitro fertilization (IVF). Optimum cleavage (96.8%) and blastocyst development (27.0%) was observed in oocytes with 120  $\mu\text{m}$ . The size of the donor follicle was linearly correlated with oocyte developmental competence with follicles 6 mm containing highly developmentally competent oocytes. Based on the above findings, oocytes surrounded by >5 layers of compact or loosened cumulus with evenly granulated and ~110  $\mu\text{m}$  diameter ooplasm, and came from >4 mm follicles are developmentally competent. These results suggest that the density and compactness of the surrounding cumulus, the diameter of ooplasm and donor follicles are positive indicators for oocytes with developmental competence.

**Keywords:** indicators of developmental competence, in vitro fertilization, water buffalo oocytes

## AS-32

### **Plasma Free Insulin-Like Growth Factor 1 (IGF-1) with the Growth Performance and Scrotal Lengths of Landrace Boars**

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Insulin-like Growth Factor I (IGF-I) is a 7.6 kDa, 70 amino acid residue peptide hormone that has been shown to be involved in the metabolic regulation of growth and reproduction in livestock. The present study was undertaken to quantify the concentrations of plasma free IGF-I in growing Landrace boars and determine whether the plasma free IGF-I concentration can be used as a selection criterion for growth. A total of fourteen (n= 14) Landrace boars were bled, weighed and monitored for ADG, backfat thickness and scrotal length at 15 and 24 weeks of age. Plasma samples were extracted from the blood and plasma free IGF-I concentrations were measured using the DSL 10-9400 Active free IGF-I Enzyme-Linked Immunosorbent (ELISA) kit. Experimental Landrace boars data on live weight, ADG, backfat thickness and scrotal length were correlated with their levels of plasma free IGF-I.

This study has demonstrated a significant decrease ( $P= 0.0001$ ) in the circulating plasma free IGF-I concentration of Landrace boars from 15 to 24 weeks of age. Furthermore, correlation of plasma free IGF-I concentration with growth traits showed a positive association with ADG ( $r= 0.72575$ ) while negative associations were established with backfat thickness ( $r= -0.41236$ ), scrotal length ( $r= -0.700016$ ) and live weight ( $r= -0.57916$ ). Results of this study suggest that circulating plasma free IGF-I is related to leaner body composition in swine.

**Keywords:** growth hormone, IGF-1, landrace boar

AS-33

## Improving the Performance of a Vision-Based Computerized Egg Grader

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The presence of physical-based quality attributes on egg shell surface such as pinholes, stretch marks, strain, discoloration, cracks, as well as dirt, and their combinations makes egg grading a complex process. Candling, the manual method of egg grading common in the *Balut* (duck egg embryo) making industry in the Philippines, is labor intensive and susceptible to some mechanical intrusion as human contact with the eggs is unavoidable. The judgment of experienced human graders is error-prone due to subjectivity, eye strain, boredom, and tiredness. To improve efficiency, minimize errors and *capture* the human's expertise, we developed a computer-based vision system using an artificial neural network (ANN) as a grader. Using a digital camera, we obtained 500 color images of human-graded eggs to train, test, and validate several ANNs. Using the respective grades of experienced human graders from two local *balut* farms in Quezon province as benchmark, we chose the ANN with the highest specificity and sensitivity (93% and 79%, respectively). We observed, however, that the wrongly-graded eggs by the best ANN were correctly graded by most of the ANNs that we did not choose. From among those ANNs that we did not choose, we further observed that the mis-graded eggs by some ANNs were graded correctly by other ANNs. Thus, to improve specificity, we combined all ANNs into a committee of classifiers, where each member casts a vote as its classification. We take the majority vote as the committee's grade for a given egg. We validated the committee's output over the validation dataset and results show that the committee agrees 98% of the time with the human graders, improving the grading efficiency by 5%.

**Keywords:** *balut*, committee machines, computer vision, duck egg embryo, egg grading, neural network

AS-34

**Multivariate Analysis of Net Phytoplankton Community Structure and Physico-Chemical Conditions in Panguil Bay, Northern Mindanao, Philippines**

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The species composition of net phytoplankton and environmental parameters were studied in Panguil Bay in Northern Mindanao on four sampling occasions (November 2008, February 2009, August 2009, May 2009) representing changes in monsoons. Samples were collected from 21 stations across the bay by vertical towing of a 20-m conical plankton net. Phytoplankton abundance was estimated by direct counting following the Utermohl method. The relationship between environmental factors and the phytoplankton community structure was analyzed using multivariate techniques in the CANOCO software. Deeper and more saline stations near the mouth of the bay were more species diverse but lower in abundance while the inner shallower and less saline stations showed the opposite. A total of 60 net phytoplankton species were identified, and the abundance was dominated, in decreasing order, by three major groups: diatoms > dinoflagellates > cyanobacteria. The centric diatom *Coscinodiscus wailesii* dominated in almost all samples from all four sampling periods. Depth was significantly correlated with phytoplankton abundance in all sampling periods reinforcing the distinct assemblages occurring in deeper outer and shallower inner portions of the bay. Dissolved nitrate concentration was significantly correlated with November, February, and May phytoplankton assemblages; salinity with February and May; tide with May and August; and temperature with May. This study demonstrates the strong influence of monsoon-associated environmental parameters on the net phytoplankton community structure in Panguil Bay, one of the fishery priority bays in the Philippines.

**Keywords:** *Coscinodiscus wailesii*, depth, ecology, Multivariate analysis, nitrate concentration, phytoplankton, salinity, tide,

## AS-35

### Use of Rice Bran and Vermicompost as Supplemental Feeds for Nile Tilapia (*Oreochromis niloticus*) Fingerlings in Aquaria

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Rice bran is the most commonly used supplemental feed for the Nile tilapia (*O. niloticus*) in the Philippines. In China, vermicompost, the organic material produced with the culture of earthworms has been found to be useful as a supplemental feed for Nile tilapia. No studies have yet been conducted on the use of vermicompost as supplemental feed for fish in the Philippines.

To test the efficacy of vermicompost produced with the “African night crawler” (*Eudrilus eugeniae*) from dried tree leaves, two feeding trials on Nile tilapia fingerlings in aquaria were conducted. In Trial 1, unfermented rice bran (D2) only (Control), 80% unfermented rice bran + 20% vermicompost (Treatment I) and 80% fermented rice bran + 20% vermicompost (Treatment II) were fed to the fingerlings which were stocked at a density of 10 per aquarium with three replicates per treatment. In Trial 2, fermented rice bran only (Control), 75% fermented rice bran + 25% vermicompost (Treatment I) and 50% fermented rice bran + 50% vermicompost (Treatment II) were fed to the fish with the same design as in Trial 2. The feeding period was two weeks for each trial.

Trial 1 showed that the fish fed with Treatment II had the mean net gain in weight which was significantly higher than those of the Control and Treatment I. In Trial 2, the mean net gain in weight of the fish fed with Treatment I was significantly higher than those of the Control and Treatment II.

Proximate analyses of the supplemental feeds used indicated that fermented rice bran was comparable with unfermented rice bran in terms of crude protein, crude fat and ash but was slightly lower in terms of crude fiber and higher in carbohydrates. Vermicompost, on the other hand, was higher in crude protein and ash compared to rice bran but lower in crude fat, crude fiber and carbohydrates. Survival rates of the fish in all treatments of Trial I was 100%, but it was only 93% in the Control and Treatment I and 87% in Treatment II of Trial 2.

We conclude that the use of 80% fermented rice bran + 20% vermicompost gives better growth of the fish than use of unfermented rice bran whether singly or in combination with vermicompost. Use of vermicompost as supplemental feed up to 25% replacement for fermented

rice bran is more efficient than use of fermented rice bran alone or a combination of 50% fermented rice bran and 50% vermicompost.

Further studies to verify the results of the abovementioned trials are recommended.

**Keywords:** Nile tilapia, supplemental feeds, rice bran, vermicompost

## AS-36

### **Bioaccumulation of Some Heavy Metals in Adult Tilapia *Oreochromis niloticus* in Southern Part of Laguna De Bay**

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Tilapia, *Oreochromis niloticus*, one of the most important fish species in Philippine aquaculture, is grown abundantly in Laguna de Bay. A preliminary study was conducted to determine the levels of accumulated mercury (Hg), cadmium (Cd) and lead (Pb) in the muscle tissue of this freshwater fish collected from February (wet season) to March (dry season) 2008 in the southern part of Laguna de Bay. Heavy metal analyses using atomic absorption spectrophotometer (AAS) showed a higher concentration of Hg and Cd during the wet season than in the dry season. However, analysis of variance revealed significant seasonal variation only in Cd ( $P=0.0253$ ). Lead, on the other hand, was not detected in the fish samples. The mean concentration of Hg (0.023 ppm) was lower than the permissible concentration set by FAO but the mean level of Cd (0.161 ppm) was almost equal to the limit given for fish. This could represent a significant health risk to the consuming public.

**Keywords:** bioaccumulation, heavy metals, Laguna de Bay, spectrophotometry, tilapia

# **BIOLOGICAL SCIENCES**

## **BS-1**

### **Bioremediation Through Selective Recovery of Heavy Metals From Industrial Wastewater Using Biogenic Hydrogen Sulfide: Screening and Optimization of Alternative Media**

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The use of commercially available synthetic media for the cultivation of H<sub>2</sub>S-producing bacteria used in the bioremediation of heavy metal contaminated wastewaters makes treatment process impractical and expensive. Hence, the need for an economical media for efficient H<sub>2</sub>S production was addressed in this study. H<sub>2</sub>S production of local H<sub>2</sub>S-producing bacterial isolate SRB-B15 in media of different carbon and sulfate sources was compared and quantified based on % copper precipitation. Optimum pH favoring H<sub>2</sub>S production was determined. Throughout the experiment, 250 mL media plus 50 mL of inocula were incubated for two days at ambient room temperature. H<sub>2</sub>S produced was purged to 200 mL of wastewater with copper concentration range of 5000 ppm – 8000 ppm. Purging time was kept at 20 minutes, time interval between purging was kept at 24 hours. SRB-B15 was capable of using egg as alternative carbon source but not coconut water and molasses; it was also capable of using CaSO<sub>4</sub> as sulfate source. Comparison of H<sub>2</sub>S production in CaSO<sub>4</sub>-Egg Media (CEM), Na<sub>2</sub>SO<sub>4</sub>-Egg Media (NEM) and Sulfate – Reducing Media (SRM) showed 90%, 81% and 58% copper precipitation, respectively. CEM and NEM were optimized by varying their pH levels. The optimum pH for CEM and NEM were pH 10 and pH 8, respectively. At optimum pH, CEM gave 99.99% copper precipitation after purging seven (7) times while NEM gave 99.99% copper precipitation after purging twelve (12) times. The remaining copper concentration for both cases was below the DENR effluent standard of 1.3 ppm. The same % removal was observed using 5 L of SRM. It can be concluded from the results that CEM and NEM are more effective than SRM because a relatively high volume of SRM was needed to produce 99.99% copper removal. CEM and NEM have high potential for being used to actual



industrial scale because they are cheaper, easier to prepare and more efficient than commercially available synthetic media like SRM.

**Keywords:** bioremediation, biogenic hydrogen sulfide, copper precipitation, sulfate-reducing bacteria

## BS-2

### Characterization of Cebu Port Water

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Cebu City Port waters are prone to domestic and industrial pollution, thus these were characterized to determine quality based on biological parameters, particularly total bacterial count, coliform count and *Vibrio* count, physical parameters including pH, dissolved oxygen, phosphates, nitrates and ammonia-N and water temperature. Piers 1 to 5 of Cebu City were considered as Sampling sites 1 to 5. Sampling site 3 water samples had the highest bacterial count ( $10^5$  cfu/ml), followed by sampling sites 1 and 2 ( $10^4$  cfu/ml) and sampling sites 4 and 5 had the lowest bacterial count ( $10^3$  cfu/ml), while total bacterial counts of all sampling sites belong to a very high category (above  $1.0 \times 10^3$  cfu/ml) as revealed by the Bureau of Fisheries and Aquatic Resources RO7 quantitative bacteriology report. However, the coliform counts for all sampling sites have the same level of more than 1600 MPN/ml, categorized as unsafe, base on the water quality standard for bathing (1000 MPN/ml) adopted by the Department of Environment and Natural Resources. *Vibrio spp* was detected from sampling sites 2 to 5 water samples. pH and dissolved oxygen tests revealed that the water taken from sampling sites 1-5 are within the normal level. Based on the mandatory standards for ammonia-N (0-1 ppm), nitrate-N (5 ppm) and phosphates (0-2 ppm), the Cebu City Port waters are within acceptable range/standards. The researchers are currently verifying the seaport water characteristics to obtain data at various seasons. The data will serve as basis for clean-up strategies, rehabilitation technologies and benchmarks of good practices.

**Keywords:** bacteriology, clean-up, pollutants, physico-chemical, seawater, waterways

**BS-3**

## **Histopathological Changes in the Arcuate Nucleus of the Hypothalamus in 'MSG-Mice'**

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A new non-genetic model of diabetes, obesity, and fatty liver was developed, called MSG-mice. This model is induced with the injection in newborn mice of monosodium glutamate (MSG). More importantly, MSG-mice are regarded as the most comprehensive model described thus far based on the co-existence of multiple aspects of the human metabolic syndrome. However, the mechanisms responsible for the effects of MSG on the ICR mice remain unknown but we hypothesize that MSG may affect the brain specifically the hypothalamus. The aim of this experiment is to observe developmental changes in the hypothalamus caused by MSG and attempt to make a model of how the lesions progress through its postnatal days during critical stages of brain development. In this study MSG was subcutaneously injected (2mg/g body weight) to the treated groups (MSG-mice) for five consecutive days starting at day of birth, while the control group (CTRL) did not receive any treatment. Mice were sacrificed after every five days until day 36. Formalin-fixed, paraffin-embedded brain tissues were processed and 4-mm thick serial sections were cut and stained with hematoxylin and eosin (HE). Lesions were quantified based on cellular aberrations such as cellular vacuolations, shrinkage of neurons and pyknosis. The results showed that the arcuate nucleus of the hypothalamus of MSG-mice have more lesions than those of the control group (at  $\alpha = 0.05$ ,  $t_s = 2.447$  and  $t = 4.053$ ). Lesions become more pronounced as the mice ages and peaks at day 26. However, improvement was observed after day 26. Possible repair mechanism at this stage may be activated from day 26. No significant difference was seen between the weights of two test groups; however, BMI of control mice was slightly higher than those of MSG-mice but not statistically significant

**Keywords:** hypothalamic lesions, MSG-mice

## BS-4

### Species Diversity and Productivity of Algae in a Littoral Area of Ilocos Norte, Philippines

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The study aimed to determine the diversity and rate of production of macrobenthic algae in a littoral area of Ilocos Norte. It also aimed to quantify the major biomass constituent of the most dominant algal species and evaluate their possible application for pulp and paper. Three stations were considered. Station I had an average depth of 0.7 m, 28.17°C bottom water temperature, 2800  $\mu\text{Em}^{22}$  light intensity, 0.93 m water transparency and 0.068 m/sec water speed. Station II had an average depth of 2.6 m, 26.67°C bottom water temperature, 2700  $\mu\text{Em}^{22}$  light intensity, 2 m water transparency and 0.104 m/sec water speed. Station III had an average depth of 4 m, 25.67°C bottom water temperature, 2400  $\mu\text{Em}^{22}$  light intensity, 2.27 m water transparency and 0.1048 m/sec water speed. The area is inhabited by 22 species of microbenthic algae: 7 species of *Chlorophyta* (green algae); 6 species of *Phaeophyta* (brown algae) and 9 species of *Rhodophyta* (red algae). In terms of diversity (H), the shallower waters of the area were more diverse in species composition with H becoming lower with increasing water depth (Station I, 16 species; Station II, 15 species and Station III, 16 species). Primary production (biomass) of the algal seaweeds in these areas was observed to be greatest at deeper waters (Stations II and III) and was dominated by *P. crassa*, *S. cristaefolium*, *S. polycystum* and *E. serra*. Among these four dominant species, *S. cristaefolium* and *S. polycystum* contained the highest amount of cellulose and hemicelluloses and the lowest amount of lignin as determined by TAPPI standard T4m, hence these have high potentials for pulp and paper applications.

**Keywords:** biomass composition, littoral area, macrobenthic algae, primary production, species diversity

## **BS-5**

### **Face Shape Selected Indigenous Groups in Mindanao**

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The face shape of individuals belonging to seven different indigenous groups (IG) from Mindanao was studied using geometric morphometric analysis. Entry protocols were properly observed in the conduct of the study. Individual members of the indigenous peoples (IP) groups recruited to participate in the study were properly informed of the nature of the study and their consents were obtained before their face images were taken. A total of 496 images of the face (217 males and 279 females) were obtained from the Bagobo, Bilaan, Higaunon, Kalagan, Maranao, Subanen and Talaandig groups. Forty-three manually defined landmarks done in triplicates generated relative warp scores which were subjected to different statistical tools in order to compare face shapes and to examine relatedness between IGs. Non-metric multidimensional scaling and discriminant analysis showed significant variation between IGs; however, patterns of clustering were different in male and female populations. Procrustes ANOVA showed that sides, individual, and interaction in all IGs of both populations had P-values of <0.000, which is indicative of the presence of asymmetry, distinctness of the face shape of each individual, and a significant variation among IGs in both male and female populations. The interaction of sides and individual p-value showed high fluctuating asymmetry (FA) for all IGs regardless of gender. This may be attributed to the intermarriage practices between individuals of same IG which are still applicable to some groups nowadays. In conclusion, each IG possesses distinct face shape but individuals belonging to each group have high degree of variation.

**Keywords:** discriminant analysis, fluctuating asymmetry, geometric morphometrics, Indigenous groups, non-metric multidimensional scaling,

## BS-6

### **The Culture of Bloody Cockles (*Anadara Antiquata* Linnaeus) in Diferent Water Levels at The Marine Waters of Northern Poblacion, San Francisco, Cebu**

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*Anadara antiquata* Linnaeus is one of the bivalves frequently gleaned in Camotes Islands and other parts of the country; hence, this experiment was conducted to find out its growth rate in off-bottom conditions placed in trays/cages divided into 3 layers representing the surface, middle and bottom water levels of the water with shell weight, length and width as indicators of its growth. Survival and mortality rates were also taken to determine the efficiency of the methods. In this study, we used the Complete Randomized Design (CRD) which was composed of 4 treatments and 3 replicates, namely: T<sub>0</sub> (control- the bloody cockles raised in the sea bottom), T<sub>1</sub> (surface layer), T<sub>2</sub> (middle layer) and T<sub>3</sub> (bottom layer) with a stocking density of 15 individual cockles in each tray in each water level. After 4 months of culture, results show that T<sub>3</sub> and T<sub>2</sub> gained the highest average shell length of 4.21 cm and T<sub>1</sub> has 4.17 cm. For shell width, T<sub>3</sub> got the highest (3.11 cm) followed by T<sub>2</sub> (3.08 cm) and T<sub>1</sub> (3.05 cm) and for shell weight, T<sub>3</sub> got the highest (16.02 grams) followed by T<sub>2</sub> (15.44 grams) and T<sub>1</sub> (14.72 grams). Survival and mortality results show that T<sub>3</sub> and T<sub>1</sub> have survival rate of 93.33% (14 pcs. of the animal) and T<sub>2</sub> has survival rate of 86.67% (13 pcs.). Results from Analysis of Variance (ANOVA) show that on 5% level of confidence it revealed that there are no significant differences on various treatments and replications based on the shell length, width and weight of the bloody cockles.

**Keywords:** *Anadara antiquata*, Cebu, Complete Randomized Design, off-bottom, San Francisco

BS-7

**Morpho-Histochemical Testing, Antibacterial Study and Propagation of *Equisetum ramossisimum* subsp. *ramossisimum* Hauke (Fern Ally)**

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In the Philippines the natural distribution of *Equisetum ramossisimum* subsp. *ramossisimum* Hauke, a fern ally, is quite limited and reported to occur only in the Mountain Province and Mindoro and in Lantapan, Bukidnon and Calinan, Davao. The plant is reported to have some medicinal uses. This study was conducted to determine the presence of active principles in the aerial stem and rhizome of *E. ramossisimum* subsp. *ramossisimum*; to test the efficacy of the plant extract against bacterial growth; and to propagate the plants outside of their natural habitat. Through histochemical tests, alkaloids, arbutin, fats and oils were found very abundant in both aerial stem and rhizome of *Equisetum ramossisimum* subsp. *ramossisimum*. Saponins, tartaric acid, tannin, and amygdalin were absent in the aerial stem. The epidermis of the rhizome showed abundant amygdalin and saponin. Tartaric acid and tannin were absent in the rhizome. For antimicrobial assay, the aerial crude stem extract of the plant had a high antimicrobial index against *E. coli* of 1.22, while the rhizome crude extract had only 0.83. Spores of *E. ramossisimum* subsp. *ramossisimum* sown in agar culture medium with 2.0 percent glucose germinated and formed gametophytes after three months in culture. Propagating the plants in potting media: P1 (soil from its natural habitat), P2 (garden soil and soil from its natural habitat 1:1), showed 100 percent survival. The results revealed that both the aerial stem and rhizome of *Equisetum ramossisimum* subsp. *ramossisimum* contained active principles which could be potential sources of medicine; the aerial stem's extract had high antimicrobial index against *E. coli* and the plants could be easily propagated outside of their natural habitat as long as there would be enough moisture in the soil.

**Keywords:** antimicrobial assay, culture, histochemical, medium

## BS-8

### A Single Stage Model for Cellulosic Ethanol Production Using Carabao Rumen Microorganisms

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Among various forms of plant matter, cellulosic biomass has the biggest potential to supply the energy needs of the Philippines. However, commercial production of cellulosic ethanol is impeded by the absence of low-cost technologies to overcome the recalcitrance of cellulosic biomass to deconstruction, saccharification and fermentation processes. Consolidated bioprocessing (CBP) is a processing strategy for cellulosic biomass that consolidates into a single process step. The main objective of our study was to develop a single-stage, consolidated bioprocess system for the production of ethanol from biodegradable waste using co-culture of Carabao rumen microorganisms and yeast. Mixed market wastes were used as substrates in the study. The rumen fluid was collected from cannulated carabao (*Bubalus bubalis carabanensis*). Three treatments were studied. In the first experiment: T-1 was a single stage, consolidated bioprocess where both rumen fluid and yeast were inoculated on day 1 of the experiment; T-2 was a two-stage bioprocess where rumen fluid was inoculated on day 1, followed by yeast after 72 hr; and T-3 served as negative control. In the second experiment, T-1 to T-8 under different conditions were carried out to determine the peak period for glucose and ethanol production. Glucose and ethanol were measured at specified time periods using standard procedures. Under non-optimized conditions substrate saccharification and fermentation occurred in as little as 5 days both in the single and two-stage processes. The saccharification efficiency of the single-stage (33.88 %) was higher than the two-stage process (29.94%). Ethanol conversion efficiency in 120 were 41.71%, 34.85%, and 38.06% in single, two-stage process, and control, respectively. These yields are equivalent to 23.89 L of ethanol per ton of waste biomass for the single stage process, and 19.26 L for the double stage and 17.91 L in the control. Peak period for glucose and ethanol production was at day 5 (120 hr). Our study successfully demonstrated that CBP, using

co-cultures of rumen microorganisms and yeast, can produce ethanol from waste biomass.

**Keywords:** biomass, cellulose ethanol, consolidated bioprocess, rumen fluid, saccharification

## BS-9

### Body Shape Variation Among Three Congeneric Species of Pony Fishes (Teleostei:Perciformes:Leignathidae)

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Ponyfishes, locally known in the Philippines as “sapsap”, are bioluminescent, schooling fishes common in the near-shore and estuarine waters of the Indo-West Pacific. These fishes occupy diverse ecological niches and show different feeding habits which could also be reflected in their body shape. Thus, three congeneric species of ponyfishes *Leiognathus equulus* (Forsskal, 1775), *Leiognathus daura* (Cuvier, 1829) and *Leiognathus aureus* (Abe and Haneda, 1972) were investigated to determine the differences, if any, in their body shapes. In this study, the truss network systems comprised of 16 landmarks were used applying the tools of geometric morphometrics. The Cartesian coordinates of 16 landmarks were digitized from scanned images of the fishes (1,200 dpi) (n=100 per species, 50 males and 50 females). Specifically, the method of Relative Warp Analysis (RWA) was used to describe the body shapes of the three congeneric species of ponyfishes collected from Riverside Punta Reef, Kolambugan, Lanao del Norte, Philippines. Landmark analyses were carried out using the Thin-Plate Spline (TPS) series. TPS is used for the analysis of images with landmarks in order to incorporate curving features within the images. This method includes the Procrustes registration, its use to construct average configurations and landmark residuals about the average, the thin-plate spline interpolation, and its uses as a geometry-based metric and to construct average images. Results showed clear-cut differentiation in the body shapes among the female ponyfishes (Wilks' lambda: 0.005, p-



value: 4.616E-24; Pillai trace: 1.848, P-value: 2.892E-24), and among the males (Wilks' Lambda: 0.009, p-value: 1.747E-59; Pillai trace: 1.692, p-value: 1.594E-44). The result of this study validates the use of the truss network system in the discrimination and classification of these species of fishes. Also, the results are discussed in relation to how differences in feeding habits and habitat preferences translate to differences in body shapes of among fishes.

**Keywords:** landmark, pony fishes, relative warp analysis, truss network

## BS-10

### **Stabilimentum Structure of the Orb-web of the Garden Spider, *Argiope luzona*, (Walckenaer, 1841) (Araneae: Araneidae Argiopinae)**

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Spiders in the genus *Argiope* Audouin 1826 (Araneidae) add a highly visible white zigzag silk decoration, originally called stabilimentum at the center of the web whose function and significance are still unclear. This study was conducted to describe the stabilimentum structure of the garden spider *Argiope luzona*, (Walckenaer, 1841). A total of twenty (20) penultimate and adult females were collected from selected agricultural areas in Iligan City. In the laboratory, spiders were housed in wooden frames and occurrence and design of stabilimentum were observed for 15 days. Results show that web decorations are not an obligatory component of the orb-webs since not all spiders add stabilimenta on their webs. There are remarkable variations in stabilimentum structures among *A. luzona* individuals. Penultimate and adult female *A. luzona* produced strictly cruciate stabilimenta which could be 1-armed, 2-armed, 3-armed, or 5-armed. Stabilimenta with 1 arm, 3 arms

and 5 arms were the least frequently observed while 4 arms and 2 arms were the most frequently observed.

**Keywords:** *Argiope luzona* (Walckenaer, 1841), cruciate, penultimate, stabilimentum, web

## BS-11

### **Web Architecture of the Garden Spider, *Argiope aemula*, (Walckenaer, 1841) (Araneae: Araneidae, Argiopinae)**

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This study was conducted to investigate the effect of the presence and absence of potential prey on web decoration frequency, web size, web capture area (portion of the web with sticky or capture spirals) and mesh height (distance between sticky spirals) of the orb webs constructed by *Argiope aemula*. Thirty (30) spiders were given two sequential feeding regimes. For the first three consecutive days, spiders were given one medium size grasshopper (with prey regime) and fasted for five days (no prey regime). For the purpose of comparison, spiders with no prey and with prey feeding regimes are categorized as starved and well-fed, respectively. Our laboratory results show that the presence of prey has a significant influence on stabilimentum (web decoration) building in *A. aemula* spiders. Well-fed spiders included stabilimenta on their webs more often than hungrier spiders which agrees with the predictions of the predator defense hypothesis but does not support those of the prey attraction hypothesis. These spiders can increase or decrease the sizes of web, capture area (portion of the web with sticky or capture spirals), and mesh height (distance between sticky spirals) in response to prey density. Starved spiders constructed significantly larger webs than well-fed spiders. In the absence of potential prey, spiders not only increased the web size but also the capture area. Furthermore, in the absence

of potential prey, spiders significantly constructed very narrow- meshed webs or tightly spaced capture spirals than in the presence of potential prey. The present study may demonstrate that spiders can manipulate their web architecture in response to different prey densities.

**Keywords:** *Argiope aemula* (Walckenaer, 1841), stabilimentum, web size, web capture area, web mesh height.

## **BS-12**

### **Taxonomic Study of Ichthyofauna in Tanduyong Island Anda, Pangasinan**

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This study was conducted to assess the fish fauna in three selected sites of Tanduyong Island in Anda, Pangasinan. It aims to provide baseline information on the commonly caught fish species of the island and generate a taxonomic listing of these species. Physico-chemical parameters such as water temperature, pH and salinity were determined. Fish hook and fish net were used to catch the species. Collection was done using transect-quadrat method in 500 m by 500 m area. A total of 46 fish species belonging to 6 orders, 27 families and 40 genera have been documented. Order Perciformes and Family Carangidae has the most number of representative species having 5 genera and species type followed by Family Scaridae with 4 genera and Family Acanthuridae, Family Labridae, Family Lutjanidae with 3 genera, respectively. The most dominant species is *Stolephorus ronguilloi*, locally known as dilis. The gathered data will provide useful information on the survival of the taxa and promote effective strategies for conservation of fish fauna.

**Keywords:** conservation, ichthyofaunal resources, taxa, taxonomic

## BS-13

### Changing the Ecological Niche of *Coprinus Comatus* from a Weed Fungus to a Nutraceutical and Biocleansing Agent

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*Coprinus comatus* is an edible fungus that normally inhabits cellulosic substrates like rice straw with appreciable amount of nitrogen. This is considered as a weed fungus by the rural-based *Volvariella* growers in the country due to its rapid growth on mushroom beds. This mushroom is producing small fruiting bodies that easily open and become inky within 12 hours. Thus, despite of its edibility, this mushroom is oftentimes ignored in the mushroom industry. Our research team initiated a study to harness the economic potential of this edible mushroom. The growth performance of *Coprinus comatus* on different pulp and paper waste formulation was evaluated. Observations were based on the best substrate having shortest incubation period, initiation of primordia and development of fruiting bodies. The ability of *C. comatus* as biocleaner of Pb –contaminated pulp and paper waste was also highlighted. The chemical components of the different pulp and paper waste were determined before and after cultivation under aseptic condition. Among the six pulp and paper wastes-based formulations, only brown pulp contains Pb with 48 ppm. This Pb -contaminated substrate was used in evaluating the ability of this mushroom to uptake this heavy metal. Our investigation revealed that 16.15 ppm was only detected on the dried fruiting bodies of *C. comatus* after it was grown on Pb – contaminated substrate. The remaining 3 formulations were used as substrates for the production of the fruiting bodies of *C. comatus* in a miniaturized glass container under aseptic condition. Results of the evaluation disclosed that *C. comatus* cultured on fine gray pulp with 50% rice straw and 10% rice bran and coarse pulp with 50% rice straw and 10% rice bran registered the shortest incubation period with the same mean of 11 days. The longest incubation period was recorded in light blue pulp with 50% rice straw and 10% rice bran with a mean of 17 days. Moreover, light blue

pulp with 50% rice straw and 10% rice bran produced the heaviest fruiting bodies with a mean of 8.85 g.

**Keywords:** *C. comatus*, pulp, lead contaminated

## BS-14

### **Monsoonal Winds Influence the Baywide Spatial Extent of Net Phytoplankton Assemblages in Panguil Bay, Northern Mindanao, Philippine**

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Changes in community structure of net phytoplankton in Panguil Bay in Northern Mindanao were investigated in November 2008 and February 2009 (northeast monsoon months), August 2009 (southwest monsoon month), May 2009 (transitional monsoon month). Samples were collected from 21 stations across the bay by vertically towing a 20? m conical plankton net. Phytoplankton abundance was estimated following the Utermohl method. Community structure was analyzed using the PRIMER multivariate analysis software. Distinct outer and inner bay phytoplankton assemblages were defined, and the spatial extent occupied by these assemblages oscillated with monsoonal wind patterns. Northeasterly winds increased by 100% the spatial extent of the outer phytoplankton species rich assemblages inwards up to the middle portion of the bay while the southeasterly winds contracted this assemblage back to its original spatial coverage at the same time expanded by 100% the spatial coverage of phytoplankton abundant inner waters of the bay towards the mouth. These findings have very important implications to the spatial structural patterns of primary productivity, and ultimately the trophic ecology during different monsoonal periods in one of the most important fishery priority bays in the Philippines.

**Keywords:** ecology, monsoons, northern Mindanao, Panguil Bay, phytoplankton

BS-15

## **The Iron-Sulfur Cluster in the Hemoaconitase Protein is a Nanosensor Involved in Lysine Biosynthetic Pathway Regulation**

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The cubane structure of the iron-sulfur cluster present in the hemoaconitase protein of *Penicillium chrysogenum* is important in the catalytic conversion of homocitrate to homoisocitrate. The effect of disruption of the cubane structure on the regulation of the lysine biosynthetic pathway was investigated in this study. A mutant strain of *P. chrysogenum* auxotrophic for lysine was used as a source of the non-functional hemoaconitase gene with a point mutation within the iron-sulfur cluster. Iron loading and chelation experiments were conducted to determine the effect of iron availability on hemoaconitase function in the wild type *P. chrysogenum*. Expression levels of other genes in the pathway, namely, homocitrate synthase and alpha-aminoadipate reductase were monitored in the mutant and wild type strains by standard northern hybridization. Results show that the point mutation (A<sup>1465</sup>/C<sup>1465</sup>) within the iron sulfur cluster of the hemoaconitase gene led to loss of its catalytic activity and to constitutive positive regulation of homocitrate synthase and alpha-aminoadipate reductase. Increase in gene expression is four- to five-fold for homocitrate synthase and seven- to eight-fold for alpha aminoadipate reductase. Iron chelation in the wild type strain also led to loss of catalytic activity of hemoaconitase and acquisition of regulatory functions leading to up-regulation of the two other genes. The cubane structure in the hemoaconitase protein therefore serves as a nanosensor for the availability of iron in the cell, and is most probably subject to global iron metabolism. The observation that iron availability also affects beta-lactam production in *P. chrysogenum* can now be better understood since both lysine and beta-lactam production branch out from the same alpha-aminoadipate pathway. Because the redox level in the cell observably affects the formation of the cubane cluster, an additional nanosensor function of the cluster is possibly that for sensing the

intracellular oxygen levels leading to up- or down-regulation of the entire pathway.

**Keywords:** alpha-aminoadipate reductase, homoaconitase, homocitrate

## **BS-16**

### **Assessment of Carbon Monoxide (CO) and Hydrocarbon (HC) Emissions of Motor Vehicles in Laoag City**

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Republic Act 8749 (The Clean Air Act) provides a comprehensive air pollution control policy requiring compliance of all motor vehicle owners to undergo emission testing for carbon monoxide (CO) and hydrocarbon (HC) before registration. Laoag City has become a center of development leading to the establishment of new commercial and industrial institutions. This has brought about the influx of people and the expansion of transport facilities from all other neighboring municipalities, leading to CO and HC emissions – air pollutants that are detrimental to the health of the people. Levels of CO and HC emissions of motor vehicles derived from the documents (200 emission records) of the Land Transportation Office (LTO) and Emission Testing Centers (ETC) in Laoag City were compared with the acceptable standard values set by the Clean Air Act. Determination of the level of awareness and extent of implementation of the Act by motor vehicle owners and policy enforcers were also considered and evaluated using a structured questionnaire. Results revealed that wagon type vehicles had the highest CO (4.46%; std. 4.5%) and HC (711 ppm; std 800ppm) emissions while motorcycles had the least CO (1.09%; std. 4.5%) and HC (412ppm; std.800ppm) among the various types of vehicles considered in the assessment. All types of vehicles showed an overall emission value of CO (2.37%) and HC (463ppm) which is still low compared to the standard emission values of CO (4.5%) and HC (800ppm). A significant negative correlation ( $r = -0.2999$ ) was obtained between the level of awareness (mean value = 3.54) and extent of implementation (mean value = 2.19) by motor vehicle owners. On the other hand, a positive correlation ( $r = 0.2386$ ) was

noted between the level of awareness (mean value =3.27) and extent of implementation (mean value = 4.16) by policy enforcers of the Act. Based on the above findings, emission testing should not only be conducted before registration or renewal of franchise of vehicles, but awareness and strict implementation of such a provision of the Clean Air Act should be seriously considered and attended to.

**Keywords:** carbon monoxide, clean air act, emission test, hydrocarbon, vehicular emissions

## BS-17

### **Effects of Different Dosages of Astaxanthin on Giant Freshwater Prawn *Macrobrachium rosenbergii* (De Man) Challenged with *Lactococcus garvieae***

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Carotenoids, such as astaxanthin (AX), have received increasing attention in recent years due to their reported various functions not only as a pigment enhancer but also as an antioxidant. As an antioxidant, carotenoids inactivate free radicals produced from normal cellular activity and various stressors. The health of stressed aquatic organisms is linked to the overproduction of reactive oxygen species, which is a precursor to the occurrence of disease. Antioxidants help protect cell membranes against the damage from excessive production of reactive oxygen species. The effects of astaxanthin (AX) injected at 0.67 and 1.34 nmol g<sup>-1</sup> BW<sup>-1</sup> on the survival, antioxidant capacity, total haemocyte count (THC) and hepatopancreas astaxanthin content of the giant freshwater prawn, *Macrobrachium rosenbergii*, challenged with *Lactococcus garvieae* were evaluated. AX-injected *M. rosenbergii* at 1.34 nmol g<sup>-1</sup> BW<sup>-1</sup> had significantly (P < 0.05) higher survival rates. However, AX showed no significant effects on the



capacity of certain antioxidant indicators (superoxide dismutase, glutathione peroxidase and glutathione reductase). This implies that *L. garvieae* infection suppressed the activity of the haemolymph antioxidant system of infected *M. rosenbergii*. This result suggests that the two different dosages used in this study could not exert significant effects on the tested antioxidant capacity of *L. garvieae*-infected *M. rosenbergii*. On the other hand, AX-injected *M. rosenbergii* at either dose showed a significant increase in the THC and hepatopancreas AX content when compared with the challenged control group. Overall, the results of this study indicate that the injected AX led to an improvement in *M. rosenbergii*'s resistance against *L. garvieae* infection.

**Keywords:** glutathione peroxidase, glutathione reductase, , hepatopancreas, *Lactococcus*, *Macrobrachium*, superoxide dismutase, total hemocyte count

## BS-18

### Frogs in Abaca-Dominated Farms of San Miguel, Catanduanes, Luzon

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The significance of frogs as bio-indicators of pollution, their economic importance, as well as their threatening status in the Philippine archipelago motivated the researchers to carry out this study on the diversity of frogs in San Miguel, Catanduanes Island, Luzon. Distribution, relative abundance and assessment of the over-all habitat of the frog species were determined in this investigation. Ten quadrats were made on the 10 square kilometer-study site in San Marcos, San Miguel each representing a particular type of habitat about 400 square meters and with an interval of 500 m from each quadrat. Based on the 8-month survey in 2002 and another 2 months survey last 2005, there were 6 species that were identified and another 2 unidentified collections were noted. These frog species were: *Rana erythrae* (Ranidae), *R. limnocaris* (Ranidae), *Racophorus pardalis* (Racophoridae), *Polypedates leocomystax*, *Occidozyga laevis* and *Kaloula kokacci* (Microhylidae). The other unidentified collections belong to the genera, *Racophorus* and

*Kaloula*. *K. kokacci* is an endemic species of the island while *R. pardalis* was found to be rare. Data show that *R. limnocharis*, *K. kokacci* and *P. leucomystax* were found to be abundant in the study site. *O. laevis* was seen on a specific habitat only in the abaca areas, while *R. pardalis* was hard to find. However, the dominance index value of 1.001 shows that no particular species gained advantage over the others. Moreover, the computed Shannon index value of 0.7026 shows that frog species diversity is high in San Marcos, San Miguel. ANOVA of the frequency distribution of frog species present in the study site during the months of April and December obtained a computed value of 1.61 that is relatively lower than the tabular value of F at  $\alpha=5.05$  level of significance. This indicates that there is no significant difference in the distribution and diversity of frogs during the wet and dry months of the year. Follow-up studies are now underway so that the identity of the 2 frog species will be confirmed as well as the further investigation on the endemic microhylid *K. kokacii* as to its habitat and other ecological characteristics. Of recent, Masagca (2009) noted the decline of this endemic frog and other vanishing species of the Gray's Monitor lizard, *V. olivaceous* in the environs of Solong Falls in the town of San Miguel due to various developmental activities.

**Keywords:** Frogs, diversity, Catanduanes, *Kaloula kokacii*, Solong Falls

## BS-19

### Preference of the Philippine Green Mussel, (*Perna viridis* L.) for Abaca as Substrate for Larval Settlement

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Among the bivalve mollusks, the search for a place to settle involves a set of behaviors loosely referred to as the reproductive behavior. This behavior may also be termed as the reproductive strategy of larvae of bivalves found in the marine environment. In the period of settling, the larva tests the substrate for its physical properties such as texture, color, exposure to light and spatial disposition. Studies indicate that the settling process is related to the nature of the substrate and the hydrological conditions. It is still

unclear whether settling proceeds better in water bodies with low or flowing rates. Compared to the settling of larvae on hard substrates, settling on soft substrates has been little studied so far, thus this study was carried out in the green mussel (“tahong”), *P. viridis* to determine the effects of hydrodynamics (i.e. turbulence) and nature of substrate on its settlement using improvised substrates. Improvised substrates made of nylon, abaca and bamboo were hung in three different placements/levels (upper, middle, bottom) in two outdoor rectangular cemented tanks (one was equipped with a submersible pump to stimulate a recirculating/flowing system while the other was only aerated to stimulate a non-recirculating or still water system). The split-split plot design replicated three times (experimental runs or trials) was used as an experimental design in the study. A total of 200 *P. viridis* larvae were stocked in the tanks during the experimental runs over a 72-hour observation period. Results show that the type of substrate most preferred was abaca ( $p>0.05$ ). The mean value of the larvae that settled in the nylon material was almost the same as the bamboo substrate (6.56), while the abaca material (9.22) was much greater. This result implies that the abaca is the most preferred material for larval settlement compared to nylon and bamboo. There exists an interaction between the hydrodynamics and re-circulating system. In general, water turbulence process could have influenced the larval settlement process in *P. viridis* and can proceed better in flowing water rather than still water bodies under outdoor conditions. The nature of material of the substrates alone had the main effect during the experiment. The larvae significantly preferred abaca substrate compared to the others. Whether the improvised substrates were placed from the upper level or to the bottom level of the tanks, larval settlement was not influenced or affected so far. The study concluded that *P. viridis* larvae preferred the abaca substrate during its settlement under outdoor tank experiments both in recirculating and non-recirculating system.

**Keywords:** Reproductive strategy, larval settlement, green mussel, *Perna viridis*, abaca fiber substrate

**BS-20**

**Geometric Morphometric Analysis of the Head Capsule of the Rice Bug, *Leptocorisa oratorius* Fabricius (Hemiptera: Alydidae)**

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The rice bug *Leptocorisa oratorius* Fabricius is an insect pest of rice that feeds on developing rice grains reducing the yield and quality of rice. Identification of this pest has been vague owing to variability in its external morphological characteristics. It has been referred to as *L. acuta* (Thunb.) and *L. varicornis* in some literature. In this study, the shapes of the head capsule were compared in populations of the rice bug using a landmark-based geometric morphometric method, and analysis of relative warp scores. Samples were collected from three different localities of which 83 were from Alubijid, Misamis Oriental; 19 from Maigo, Lanao del Norte; and 82 from Buug, Zamboanga Sibugay. Of the 184 individuals, 116 were classified as males and 68 were classified as females. Images of the dissected head capsule were acquired with the use of MacronCam and Leica ES2 microscope. Landmark analyses was done on the x- and y- coordinates of the head outline which totalled to 35 landmark points. The results showed variability within and among populations of the rice bugs in the regions at the labrum, vertex, and the outline of the compound eye insertion. This variability may represent unique genotypes and this geographic variation may have an important effect on expanding population sizes in following years which should be considered in control methods.

**Keywords:** canonical variate Analysis, discriminant function analysis, geometric morphometrics, *Leptocorisa oratorius* (Fabricius), relative warps analysis,

## BS-21

### Association of Blood Coagulation and Humoral Biodefense Genes: Evidence From Crustaceans

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Blood coagulation is a conserved defense mechanism among invertebrates and it has been well studied in the horseshoe crab (chelicerate) and the freshwater crayfish (crustacean) but is not well defined in shrimp. Here, we demonstrate *in vivo* the functional involvement of transglutaminase (TGase) and clotting protein (CP) in the shrimp blood coagulation system using RNA interference, and their influence in the mRNA expression of antimicrobial peptides and genes involved in the prophenoloxidase system. Expression of TGase mRNA was inhibited in gills, heart, hemocyte, hepatopancreas, intestine and lymphoid organ, while the CP gene was suppressed only in gills and heart tissues on day-1 post injection, with 1 µg and 10 µg of TGase- and CP-dsRNA, respectively. However, at day-7 post injection, systemic gene silencing was observed for both genes and dosages as shown by mRNA expression, blood coagulation and protein data. A challenge test with white spot virus and *Vibrio penaeicida* revealed the critical function of TGase and CP in the immune system of shrimp. Suppression of antimicrobial peptides and genes involved in the prophenoloxidase system following TGase and CP silencing demonstrates an association between blood coagulation and humoral biodefenses in shrimp. This finding suggests a possible alternative mechanism in the activation of antimicrobial peptides and genes involved in the prophenoloxidase system in chelicerates and crustaceans.

**Keywords:** blood coagulation, clotting protein, crustacea, prophenoloxidase RNA interference, transglutaminase

BS-22

## Grass Pollen-Specific IgE Levels of Selected Allergic Patients in Bayombong, Nueva Vizcaya

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Allergy is a major health problem and its proportion in all populations is steadily increasing. Of the potential allergen sources, pollen grains affect 40% of allergic individuals and significantly, 86.5% of them are specific to grass pollen grains. To investigate the inadequate pollen allergy data in the Philippines, the effects of grass pollen grains on allergic patients were studied. Allergic patients (n=141) having the allergic symptoms associated with asthma, dermatitis, rhinitis, and conjunctivitis and non-allergic subjects (n=141) were recruited in Bayombong, Nueva Vizcaya. The study area has 60% grassland and 17% agricultural land where pollen grains from common grasses such *Cynodon dactylon*, *Axonopus compressus*, *Saccharum spontaneum*, *Sporobolus indicus*, *Chloris barbata*, *Oryza sativa*, *Zea mays*, and *Eleusine indica* were collected. This collection was simultaneously done during blood sampling of the subjects. The total IgE and pollen-specific IgE levels between allergic and non-allergic subjects using the enzyme-linked immunosorbent assay (ELISA) revealed a significant difference ( $P < 0.0001$ ) between the two groups. IgE reactivity (%) of the studied grass pollen allergens were 23.40, 13.48, 57.45, 89.36, 90.78, 100, 98.58, 100, 49.65, and 9.29, respectively. Among the pollen allergens, specific IgE levels of the patients showed a significant correlation ( $P < 0.001$ ). Western blot analysis presented reactive proteins from all the aqueous pollen extracts. Apparently, *S. indicus* and *C. barbata* can now be added to the list of potential grass pollen grains allergen. The profiling of allergic patients and characterization of grass pollen allergens can contribute to the baseline information for allergy researches and can contribute to more accurate and specific diagnostic and therapeutic protocols.

**Keywords:** allergy, grass pollen allergens, total IgE level, pollen-specific IgE level

**BS-23**

**Allergenicity of Parvalbumin and Muscle Protein Extracts  
From *Decapterus macarellus*, *Chanos chanos* and *Oreochromis  
niloticus***

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Fish species such as galunggong (*Decapterus macarellus*, *Dm*), bangus (*Chanos chano*, *Cc*) and tilapia (*Oreochromis niloticus*, *On*) are highly consumed by most Filipinos. Unfortunately, fish consumption is often coupled with allergic reactions, a common immune disorder not properly documented in the Philippines. The specific IgE profiles of 120 Filipino subjects to allergens from the muscle extracts of three fish species and recombinant parvalbumin, a common fish allergen, were investigated in this study through Enzyme-linked Immunosorbent Assay (ELISA) and Western Blot Analysis. An average of ~54 mg total protein was isolated separately using 5 g (wet weight) of muscles from the three fish species. Multiple bands ranging from 10-250 kDa were observed in the muscle extract preparation under a 15% polyacrylamide gel. IgE reactivity of the 60 allergic sera showed that 46.67%, 58.33%, and 20 are sensitized with allergens from *Dm*, *Cc* and *On*, respectively. Of the 28, 35, and 12 positive reactions in *Dm*, *Cc*, and *On*, 16, 14, and 6 respectively, registered high IgE levels equal to or above 100 IU/mL. Recombinant parvalbumin registered positive IgE reactivity in 63.33% of the allergic subjects. A highly significant difference in the mean IgE reactivity was observed between the allergic and non-allergic sera against the allergen from *Dm* ( $p < 0.0001$ ), *Cc* ( $p < 0.0001$ ), *On* ( $p < 0.0001$ ), and Parvalbumin ( $p < 0.0001$ ). Common IgE binding proteins with molecular weights of ~100 kDa were observed in the 3 muscle protein extracts. Results presented in this study have shown that Parvalbumin, a muscle protein present in fish species, is a highly reactive allergen causing sensitization in the majority of allergic Filipino patients tested. These findings provide a basis for novel forms of diagnosis of parvalbumin- and fish-induced allergic reactions.

**Keyword:** bangus, *Decapterus macarellus*, parvalbumin

BS-24

**Toxicity of Sub Acute Lead Chloride to the Sucker Mouth Armored Catfish *Pterygoplichthys pardalis* (Castelnau, 1855): Bioaccumulation, Organ Pathologies and Other Physiological Effects on Vital Organs**

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In this study, we investigated the effects of sub acute lead chloride (70 ppm) exposure on organ integrity, bioaccumulation capacity and physio-pathology in the janitor fish *Pterygoplichthys pardalis*. Histologically, exposed samples exhibited thickened lamellar epithelium and distinct thrombosed telangeictatic secondary lamella. The liver had the least type of lesion such as fatty change and focal necrosis. Massive sloughing of the submucosa and vacoular degeneration and necrosis of secretory cells were seen in the gut. The 7-day-response analysis show that PbCl<sub>2</sub> significantly induced oxidative stress through elevated MDA (mg protein<sup>-1</sup>) in the spleen, liver and gills and a significant elevation of MDA in the spleen at the 7<sup>th</sup> day of exposure. Differential leukocyte counts show immunosuppressive affect of PbCl<sub>2</sub> through significantly reduced % abundance of lymphocytes and increased % monocytes during day 1 and reduced % lymphocyte and increased % thrombocytes on day 7. Pattern of lead accumulation was in the order of gut> liver>gill>muscle of which Pb was significantly accumulated in the gut at highest concentration (46.33mg/L). High accumulation of Pb in the gut often considered as “end accumulator” organ rather than a “primary accumulator” could suggest the potential of *P. pardalis* as a “*partial regulator*” for Pb contamination. Low levels of Pb in the liver, the principal bioaccumulation target and organ for metal detoxification suggest that *P. pardalis* may have some potential regulating mechanism that mediate detoxification, presumably through efficient metallothionein metal-binding capacities which attenuates the general toxic effect of lead despite observed physio-pathologic injury hence, the 0% mortality during the course of exposure. These results serve as support data regarding the characteristic tolerance of this species to polluted waters containing heavy metals. Possible metal regulation capacity has yet to be confirmed through long term, static



exposure studies and investigations on the molecular mechanisms of Pb toxicity in this species.

**Keywords:** bio accumulation, histology, Janitor fish, lead, oxidative stress, *Pterygoplichthys pardalis*

## **BS-25**

### **Assessment of the External and Photic Parts of the Caves in Camotes Island, Central Philippines**

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In line with the Cave Conservation Act of 2001 and with the progress of tourism industry, caves were considered as one of the tourist destinations, hence, the study of the caves of Camotes Islands was conducted in order to find out their physical features as well as their inside and outside floral and faunal components. This study focuses only the photic part of the cave using field study technique and interview guide to gather the data from the inhabitants living near the 7 caves surveyed namely: Timobo Cave, San Francisco, Cebu; Tangub Cave of Poro; Bukilat, Dorenea, Lilang Daku and Suton Caves of Tudela and Guiwanon Cave of Pilar, Cebu. Results showed that caves of Camotes Islands have an area ranging from 1,500 to 15,000 m<sup>2</sup> with water depth inside from 1m to 15 m. where Dorenea and Suton Caves are exempted due to no body of water present inside. Mouth sizes to serve as entrance ranges from 0.13 meter to 14 meters. The largest mouth opening is Tangub Cave of Pagsa, Poro, Cebu which is 15 meters and the narrowest is Dorenea cave of Tudela, Cebu. Stalactite heights range from 4 inches to 7 inches which are found in Timobo Cave and Dorenea Cave. Stalagmite heights range from 5 inches to 7.5 ft. Floral components are species of ferns, moss and water lilies distributed in the caves except in Guiwanon and Suton Caves. Faunal components are usually birds (balinsasayaw and bats found only in Bukilat and Tangub Caves); shrimps, crabs and fishes. Water salinity ranges from 6 ppt to 22 ppt. and pH ranges from 6.79 to 7.48. External features of the caves range from rocky and grassy areas with trees like mango, coconut and gemelina growing together with shrubs and bananas. Economically, the caves of Bukilat, Timobo and Tangub serve as tourist

destination where vendors usually sell products. Ecologically, Tangub and Suton Caves are resting places of bats and birds.

**Keywords:** Assessment, Camotes Islands External, Caves, Photic

## BS-26

### **Developmental Morpho-Anatomy of the Oil Cells of *Moringa oleifera* Lam. and its Implications to the Fruit, Seeds and Embryo**

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*Moringa oleifera* Lam. is a species of interest because of its nutritional, medicinal and energy-producing properties. This study aims to trace the ontogeny of the oil cells found in the seeds of *M. oleifera*, characterize their distribution and frequency in the embryo, and correlate the fruit form, size and age to the presence of oil cells at different developmental stages. Different histological and histochemical techniques were used in the determination of the presence of oil cells. The occurrence of cotyledonary embryos among the different fruit stages was observed. This indicates that the developmental stages of embryos are non-concomitant in relation to fruit age and form. In terms of fruit age and form, oil cells were not observed among young to middle-aged pods but were observed throughout the embryos of green and dry mature pods. In terms of embryo stage, the presence of oil cells was observed among late cotyledonary to mature (flattened anterior and posterior region) embryos. This indicates that as the embryo matures, the parenchyma cells become larger and more capable of storing substances such as oil droplets. Longitudinal- and cross-sections of mature embryos stained with Sudan IV, Sudan Black, and Sudan Red show the accumulation of oil droplets as the embryo reaches maturity. Images obtained from Tabletop Hitachi TM1000 Scanning Electron Microscope (SEM) show parenchyma cells that have accumulated oil droplets. If green and dry mature fruits were observed to have oil droplets, and if the embryo stages observed in these fruits are late cotyledonary and mature, then it can be suggested that the accumulation of oils is highly dependent on the developmental stage of the embryo and not the general morphology of the

Pods. The presence of late cotyledonary embryos in middle-aged fruits, but the absence of oils in this stage of development of the fruit, shows that the accumulation of oil droplets happens in the mature stage of the embryo. This correlation of the presence of oil in the seeds of *M. oleifera* to the embryo stage and fruit age and form provide necessary information to facilitate efficiency and to maximize the yield during the extraction of oils.

**Keywords:** cotyledon, embryo, oil cells, pod

## BS-27

### ***Rhizopus oryzae*, A Potential Microbial Detoxicant of Aflatoxin in Copra Meal**

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Copra meal, a fibrous residue after extraction of coconut oil from copra, is a valuable source of oils and protein in animal feeds, especially dairy feed. A major problem for its full utilization, however, is its high aflatoxin content. Aflatoxins are cancer-producing substances that are a threat to human health, and at the same time impose economic losses to agriculture as a result of domestic and export market rejects and reduced animal productivity. Feeds to dairy cattle are given significant attention because of the potent aflatoxin by-product that finds its way into milk. The potential of *Rhizopus oryzae* NRRL 395 as detoxicant of aflatoxin in copra meal was evaluated. Aflatoxin-contaminated copra meal samples were inoculated with 1, 3 and 5% (v/w) of the *R. oryzae* spore suspension. Sampling was done at 0, 10 and 15 days of treatment to determine the reduction in aflatoxin content. Aflatoxin B<sub>1</sub> reduction of 58.33 and 48.81% at 3% (v/w) spore concentration was obtained after 15 and 10 days of treatment, respectively. Aflatoxin reduction increased with increasing time of treatment. Both length of time and spore concentration were significant factors in aflatoxin detoxification using *R. oryzae*. Toxicity of the water and oil extracts of the detoxified copra meal samples in chicken embryo showed 90% and 85% viability/survival, respectively. Thus, utilization of *R. oryzae* to detoxify aflatoxin in copra meal is a potential alternative to chemical detoxification.

**Keywords:** aflatoxin, chicken embryo assay, copra meal, feeds, *Rhizopus oryzae*

BS-28

**Extracts of *Sargassum oligocystum* (Magnaye) From Cagayan, Philippines Inhibit Growth of Selected Aquaculture Pathogenic Bacteria**

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Among marine organisms, seaweeds are considered a source of bioactive compounds as they are able to produce a great variety of secondary metabolites characterized by a great spectrum of biological activities. The present study was conducted to investigate the antibacterial activity of the different extracts of *Sargassum oligocystum* from Cagayan, Philippines against six aquaculture pathogenic bacteria. In vitro antibacterial assays of *S. oligocystum* (Phaeophyceae) were conducted in this study. Methanol, n-hexane, dichloromethane, ethyl acetate, and aqueous extracts of *S. oligocystum* were screened for its antibacterial activity against six aquaculture pathogenic bacteria (*Vibrio harveyi*, *V. parahaemolyticus*, *V. alginolyticus*, *Flavobacterium aurantiacum*, *Aeromonas hydrophila* and *Pseudomonas aeruginosa*) using the exhaustive sequential extraction method. The methanol extracts of *S. oligocystum* showed the highest antibacterial activity against *V. harveyi*, and *P. aeruginosa* and moderate bioactivity to the rest of test pathogens. The n-hexane and dichloromethane extracts of *S. oligocystum* also showed high bioactivity against *V. harveyi*. Among the test pathogens, *V. harveyi* is the most susceptible bacterial strain. The result of this study shows that the extracts of *S. oligocystum* could be a promising source of antibacterial agents or dietary immunostimulants for aquaculture.

**Keywords:** antibacterial agent, brown algae, fish pathogenic bacteria, *Sargassum oligocystum*, sequential extraction

## **BS-29**

### **Assessment of the Bio-Invasiveness of Mahogany (*Swietenia macrophylla* King) in Mt. Makiling Forest Reserve**

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A study was conducted at the Mt. Makiling Forest Reserve, College of Forestry and Natural Resources, University of the Philippines Los Baños to assess the bio-invasiveness of mahogany. Specifically, to determine the number of regenerants of mahogany and other species inside and around the 1 hectare mahogany plantation (PFLA 3); classify the regeneration of mahogany according to size/dbh; 3) characterize the species composition inside and around PFLA; and 4) compare the relative density, relative dominance, relative frequency and importance value of mahogany and other species inside and around PFLA 3 from edge of the plantation outward. A total of 13 main plots (20m x 20m) were located and established in five sampling locations in the study area, one at the center of PFLA 3 and three each at the four cardinal directions (N, E, W, and S) from the edge of the plantation boundaries. All trees with 10cm DBH inside the main plots were identified and measured. A 5 m x 5 m subplot was established inside each main plot where trees with DBH from 5 – 9.99 cm were inventoried. Lastly, 1 m x 1m subplot 2 was nested inside each subplot wherein trees < 5cm DBH were tallied. Results showed that the number of species in the various sampling locations around PFLA 3 (North – 20, West – 17, South – 15, and East – 10) is at least triple the number inside PFLA 3 (with only 3 species). This indicates that the area north of PFLA 3 is the most diverse in terms of species composition. The higher basal area of mahogany at the west direction could be due to the bigger sizes of mahogany trees found along the road where the three plots at 50 m interval were established. The number of saplings (5 – 9.99 cm DBH) per hectare recorded also varies with sampling locations. Mahogany saplings were found in plots located south, east and west of the PFLA 3 but no saplings were recorded in the plots inside and north of PFLA 3. The saplings of mahogany found in the three directions (south, east and west) can be progenies of the older mahogany trees found in these

areas. The absence of saplings inside PFLA 3 could be due to limited light reaching the forest floor. It was observed that the canopy of the plantation was very dense. Fallen mahogany seeds might be able to germinate in the forest floor but because of unfavorable light condition inside PFLA 3, the germinants died with time. The lack of mahogany saplings inside PFLA 3 could also be due to the thick litter produced when the trees shed their leaves. Regenerants of mahogany inside PFLA 3 at the time of the survey was high (70,000 ha<sup>-1</sup>). However, the survival of these regenerants through time is interesting to monitor because during the survey, no saplings (5-9.99 cm DBH) were recorded inside the plots.

**Keywords :** bio-invasive, mahogany, progenies, regenerants, saplings

## **BS-30**

### **Biodiversity of Edible and Other Non-Edible Fungi in Selected Mountain Ecosystems in Laguna, Philippines**

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Biodiversity assessment of edible and other fungi was conducted in 3 ecosystems from Mt. Banahaw de Majayjay, Sierra Madre and Mt. Makiling during the wet and dry periods. The objective of the study is to investigate fungal diversity in different mountains and determine their benefits to local communities, following quadrat sampling and key informant approach. A 2-4 km transect was stretched per ecosystem and 10x10 m sampling plots were established to determine existing plants. Three sub-quadrants (3x3m) inside each sampling plot were used to characterize fungal flora morphologically and quantify their ecological parameters (soil analysis, density, frequency, diversity, and evenness values). Plant density in Mt. Banahaw was higher than Mt. Makiling and Sierra Madre. All forest ecosystems were multi-layered, producing greater amount of woody substrate for fungi, with optimal soil pH. There were 87 fungal species belonging to 44 genera under 20 families and 7 orders mostly growing on woody substrate. Fungal diversity was highest in Mt. Banahaw and Sierra Madre during summer and in Mt Makiling during the wet period. Overall, fungal richness indicates

some level of ecosystem stability where most locals depend on 20 edible fungal species as source of alternative food during rainy season.

**Keywords:** Biodiversity assessment, ecological parameters, edible and non-edible fungi, fungal diversity

## BS-31

### **Diversity and Climbing Behavior of Forest Vines in Permanent Field Laboratory Areas in Mt. Makiling Forest Reserve**

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Vine flora is considered as one of the dark areas in taxonomy due to limited studies and researches conducted on this plant group. The Makiling Forest Reserve has exceptionally rich floral diversity. However, its vine components have long been neglected. It is therefore important to gather primary data/information on the diversity of vines including the factors affecting climbing behavior. The study was conducted in three Permanent Field Laboratory Areas (PFLA) in Makiling Forest Reserve. A total of 1,053 individuals belonging to 23 families, 27 genera and 44 species of vines were recorded for the 3 sites. PFLA 3 has the highest diversity with 39 different species. Diversity of vine is observed to be affected by forest gaps, source and amount of light, host plants and environmental condition in the area. Forty species were observed to exhibit clockwise behavior, three species cling both clockwise and counter-clockwise while *Synthaea sp.* is the only species that twines in counter-clockwise behavior only. There is no strong evidence yet of the specific factor affecting vine climbing behavior. However, results of the study suggest that it is most probably genetically influenced therefore species-related. It is strongly recommended to have more duplication of the study in other sites for better comparison and more conclusive findings. Nevertheless, the study will serve as important baseline information considering the paucity of information on the vine flora.

**Keywords:** climbing behavior, clockwise and counter clockwise behavior, forest vines, vines diversity

BS-32

## Stomatal Response of *Mangifera indica* (Mango) Leaves to Vehicular Smoke Emissions (VSE)

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Trees are good indicators of a community's ecological health. One of which is *Mangifera indica* or mango considered with great medicinal and economic values. They are dominant trees continuously exposed to vehicular smoke emissions (VSE) coming from various types of motor vehicles in Batac ( $S_1$ ), San Nicolas ( $S_2$ ) and Nangalisan ( $S_3$ ), Ilocos Norte main road. Studies showed that plant sensitivity to any gas emissions is associated with stomatal opening and stomatal measurement. Two varieties of mango leaves: native (n) and hawaiian (h) were collected and examined from three experimental stations ( $S_1$ ,  $S_2$  and  $S_3$ ) constantly exposed to VSE and control leaves from Capacuan ( $S_4$ ) Batac, Ilocos Norte far from exposure to VSE. Histological preparations and microscopy were performed to evaluate stomatal number per microscopic field and its size (length, width and aperture) within the lower epidermis. Data measurements used Analysis of Variance. Vehicular smoke emissions significantly affected the stomatal number (n: $F_{.01}=16.74$ ; h: $F_{.01}=6.73$ ), width of guard cells (n: $F_{.05}=1.53$ ; h: $F_{.05}=4.18$ ), and stomatal aperture (n: $F_{.01}=19.18$ ; h: $F_{.01}=19.18$ ) of *Mangifera indica* leaves (n and h varieties) collected from  $S_1$ ,  $S_2$  and  $S_3$  while the length of stomates was not affected. Leaf samples from  $S_3$  had significantly the least number of stomates (n: 34.60; h:35.85) and smallest stomatal aperture, (n:.006 $\mu$ m;h:.006 $\mu$ m) compared to  $S_4$  (control) with greater number of stomates (n:40.73;h:49.40) and larger stomatal aperture (n: .001 $\mu$ m; h: .001 $\mu$ m). The increasing number of motor vehicles may pose a threat to the environment making the local community at risk from VSE. But with such stomatal responses, experimental *Mangifera indica* varieties are still capable of sustaining their own growth and physiological activities as reflected by their structure and leaf morphology as compared to those from Capacuan..

**Keywords:** Guard Cells, *Mangifera indica*, Stomata, Stomatal Aperture, Vehicular Smoke Emission (VSE)



BS-33

## Ectomycorrhizal Fungi Improved Growth and Biomass Yield of *Eucalyptus pellies* F. Meull. Seedlings

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Due to the demand of high quality timber and other wood products for industrial applications, *Eucalyptus* is the most widely planted hardwood tree with plantations established in 90 countries. Eucalypts are well known for their fast growth, straight bole, valuable wood properties and wide adaptability to soils and climates. *Eucalyptus pellita* F. Muell. is naturally occurring in Papua New Guinea, Irian Jaya and north Queensland and New South Wales, Australia. Successful introduction of exotic tree species in a new environment is achieved through inoculation with symbiotic microorganisms, particularly mycorrhizal fungi. Thus, this study was conducted to determine potential ectomycorrhizal (ECM) fungi that can promote the growth of *E. pellita* seedlings. Seven ECM fungi were tested: *Amanita pantherina*, *Ramaria botrytis*, *Tricholoma portentosum*, *Leccinum* sp. and three (PtKa, PtKACC and PtN) isolates of *Pisolithus tinctorius*. Aseptically germinated seedlings were inoculated with mycelia of ECM fungi, grown in peat perlite vermiculite medium and incubated under glasshouse conditions for three months. All the ECM studied colonized the roots of *E. pellita* seedlings. Root colonization ranged from 33 to 60%. *Pisolithus* PtKACC and PtN gave the highest root colonization and the lowest was by *Tricholoma*. Only *Amanita* and *Tricholoma* promoted ( $p < 0.01$ , 17-19%) plant height and only *Ramaria* promoted (11%) stem diameter. On the other hand, all the ECM fungi promoted ( $p < 0.001$ ) total plant dry weight ranging from 27 to 41% relative to the control (2.42 g plant<sup>-1</sup>). *Pisolithus* KACC and *Ramaria* promoted the highest biomass yield (40 and 41%) and the lowest was from inoculation with *Pisolithus* PtKa and *Amanita* (27 and 21%, respectively). Total plant dry weight was strongly correlated with percent mycorrhizal root tip colonization with  $r^2$  of 0.89. The results show that ECM inoculation promoted growth and biomass yield

of *E. pellita* seedlings and that the effectiveness of the seven ECM fungi differed.

**Keywords:** Ectomycorrhizal fungi, *Leccinum*, *Pisolithus*, *Amanita*, *Tricholoma*, *Ramaria*

**BS-34**

### **Growth Response of Six Transgenic Clones of *Populus alba* X *P. glandulosa* to Ectomycorrhizal Fungi During Acclimatization Period**

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*Populus* (poplars) hybrid lines have been reported to be more tolerant to heavy metals and grew faster than the wild type. Moreover, transgenic clones of hybrid *Populus alba* x *P. glandulosa* have been developed carrying genes expressing tolerance to cadmium, lead, zinc and arsenic. Ectomycorrhizal (ECM) fungi improved growth and survival of plants particularly in stressed environment. Combining the most promising transgenic clones with the best suited ECM fungi offers a successful rehabilitation strategy. Thus, this study aimed to screen responsiveness of six transgenic to ECM inoculation as a pre-requisite for the mass production of planting materials for phytoremediation purposes. One month old tissue-cultured transgenic clones (ABC16BGoR10, PABC2 1, PABC25, Cd26c11, cd26c2 and NYCf7) were either uninoculated or inoculated with mycelia of ECM fungi *Paxillus involutus*, *Amanita pantherina* or *Pisolithus tinctorius*. After four months in a glasshouse, Cd26c11 and cd26c2 outgrew the other clones and had the highest nutrient uptake. ABC16BGoR10 had the lowest height, diameter, shoot, root, dry weight and nutrient uptake. The effect of ECM on plant growth was clearly seen one month after inoculation. NYCf7 was the most responsive clone to ECM inoculation, while no response was observed in cd26c11 and PABC21. Irrespective of clones, *Pisolithus* was

the best ECM in promoting plant growth and biomass yield, but this was not statistically significant as compared with *Amanita* and *Paxillus*. In conclusion, *Pisolithus* was the best for ABC16BGoR10 and PABC25, *Paxillus* and *Amanita* for NYCf7 and the three ECM fungi promoted similar biomass of Cd26c2. Control plants had shorter height and smaller stem diameter, lower biomass yield and nutrient uptake than the mycorrhizal plants. Final screening should be done under field conditions, particularly in heavy metals sites, before embarking on large scale production of clones.

**Keywords:** *Amanita*, genetic engineering, *Paxillus*, *Pisolithus*, *Populus alba*

## BS-35

### Lead Bioaccumulation and its Histological Effects on the Gills of “Get Excel” Tilapia Fingerlings

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The bioaccumulation of lead and its histological effects on the gills of GET EXCEL Tilapia fingerlings were evaluated in *in vitro* assays. A preliminary study was conducted to determine the median lethal concentration (96-hr LC50) of lead to the fingerlings. The bioaccumulation of lead was determined by the Atomic Absorption Spectrophotometric Analysis of the lead content of the gills exposed to the lethal concentration (96-hr LC50 = 28 ppm) and to two sublethal concentrations ( $\frac{1}{2}$  96-hr LC50 = 14 ppm,  $\frac{1}{4}$  96-hr LC50 = 7 ppm) of lead nitrate. Histological effects of lead in the gills of the fingerlings were determined by light microscopic examination of the lead-exposed gills. Results of the exposure study show that fingerlings exposed for one month to the 14 ppm significantly had higher lead content (mean = 56.54 ppm) in their gills than those exposed to the 7 ppm (mean = 46.78 ppm) of lead nitrate. High accumulation of lead also occurred in those exposed for four days to 28 ppm (mean = 47.96 ppm). Histopathologic changes detected in the gills examined include (a) epithelial hyperplasia of undifferentiated cells basally located in the primary lamellae, leading to obliteration of the space between adjacent lamellae and fusion of the latter; (b) club-shaped deformation of the tips of the secondary lamellae

through hyperplasia of unspecialized lamellar cells; (c) detachment of the lamellar epithelium or epithelial lifting; and (d) lamellar telangiectasis or aneurism leading to swollen, rounded, secondary lamellae composed of disorganized mass of pillar cells and blood cells. All the changes were observed in all the gills exposed to lead except telangiectasis which was observed only in the gills exposed to the lethal concentration of 28ppm. Based on these findings, it is concluded that bioaccumulation of lead in GET EXCEL Tilapia fingerlings is affected by length of exposure and concentration of lead. The longer the exposure of the fish to the same concentration of lead, the greater is the accumulation. Similarly, exposure of the fish to higher concentration of lead for the same period of time leads to greater lead accumulation. Histological lesions caused by lead toxicity shows greater severity with higher concentration. Moreover, in this study, both types of structural changes: one in response to the direct toxic effect of lead leading to degeneration and necrosis; and the other, in compensatory response to deal with lead toxicity, are both operational. It is observed that the gills of GET EXCEL TILAPIA size 14 fingerlings are good accumulators of lead and are good bioindicators of chronic as well as acute lead toxicity. Branchial epithelium changes that occur after exposure are good biomarkers to be used in monitoring lead pollution in fresh waters.

**Keywords:** fish gills, Get Excel Tilapia, histology, lead pollution, monitoring

## BS-36

### **Bacterial Isolates From the Gut of the Larvae of Asian Corn Borer (*Ostrinia furnicalis*) Attacking Sweet Sorghum**

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Sweet sorghum (*Sorghum bicolor*) Moench is a very unique plant producing both grains and juicy stalks. It is a crop that is drawing the attention of researchers for its potential as feedstock for bioethanol production. It is however attacked by insect pests like the Asian corn borer (*Ostrinia furnicalis*), which devours both the leaves and the stalks. Some of the larvae die even prior to pupation which may be due to the bacteria in their gut. This study focused on isolating and characterizing the bacterial flora

from the gut of the larvae of the Asian corn borer (*Ostrinia furnicalis*). Collected larvae from both the leaves and the stalks were soaked in 70% alcohol for one minute prior to dissection. Inocula from the gut were aseptically obtained and cultured overnight in Nutrient Broth. Pure cultures were isolated and characterized morphologically and biochemically. Results show that the isolates are all Gram positive bacteriococci. They are negative for amylase and lipase tests but are positive for both the protease and hemolysin tests. The isolates produce protease and hemolysin as virulence factors which could be the reason for the death of larvae before reaching the pupa stage. These isolates could have the potential as biocontrol agents for pests like the Asian corn borer attacking sweet sorghum.

**Keywords:** bacterial isolates, Gram positive bacteria, gut isolates, hemolysin, insect-borer pest, sweet sorghum, protease

## **BS-37**

### **Site Quality and Yield Model for Mangium (*Acacia mangium* Willd.) in Claveria, Misamis Oriental, Philippines**

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Mangium (*Acacia mangium* Willd.) is an important tree plantation species and commodity for the wood industry in the region and the country. Sound and effective management of a plantation for wood production necessitates information on growth and yield. The study was designed to develop a reliable yield prediction equation and yield table according to various site qualities, ages and spacing for mangium plantation. Fifty temporary sample plots were established in Claveria, Misamis Oriental, with a total of 5,750 trees measured. The study had generated two equations: 1) site index guide equation ( $\log H = 0.6603 + 0.8955 \log A$ ); and, 2) yield regression equation ( $Y = 8.122(A) + 65.284(\log SI) + 1.14(SP) - 118.493$ ). The site index guide equation can be employed to assess the quality of the site for the establishment of a mangium plantation. Tree farmers and industrial tree plantation managers could make use of yield tables in determining the volume of wood that can be harvested, economic rotation, cut schedule, forest development schedule and business projection. The equations have

been developed for plantations located in Claveria, Misamis Oriental, particularly those with ages ranging from 3 to 17 years old, site index ranges from 12 to 27 meters, and spacing of 2m x 2m, 1m x 4m, 2m x 3m, 1m x 6m, 2m x 4m, 3m x 3m, 3m x 4m, 2m x 6m and 1m x 8m. The equations were applicable outside the study area but careful validation should be done to ensure effective establishment and management of mangium tree plantation.

**Keywords:** mangium, site index, yield, modelling

## BS-38

### **Cytogenetics of Four Philippine Endemic Hoyas: *Hoya crassicaulis*, *Hoya merrillii*, *Hoya mcgregorii* and *Hoya pubicalyx***

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Hoyas, most commonly known as wax plants, are one of the most outstanding endemic ornamental plant of our country. To date, 68 Philippine hoya species have been identified and yet many are still unknown and waiting to be discovered. The origin, anatomy and cultural management of hoya have been well studied but so far no investigation in terms of cytological behavior has been done; hence this pioneering work was conducted. Four Philippine endemic hoyas namely *Hoya crassicaulis*, *Hoya merrillii*, *Hoya mcgregorii* and *Hoya pubicalyx* were characterized in terms of their chromosome number, morphology and behavior during mitosis and meiosis. Meristematic cells were observed from the root tips of each species. All species exhibited normal mitotic activity, however, a very low mitotic index ranging from 3.85% to 10.00% was noted. Karyotypes of the four endemic species revealed a consistent diploid chromosome number of  $2n = 22$ . Based on the position of the centromere, two types of chromosomes were observed. Majority of the chromosomes are metacentric except for *Hoya merrillii* where submetacentric chromosome predominates. Meiosis in the four endemic hoyas is normal and 11 chromosome pairs were observed at diakinesis. Benchmark information gathered will serve as an aid in the

establishment of a complete taxonomic and phylogenetic relationship among the different members of our Philippine hoyas.

**Keywords:** chromosomes, cytogenetics, hoyas, karyotypes, meristematic cells, phylogenetic relationship, taxonomic

## BS-39

### **Length-Weight and Gonado-Morphometric Characterization of the Janitor Fish *Pterygoplichthys disjunctivus* (Weber, 1991) From Marikina River, Philippines**

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The present study assessed the length-weight distributions and gonado-morphometric indices in the non-native suckermouth sailfin catfish *Pterygoplichthys disjunctivus* (Weber, 1991), locally known as Janitor fish from Marikina River, Philippines where it is largely dominating the ichthyofauna. Results reveal that the sampled population was slightly male-biased (54%) and that in large sizes (41-45 cm, 46-50, >50 cm), male *P. disjunctivus* were more abundant than females. Females were capable of spawning at relatively smaller sizes with the minimum length of maturity at 26 cm, and the maximum length to be spawning-capable at 32 cm which is consistent with other loricariids. Ovaries are cystovarian and are strongly asymmetric, with the left ovary slightly larger than the right in mature samples. Visual-based macro scale classification of the ovaries is consistent with the validations by microscopic observations where the maximum oocyte diameter observed was 3.8 cm, and that the ovary has three modal diameters suggesting a modified group-synchronous mode of ovarian development. Size and morphology of oocytes are related to the parental care by males in this species and the reproductive and fertilization success as eggs are released during spawning. Histological characterization of the ovary and the testes is the first for this species; hence, further studies are necessary to fill in the gaps and dynamics of oogenesis and spermatogenesis to further understand the reproductive biology of this group, its possible reproductive plasticity and biological control. Results of this study also serve as a vital baseline reference of the status of length-weight distributions and

reproduction of the largely invasive janitor fish in the Marikina River before the recent devastation of typhoon Ondoy in 2009, which not only gravely affected the Marikina River system, but might have consequently displaced and promoted the spread of these fishes in other water systems.

**Keywords:** gametogenesis, janitor fish, Loricariidae, *Pterygoplichthys disjunctivus*

**BS-40**

## **Some Butterflies of Bulacan**

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There is inadequate knowledge on the butterfly fauna composition in a particular place and time, including those in the Philippines. Most of the time, conservationists and interested individuals are not aware of the species present in a given locality, including their abundance or scarcity. Faunistic surveys of butterflies even for limited geographical areas and time are still useful and important, especially in these times of diminishing biodiversity. We studied the butterflies of Bulacan from 1990 to date particularly in Pulilan, San Ildefonso, Malolos, San Miguel and Angat. We did informal inventory every time we have official travels in the said areas. Our aim was to document the butterfly fauna of Bulacan and contribute to the biodiversity inventory in the various localities. We recorded the species that we observed based on their flight pattern and morphological appearance. In other cases, we use sweep net to examine closely the butterfly and release them later. A total of 45 species from 7 families were observed. The order of decreasing density of the seven families of butterflies that were observed was: Nymphalidae (10) > Papilionidae (9) > Pieridae (8) > Danaidae (6) > Satyridae (5) = Hesperiiidae (5) > Lycaenidae. The Angat observation site was the most diverse due to the presence of forest cover near the sampling site where various host plants for oviposition and larval food are available. More species are expected to be recorded in future visits to the said areas including new sites that we haven't visited yet. We will also work closely with students and researchers who are interested on butterflies.

**Keywords:** Biodiversity, Bulacan, Butterflies, inventory, surveys



**BS-41**

**Growth Performance of Philippine Wild Edible Mushroom,  
*Lentinus sajor-caju*, on Sweet Sorghum-Based Substrate**

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*Lentinus sajor-caju* is one of the wild edible mushrooms in the Philippines with nutraceutical properties. This wood rotting mushroom is popularly known by the Ilocanos as *kulat-kulat* due to its leathery-textured fruiting bodies. Our initial investigation on its nutraceutical properties confirms its place in the list of Philippine wild nutraceutical mushrooms (*Lentinus tigrinus*, *Volvariella volvacea*, *Schizophyllum commune*, *Collybia reinakeana*, *Auricularia polytricha*, *Coprinus comatus* and *Ganoderma lucidum*) that the Center for Tropical Mushroom Research and Development had established. With its potential contribution to the Philippine mushroom industry, the biophysiology of *L. sajor-caju* was elucidated. Our investigation was focused on the growth performance of *L. sajor-caju* on sweet sorghum-based formulation as substrate. Following the standard protocol on mushroom culture, the best indigenous culture media, mother spawn and best ratio of sweet sorghum-based bagasse and leaves as substrates for fruiting were investigated. *L. sajor-caju* was evaluated on ten culture media made from sweet sorghum decoction and extract formulation. *L. sajor-caju* cultured on 100% sweet sorghum extract media had shortest incubation period of 5 days and produced very thick mycelial growth. For mother spawn production, sweet sorghum grains and ordinary sorghum were evaluated. Luxuriant mycelial growth was observed in sweet sorghum grains having the shortest period of incubation of 6 days. Mycelial growth and fruiting performance on sweet sorghum bagasse and leaves formulation were also evaluated. The ratio of 10 parts sweet sorghum bagasse recorded the shortest incubation period characterized by very thick and cottony mycelial growth, while 4 parts sweet sorghum bagasse + 6 parts sorghum leaves registered the longest incubation period of 32 days with thin mycelial growth. Meanwhile, combination of 2 parts sweet sorghum bagasse + 8 parts sorghum leaves produced the biggest average size of fruiting bodies of 486.78 mm, while 3 parts sweet sorghum bagasse + 7 parts sorghum leaves

formulation produced the heaviest weight (34.55g) and highest biological efficiency (4.94%).

**Keywords:** *Lentinus sajor-caju*, mushroom nutraceutical, Philippine wild edible mushroom

**BS-42**

**The Effect of BT Corn Pollen on Non Target Organism,  
*Hypolimnas bolina* Philippensis Butler  
(Lepidoptera: Nymphalidae)**

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The sustained use of transgenic crops depends on various factors and foremost of these is the effect on non target organisms. This study was conducted to determine if ingestion of Bt corn pollen is a hazard to *Hypolimnas bolina* (Linnaeus) larvae since the insect is most likely exposed to Bt corn pollen in the field. Three days old larvae of *H. bolina* were individually exposed on leaf of *I. triloba* Linnaeus dusted with Bt corn (MON 810) pollen. Controls were individually exposed to *I. triloba* dusted with sweet corn (SG-75) pollen. Fifty larvae each were used in treated and control experiments. Five trials or 250 larvae were utilized on each corn variety. A total of 28 larvae died on the Bt corn while 25 perished in sweet corn, respectively. The larval mean percent mortality and weight of the treated and control trials were statistically compared using t-test. The difference in mortality of the treated and control means were not significant ( $P=0.534$ ). The difference in weight between the treated and control groups of larvae were also not significant ( $P=0.260$ ). The result showed that Bt corn pollen is not a hazard (toxic) to the non target *Hypolimnas bolina* Linnaeus.

**Keywords:** Bt corn, non target organism, pollen, t-test

BS-43

## Identification of Two Novel Growth Hormone MRNAs Expressed Mainly in Mouse Immune Tissues

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The growth hormone (GH) is a well-known pituitary hormone that is responsible for postnatal growth in vertebrates. However, the specific localization of GH mRNA throughout the mouse immune system remains unknown. In the laboratory of Cell Signaling, a novel GH variant, referred to as GH-type 2 mRNA, expressed specifically in mouse immune tissues, in addition to the well-known GH mRNA, was found. Interestingly, preliminary experiments suggest that GH-type 2 mRNA is detected in mice but not rats. Thus, this research study aims to determine the expression of novel growth hormone mRNA variants in mouse immune tissues and identify the cell types that express such mRNA variants. Through RNA extraction and reverse transcription-PCR, it was found that mouse immune tissues express two novel GH mRNA variants, referred to as GH-type 2 and GH-type 3. By using the pituitary gland and spleen as samples, DNA sequencing revealed that these novel GH mRNA variants use alternative promoters. The GH-type 2 encodes the same mature GH as that of the well-known GH mRNA expressed in pituitary somatotrophs. On the other hand, the GH-type 3 mRNA encodes a truncated growth hormone whose alternative exon 1 could probably include intron 1 with a still undetermined exact promoter region. Construction of the gene structure revealed that GH-type 2 and GH-type 3 have an open reading frame of 705 base pairs and 624 base pairs, respectively. This is the first finding that mammalian GH gene expresses mRNA variants by using alternative promoters. Through Alkaline Phosphatase staining technique in immunohistochemistry, the marginal zone and red pulp of the spleen revealed positive signals for immunoreactive-GH. Furthermore, *in situ* hybridization revealed that GH-type 2 mRNA variant is indeed expressed in the marginal zone and red pulp of the spleen. The marginal zone is comprised of lymphocytes, plasma cells and platelets, while the red pulp is made up of platelets and reticular cells which may actually represent macrophages that have engulfed erythrocytes, platelets and a few

plasma cells. These findings should provide additional support for the involvement of growth hormone in immunomodulation. In future studies, it is suggested that the regulatory mechanism of expression and physiological role of the GH-type 2 and GH-type 3 mRNA variants be identified to provide more concrete support for the role of growth hormone in immunomodulation.

**Keywords:** alternative promoters, growth hormone (GH), GH-type 2, GH-type 3, immunohistochemistry, in situ hybridization

## BS-44

### **Characterization of the Promoter Regions of a Ripening-Specific Mads-Box Gene Isolated from Philippine Banana Cultivars**

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The MADS-box genes are transcription factors that are directly involved in flower, seed and fruit development. Some MADS-box genes act upstream of the ethylene biosynthetic pathway, and significantly regulate climacteric fruit ripening. This study reports on the isolation and characterization of putative promoter region of the gene for a MADS-box transcription factor, *MaMADS2*, which has been previously shown to regulate banana fruit ripening. The study of the promoter region is important in understanding gene expression regulation, and the development of better molecular ripening control strategies. *MaMADS2* was amplified, isolated and sequenced from ripe fruit cDNA of the local banana cultivars Cavendish, Lakatan, Saba and Señorita. A reverse primer from a portion of the K-region of the *MaMADS2* gene was designed and used for the preliminary isolation of the DNA region upstream of *MaMADS2*. Promoter sequences were submitted to PLACE (A Database of Plant *cis*-Acting Elements) for scanning and identification of known regulatory elements as well as their types and positions in the DNA. These promoter sequences were also aligned to establish similarity in motifs and sites of the regulatory elements. The promoters from the different cultivars contained diverse functional elements. Cavendish, Lakatan and Señorita have very similar *cis*-elements which

clustered on similar sites in the DNA. However, the type and positioning of the elements in Saba were different. Known binding sites for MADS-box genes were present, hinting at possible autoregulation of *MaMADS2* gene expression. A putative promoter map for Cavendish was constructed based on preliminary data. Further purification, characterization and comparison with other promoters are deemed necessary in understanding the regulatory roles of these promoters.

**Keywords:** banana, *cis*-elements, Lakatan, MADS-box, promoter, ripening, Saba, Señorita

## BS-45

### Molecular Cloning, Characterization and Phylogenetic Analysis of Abaca Resistance Gene Analog

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Our research group has developed abaca breeding lines that are resistant to the most dreaded viral disease (ABTV -- Abaca Bunchy Top Virus) that wiped out a total of 12,000 hectares of abaca plantation and severely damaged the abaca industry in the country in the previous years. Currently, we are elucidating the possible mechanism of resistance exhibited by our resistant clones. One of the established defense mechanisms of plants against invading pathogens is through the action of specific resistance genes and resistance gene analogs (RGAs). In this study, the RGA of BC2 abaca clone that is resistant to ABTV was cloned, verified, sequenced and characterized. Using degenerate primers, the resulting PCR product was cloned and isolated. Restriction digestion of the purified recombinant plasmid using *EcoRI* revealed a distinct band corresponding to 868 bases. Sequence analysis revealed a 666-base perfect alignment RGA insert. Using Blastn search (NCBI) and NJ TREE Pairwise Alignment, significant alignments with nbs disease resistance gene of different *Musa* species were

observed. Further analysis using Blastx revealed high homology with the nucleotide binding site - leucine rich repeats (NBS-LRR) disease resistance protein of *Musa balbisiana* (97%), *Musa acuminata* (93%), Musa ABB group (92%) and Musa AAB group (92%). Motif analysis (Prosite) of the 218 amino acid sequence revealed four main motifs -- ATP/GTP-binding site or P-loop (for amino acid – phosphate interaction) N-myristoylation site (for acetylation of proteins), casein kinase II phosphorylation site (for signal transduction), and N-glycosylation site. One initial exon with 290 bases open reading frame (ORF) was predicted (Genescan). The identification, cloning and characterization of abaca RGA could provide insight into the molecular defense mechanism of resistant abaca lines to this devastating Abaca Bunchy Top Virus.

**Keywords:** Abaca Bunchy Top Virus, cloning, fiber crop, resistance gene analog, plant disease resistance genes

**CHEMICAL, MATHEMATICAL  
AND  
PHYSICAL SCIENCES**

## CMPS-1

### **Quantitative Determination of d-methamphetamine in Urine Using an Enantioselective Quartz Crystal Microbalance Sensor**

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A quartz crystal microbalance (QCM) sensor based on molecularly imprinted polymer (MIP) was developed for a quantitative determination of an illicit drug d-methamphetamine (d-MA) also known as “shabu”. The enantioselective MIP for d-MA was synthesized through bulk polymerization of the functional monomer methacrylic acid, d-methamphetamine as template and ethyleneglycol dimethacrylate as crosslinker, 2,2'-azobis(isobutironitrile) as the initiator and chloroform as solvent. Subsequent removal of the template from the powdered MIP by extraction with methanol-acetic acid followed. The resultant MIP suspension in THF was then coated on the gold electrode of an AT-cut quartz crystal. A non-imprinted polymer coated reference sensor was also prepared. Various parameters like curing time, volume of polymer coating, and buffer type were investigated to optimize the sensor response. The QCM-MIP gave stable sensor response to standard d-MA solutions (response time = ca.100 seconds). It exhibited good repeatability (rsd = 0.03% to 3.09%; n = 3), good reproducibility (rsd = 3.55%; n = 5), detection limit of 1.19 pg/mL and a linear range of  $1 \times 10^{-5}$  to 1.0  $\mu\text{g/mL}$  ( $r=0.9997$ ). The sensor response is highly enantioselective to d-MA compared to its response to l-MA, racemic MA and phentermine. The sensor performance was validated by application to human urine samples. Through standard addition method good recovery was achieved in the samples spiked with d-MA standard solution (%Recovery = 95.3% to 110.9%). The developed sensor is a potential alternative low cost and simple method for the quantitation of d-methamphetamine in urine.

**Keywords:** enantioselective sensor, molecularly imprinted polymer, methamphetamine, piezoelectric quartz crystal



## CMPS-2

### **Fabrication and Characterization of Layer-by-Layer Films of Poly(3,4-Ethylenedioxythiophene) – Poly(Styrenesulfonate)/ Poly(Diallyldimethylammonium) Chloride as an Organic Light Emitting Diode**

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The layer-by-layer assembly method involves alternate exposure of a charged substrate to solutions of positively and negatively charged materials, leading to build-up of films with thicknesses in the nanometer scale. The objective of the study is to fabricate poly(3,4-ethylenedioxythiophene)–poly(styrenesulfonate)/poly(diallyldimethylammonium) chloride thin films by this method. The study also aims to obtain the most suitable parameter for the chemical polymerization of poly(3,4-ethylenedioxythiophene) – poly(styrenesulfonate) to be used in the assembly and to investigate the possible application of the fabricated films as an organic light emitting diode (OLED).

The monomer 3,4-ethylenedioxythiophene (EDOT) was polymerized with poly(styrenesulfonate) dopant using ferric chloride as oxidant. The polymer produced is poly (3,4-ethylenedioxythiophene) – poly(styrenesulfonate) (PEDOT-PSS). Layer-by-layer assembly was applied on both functionalized indium tin oxide (ITO) and microscope glass slides. Layer assembly on the glass substrates was done with initial dipping in poly(diallyldimethylammonium) chloride (PDADMAC) for 15 minutes, followed by immersion in PEDOT-PSS. This cycle was repeated to obtain the desired number of pair layers. The PDADMAC/PEDOT-PSS/PDADMAC film aggregation on the glass substrate was characterized by UV-VIS spectroscopy. Scanning electron microscopy (SEM) and atomic force microscopy (AFM) were also used to characterize the surface morphology of the polymer films. Cyclic voltammetry (CV) was done on the ITO substrate to investigate the electroactivity of the films. The possible application of the films as organic light emitting diode was investigated.

The PEDOT-PSS solution exhibited a dark-blue color with absorption peaks at 306 nm and 930-980 nm, characteristic of PSS and PEDOT, respectively. Only small peaks were observed for PEDOT due to dilution

factor. AFM images revealed rough and uneven surfaces with thickness of ~2.364 nm.

**Keywords:** chemical polymerization, layer-by-layer method, poly (sodium styrenesulfonate), poly(3,4-ethylenedioxythiophene), organic light-emitting diode

## CMPS-3

### **Evaluation of the Electrocatalytic Activity of Platinum Metallic Particles Dispersed on Poly(3, 4-Ethylenedioxythiophene) (Pedot) - Modified Gold Electrode Towards Electro-Oxidation of Ethanol**

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Fuel cells are promising technology as an alternative energy source because of its high-energy conversion efficiency and in theory, does not emit any harmful substances. Ethanol is seen as an attractive fuel for direct alcohol fuel cell since it can be easily produced in large amounts by fermentation. In order to hasten and improve the electro-oxidation of ethanol, platinum catalysts are often used.

Platinum particles dispersed on poly(3,4-ethylenedioxythiophene) (PEDOT) film show enhanced electrocatalytic properties than bulk platinum and Pt-modified Au electrode for ethanol oxidation in sulfuric acid solution. Pt particles were incorporated on a PEDOT matrix from 1.0 mM  $\text{H}_2\text{PtCl}_6$  in 0.1 M  $\text{H}_2\text{SO}_4$  using potentiodynamic deposition mode. The effect of different number of Pt deposition cycles on their electrocatalytic activity was also studied. Performance evaluation for the electrocatalytic activity towards ethanol oxidation at  $E = + 0.600 \text{ V}$  (vs. Ag/AgCl) of the Pt metallic particles dispersed on PEDOT-modified Au electrode and Pt metallic particles-modified Au electrode were compared with bulk Pt. Enhanced electrocatalytic properties towards ethanol oxidation were observed for Pt metallic particles dispersed on PEDOT-modified Au electrode ( $1810 \mu\text{A cm}^{-2}$ )

in comparison to bulk Pt ( $404.84 \mu\text{A cm}^{-2}$ ) and Pt particles-modified Au electrode ( $1296.47 \mu\text{A cm}^{-2}$ ). Cyclic voltammetric data revealed that Pt metallic particles deposited for 12 cycles exhibited the greatest electrocatalytic activity ( $1810 \mu\text{A cm}^{-2}$ ) towards ethanol oxidation. The film morphology and elemental analysis of the composite electrode were analyzed using Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray (EDX) analysis, respectively. The enhanced electrocatalytic behaviour for the Pt metallic particles dispersed on PEDOT-modified Au electrode can be correlated with the surface properties of the composite film. SEM data revealed that the Pt particles were homogeneously dispersed (with particle size of  $\sim 1.0 \mu\text{m}$ ) on the PEDOT matrix. This uniform distribution or dispersion of the Pt particles on the polymer matrix coupled with the high electric conductivity of PEDOT could pave the way for the enhancement of the electrocatalytic activity of the prepared electrocatalyst.

**Keywords:** ethanol, electrocatalysis, PEDOT, platinum particles, fuel cell, SEM

## CMPS-4

### **Molecular Assembly and Electropolymerization of 3,4-Ethylenedioxythiophene (EDOT) on Bare Au(111) Single Crystal Electrode as Probed by Electrochemical Scanning Tunneling Microscopy**

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Electrochemical scanning tunneling microscopy (EC-STM) was used to obtain molecular insight on the adlayer structures and electrochemical polymerization of 3,4-ethylenedioxythiophene (EDOT) on bare Au (111) single crystal electrode in 0.1 M  $\text{HClO}_4$  solution. Cyclic voltammetric (CV) studies showed an increase in anodic current at 0.90 V with the oxidation of

EDOT monomer occurring at  $E = 1.10 \text{ V}$  (vs. RHE).

*In-situ* STM revealed for the first time, that EDOT molecules can spontaneously form organized adlayers on bare Au (111) surface with 18 M concentration of EDOT in aqueous solution. The molecularly resolved STM images of EDOT adlayer showed two domains consisting of disordered and ordered structures with the formation of vacancy islands or "etch pits". Several EDOT structures were observed at + 0.600 V vs. RHE namely: (4 x 7), (5 x 37), (7x3) with calculated coverages of 0.107 ML 0.114 ML, 0.111 ML, respectively. Electropolymerization was also carried out using *in-situ* STM in 0.10 M HClO<sub>4</sub> under potential control.

**Keywords:** 3,4-ethylenedioxythiophene, self-assembled monolayer, Au(111) single crystal electrode, electropolymerization

## CMPS-5

### Solid-Phase Extraction of Histamine using Molecularly Imprinted Polymethacrylic Acid

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The use of molecularly imprinted polymer (MIP) as adsorbent in sample concentration, clean up, screening and isolation by solid-phase extraction (SPE) with compound-specific or group-specific extractions has been widely used with promising applications. In this study, histamine-imprinted polymer was synthesized by precipitation polymerization and its application for SPE as clean-up step for the determination of histamine in foods by HPLC was explored. The MIP was prepared using methacrylic acid, histamine, trimethylolpropane methacrylate (TRIM), 2,2-azobis (isobutyronitrile) and dichloromethane as functional monomer, template, cross-linker, initiator and porogen, respectively. A non-imprinted polymer (NIP) was prepared using the same procedure but without the addition of histamine. The template was removed from the polymer by Soxhlet extraction with methanol-acetic acid. The imprinting effect of the MIP was assessed by its performance as sorbent in SPE experiments. Parameters such as solvent type, time, amount of sorbent and amount of histamine were varied in the molecularly-imprinted solid-phase extraction (MISPE) process to obtain acceptable recoveries in each step. Elution behavior of histamine was

then compared using a blank (NIP) and a classical Supelco DSC18 cartridge. Recoveries higher than 86% were obtained using methanol-acetic acid as the eluting solvent. Selectivity was also explored using histamine, 1-methylhistamine and tyramine. Recoveries obtained for histamine and 1-methylhistamine were 102% and 105%, respectively. The MIP was not selective to tyramine, with 41% and 36% recovered in the loading and elution steps, respectively. Applicability of the MISPE to real food sample was carried out using canned tuna. The resulting recovery was found acceptable (>96%). The MIP was capable of selectively extracting histamine from tuna sample and pre-concentration which can be applied for trace enrichment preparation prior to quantitative analysis.

**Keywords:** histamine, solid-phase extraction, precipitation polymerization, molecularly imprinted polymer, molecularly imprinted solid-phase extraction.

## CMPS-6

### Characterization of Zinc Oxide Ultrafine Particles Using Different Solvent Systems and Calcination Temperatures

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Ultrafine zinc oxide is an important versatile semi-conductor material which has a wide range of applications such as solar cell, luminescent and chemical sensors that detect the combustible or toxic gases by virtue of their high sensitivity and stability. This study aimed at synthesizing ultrafine zinc oxide via chemical precipitation method using NaOH, LiOH and NaOH-LiOH combination,  $ZnSO_4 \cdot 7H_2O$  and  $NH_4HCO_3$ . The synthesized precursors were then subjected to three calcinations temperatures – 250, 400 and 550°C.

Scanning electron micrographs of the synthesized ZnO showed only grainy texture and irregularly shaped and agglomerated particles. Particle sizes were finer compared to the commercial ZnO micrograph with the same magnification. Energy dispersive X-ray spectrometry (EDXS) investigation of the purity of the samples showed no other metal impurities were in the ZnO calcined at 400 and 550 °C while an X-ray peak corresponding to carbon was observed in the sample calcined at 250 °C. Infrared (IR) analysis

indicated the presence of -OH group and absence of NH<sub>3</sub> group. Samples calcined at 250 °C contained coordinated OH and carbonates while those calcined at 400 and 550 °C had attenuated carbonate band and OH bands due to adsorbed water. The color of the synthesized powders became more intense yellow and more porous as the calcination temperature was increased.

Based on the results of the characterization of the synthesized samples, the chemical precipitation methods using the abovementioned solvent systems and calcinations temperatures would yield ZnO with particles that are finer than the commercial ZnO.

**Keywords:** calcination temperature, chemical precipitation, synthesized ZnO, ultrafine particle

## CMPS-7

### **Development of Fuel Cell Electrocatalysts Based On Poly(3,4-Ethylenedioxythiophene) (Pedot)-Modified Pt(111)/Nanoparticle Composite Film: Electrochemical and Surface Properties**

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Fuel cells are electrochemical devices with low pollutant emission and high-energy conversion efficiency, making it a promising alternative source of clean energy. Modification of its individual parts (i.e. anode, cathode, electrolyte membrane) can enhance its electrocatalytic activity towards fuel oxidation. Ethanol as fuel can be effectively electro-oxidized using Pt as electrocatalyst, however, this metal has certain drawbacks such as its susceptibility to poisoning. Reducing Pt to small particles and its dispersion on a polymeric matrix significantly enhances its electrocatalytic activity and resistance to poisoning.

In this study, Pt particles were deposited on poly(3,4-ethylenedioxythiophene) (PEDOT) – modified Pt electrode. Modification of Pt polycrystalline substrates with PEDOT was done by

electropolymerization of 0.01 M EDOT at 50 mV/s in 0.1 M HClO<sub>4</sub>. On the other hand, Pt particles were deposited potentiodynamically from -400 mV to +850 mV at 10 mV/s using 1 mM H<sub>2</sub>PtCl<sub>6</sub> in 0.1 M H<sub>2</sub>SO<sub>4</sub> for 12 cycles. Each of the modified-electrodes was characterized by cyclic voltammetry (CV), Scanning Electron Microscopy (SEM) & Energy Dispersive X-ray (EDX). The electrodes were subjected to electro-oxidation of 1 M ethanol in 0.1 M H<sub>2</sub>SO<sub>4</sub> and their electrocatalytic activities were compared. The utilization of Pt(111) single crystal electrodes was also studied and compared with that of the Pt polycrystalline electrode. CV results showed enhanced electrocatalytic activity of the dispersed Pt particles compared to bulk Pt towards ethanol oxidation, which is attributed to the higher surface-to-volume ratio of Pt particles. Moreover, Pt dispersed on PEDOT-modified Pt(111) single crystal electrode exhibited higher electrocatalytic activity towards ethanol compared to when polycrystalline Pt electrode was used as substrate. This was attributed to the well-defined growth of PEDOT on Pt(111) as observed using SEM, which in turn enhanced the dispersion of the Pt particles.

**Keywords:** PEDOT, polycrystalline Pt, Pt(111) single crystal electrode, electrooxidation, ethanol

## CMPS-8

### **Assessment of Atmospheric Chemical Pollutants In Southern Philippines Using Lichen *Pyxine Coccoes* (Sw.) Nyl.**

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Air pollution biomonitors are important as support for or as an alternative to the conventional method of air sampling in cases when the conventional method is not practical or is not possible to set-up, but local studies need to be done to assess the feasibility of using certain species in a local environment. The lichen *Pyxine cocoes* (Sw.) Nyl, being the most abundant and ubiquitous air pollution biomonitor species in four Metro

Manila sites (urban sites) and two sites near and around coal-fired power plants, was used to assess the atmospheric chemical pollutants in these sites using X-ray fluorescence (XRF) spectrometry. Results show sensitivity of *P. cocos* to S, Zn, Cu and Pb (average concentrations ranging from 1.6-4.0%, 91-268 ppm, 21-61 ppm, and 7-43 ppm, respectively) since bioaccumulated levels of these elements in the lichens are quantifiable by XRF and variation of levels of these indicate differing degree of pollution. The lower S level (ave. 2.5%) in the coal-fired power plant area as compared with that in urban sites (ave. 4.0%) can be attributed to either to the greater dispersion of SO<sub>2</sub> at higher heights (stack heights) or to the effective pollution controls of the power plant for the release of this pollutant to the atmosphere. The high levels of S in two Metro Manila (MM) sites can be attributed to exposure of lichens in these areas to vehicle diesel exhaust which also contains SO<sub>2</sub>.

**Keywords:** *Pyxine cocos*, biomonitor, xrf, air pollution, lichen

## CMPS-9

### Gas Chromatography and Mass Spectrometry Analysis of Gamma-Hydroxybutyrate In Urine

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Club drugs remains as one of the most commonly used illegal drugs. These are chemical substances which are recreationally used in order to serve as enhancements for social experiences. In recent years, gamma-hydroxybutyrate (GHB), along with ecstasy or methylene-3,4-dioxymethamphetamine (MDMA), rohypnol, ketamine and lysergic acid diethylamide (LSD) has gained notoriety as a date-rape drug. Furthermore, a growing number of intoxication on GHB has been reported with some cases of overdose or even drug-related comas. In spite of the growing concern over the use of this drug of abuse, analysis of this club drug in urine has not been done in our country.

Gas chromatography with mass spectrometry (GCMS) was utilized for the analysis of GHB. The chromatographic column was RTX-1, MS



crossband capillary column coated with 100 % dimethylpolysiloxane while the carrier gas used was helium. N,O-Bis(trimethylsilyl)trifluoroacetamide (BSTFA) was used as derivatizing agent. Ketocaproic acid was used as an internal standard.

The GHB peak had an average retention time of 6.20 min. with coefficient of variation (CV) ranging from 0.2 to 0.4%. The mass spectrum exhibited three diagnostic ions for GHB at m/z 147, 204 and 233. Linear calibration plots of GHB were obtained in the range of 0.0 to 50.0 ppm. Limit of detection was 0.7 ppm and limit of quantitation was 2.0 ppm. Analyses of GHB spiked in certified blank urine gave a percent recovery ranging from 81.4% to 93.0%.

**Keywords:** Gamma-hydroxybutyrate (GHB), GC/MS, urine, club drug

## CMPS-10

### **Gas Chromatography/Mass Spectrometry (GC/MS) Analysis of Lauric Acid and Monolaurin in Human Serum Samples**

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Coconut oil contains significant amounts of lauric acid, a medium chain fatty acid, which has antimicrobial properties. In this study, a gas chromatograph/mass spectrometry method was developed to analyze the two metabolites of virgin coconut oil, monolaurin and lauric acid in the serum of healthy volunteers.

Two sets of healthy subjects were included, those given with VCO and those given a placebo. All the subjects were required to fast before taking VCO. Blood was extracted at 0, 2, 4 and 6 hrs after taking VCO. Serum was separated from the blood and analyzed by GC/MS for lauric acid and monolaurin content. Calibration standards were prepared by spiking monolaurin and lauric acid in blank serum. Pentadecanoic acid was used as internal standard. Diethyl ether was used as extraction solvent. The solvent concentrate was derivatized with MSTFA prior to injection in the GC/MS.

The average retention time of monolaurin was at 18.0 min and abundant with  $m/z$  315. Pentadecanoic acid was detected at 15.1 min and was abundant with  $m/z$  317. While lauric acid, abundant with  $m/z$  275, was detected at 11.21 min. The concentration of the monolaurin and lauric acid standards ranged from 0.5 to 2.5 ppm for the set of subjects who were given the VCO. For all the subjects in the group given with VCO, the monolaurin concentration in the serum samples ranged from 0.57 to 3.3 ppm. Lauric acid concentration for the group given VCO ranged from 1.08 to 9.22 ppm. Meanwhile, both monolaurin and lauric acid were not detected in the serum samples of the subjects given the placebo. The method developed could detect and analyze samples for monolaurin and lauric acid concentration in serum samples.

**Keywords:** gas chromatography/mass spectrometry (GC/MS), lauric acid, monolaurin, medium chain fatty acid, virgin coconut oil

## CMPS-11

### **Analysis of Mercury in Human Blood by Differential Pulse Anodic Stripping Voltammetry**

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Mercury is a toxic heavy metal that is found in the environment. Human exposure to mercury may cause harmful effects on the nervous, digestive and respiratory systems, as well as the kidneys. Mercury in blood is used as a biomarker to estimate exposure and risk of health effects. The current standard procedure to analyze mercury in blood is by cold vapor atomic absorption spectrophotometry which is a costly technique. In this study an inexpensive technique is explored as an alternative method to analyze mercury in blood.

One of the most sensitive and relatively inexpensive electroanalytical technique, anodic stripping voltammetry (ASV) was utilized for the analysis of mercury. The voltammetric set-up consisted of a 3-electrode

configuration: a gold electrode as working electrode, a glassy carbon electrode as the auxiliary electrode and Ag/AgCl electrode as the reference electrode. The supporting electrolyte was 0.1 M nitric acid. The ASV voltammograms exhibited a stripping peak for mercury at + 0.6 V versus Ag/AgCl reference electrode. The stripping peak currents were measured at different concentrations of mercury. 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. The percent recovery ranged from 84.6% to 99.9%.

**Keywords:** differential pulse anodic stripping voltammetry, anodic stripping voltammetry, electroanalytical, mercury, voltammogram

## CMPS-12

### **Quality Assessment of Virgin Coconut Oil Using Chemiresistor Electronic Nose Based On Conducting Polymers**

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A chemiresistor electronic nose system was developed based on conducting polymers was developed and utilized for differentiating virgin coconut oil (VCO), refined bleached and deodorized (RBD) coconut oil and rancid VCO. Polyaniline (PANi), polypyrrole (PPy) and poly-3-methylthiophene (P-3MTp), doped with various counter-ions were used as the sensing elements. The conducting polymers were synthesized by potentiostatic polymerization and deposited as a film onto the microgap between two gold electrodes set on a Teflon substrate. The sensor was subjected to a conditioning potential prior to its use.

The sensors were exposed to the headspace of the oil samples, and the electrical resistances of the chemiresistors were measured through a bridge circuit operating in deflection mode. The vapors in the headspace of the oil samples caused a change in the resistance of the conducting polymers films

– an increase in the Ppy films and a decrease in the Pani and P-3MTp films. A stable response was obtained for an average time of 5 min. The sensors exhibited very good reversibility (relative standard deviation = 0.033 to 1.8 %, n = 3), good repeatability and reproducibility (relative standard deviation < 10%, n = 3). A radar plot of the sensor responses to the various oil samples exhibited distinct patterns for the VCO, RBD and rancid VCO samples. Chemometric analysis of the data through principal component analysis yielded a clustering of the sensor responses to VCO, RBD and rancid VCO samples. These results indicate the capability of the sensor array to differentiate VCO, RBD and rancid VCO, and its potential for application in VCO quality assurance. The electronic-nose system developed in the work presents a simpler, more reliable and less expensive method compared to the human sensory panel and the gas chromatography methods currently being used for the identifying authentic samples of VCO.

**Keywords:** electronic nose, chemiresistor, conducting polymers, virgin coconut oil and principal component analysis

## CMPS-13

### **Trimethylamine Chemiresistor Sensor Based on Polyaniline/Nylon Composite**

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A chemiresistor sensor based on polyaniline (PANI)/nylon composite was fabricated for the headspace analysis of trimethylamine (TMA). TMA is the prominent toxic gas in decaying foods and other biological materials, and is known to increase significantly as a result of the said process. The composite was prepared by an *in situ* chemical oxidative polymerization of aniline with an equimolar amount of HCl (0.4M) onto a nylon membrane for 30 min using 0.6M ammonium peroxydisulfate (APS) oxidant. The chemiresistor sensor was exposed to 15 mL TMA solution in a headspace manner at room temperature. The response was measured using four-point probe technique, and it was found that the resistance increases with TMA concentration due to reduction of PANI.

The chemiresistor gave a sensitivity ( $m$ ) of 14.05  $\mu\text{A}/\text{-log ppb TMA}$  and linearity ( $r$ ) of 0.975 at a dynamic concentration range of  $10^9$  to  $10^6$  ppb TMA. It has an average response time ( $t_{90}$ ) of 8 and a repeatability (COV) of 7.8% for the  $10^6$  ppb sample cycled thrice. This type of gas sensor is attractive because it provides a promising low-cost means to monitor TMA at room temperature. It also involves a compound that can be modified chemically to give high sensitivity, and the mode of measurement offers simplicity.

**Keywords:** chemical polymerization, chemiresistor, trimethyl aminopolyaniline, nylon

## CMPS-14

### **Characterization and Identification of Air Pollution Sources in Metro Manila**

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Air particulate matter ( $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ ) is a mixture of different pollutant sources which can be of anthropogenic and/or natural origin. Identification and apportionment of pollutant sources is important to be able to have better understanding of prevailing conditions in the area and thus better air quality management can be applied. Results have shown that in all the sampling sites, a major fraction of pollutant sources comes from vehicular or traffic-oriented sources, comprising more than 30% of  $\text{PM}_{2.5}$ . Of particular great concern especially in the residents of the area are the high Pb levels in Valenzuela City. In 2005, the annual mean level of  $\text{PM}_{10}$  Pb in Valenzuela was  $0.267 \mu\text{g}/\text{m}^3$  while the other PNRI sampling sites registered annual mean levels between 0.033 to  $0.085 \mu\text{g}/\text{m}^3$ . The high Pb condition is reflected in the source apportionment studies with Pb sources showing up in both the coarse ( $\text{PM}_{10-2.5}$ ) and the fine fractions ( $\text{PM}_{2.5}$ ). The CPF analysis plots of 2008 Pb levels in both the coarse and the fine fractions show patterns for probable sources in the 2008 data similar to that in the 2005 data indicating that Pb sources in 2005 could still be the same Pb sources in 2008.

Further study of the location of battery recycling facilities and other possible sources of lead is needed to validate the results of the CPF determination.

**Keywords:** air particulate matter, Metro Manila, PM<sub>10</sub>, Pb, receptor modeling, Valenzuela

## CMPS-15

### **Piezoelectric Sensor for Folic Acid Based on Poly(4-Vinylpyridine) Imprinted Polymer**

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A piezoelectric sensor for folic acid was fabricated based on molecularly imprinted polymer (MIP) prepared by bulk polymerization. The folic acid imprinted polymer reagent phase composed of the MIP powder, tetrahydrofuran and polyvinylchloride, was deposited onto the electrode on one side of a quartz crystal by spin coating. A reference sensor was prepared using a non-molecularly imprinted polymer (*n*MIP) using the same procedures. Optimization of sensor response was established using 10  $\mu$ L reagent phase coating, 2-hour curing time, and 0.1 M NaOH as solvent for folic acid standard. Concentration range of  $1 \times 10^{-3}$  to 2.0  $\mu$ g/mL gave the best linearity ( $r=0.9951$ ) and sensitivity (95.9 Hz/ln[ $\mu$ g/mL]). Response time ranged from 90–340 s. The sensor exhibited good response repeatability and reproducibility (rsd=2.55% and 8.16%, respectively) and the limit of detection was found to be  $3.28 \times 10^{-11}$   $\mu$ g/mL. Results of analysis with juice and milk using the fabricated sensor gave acceptable percentage recoveries of 91.2% and 97.1%, respectively, based on the folic acid contents declared on the nutrition label. Furthermore, the infrared spectra and electron micrographs confirmed the imprinting and rebinding of the folic acid to the polymer. Evaluation of the fabricated sensor in real time analysis is recommended for use in assessing folic acid depletion per food manufacturing step to ensure fortification of products. Consequently, this

simple, rapid and low-cost technique can be used to analyze food sample that are included in the Philippine Food Composition Tables.

**Keywords:** folic acid, piezoelectric, molecularly imprinted polymer, 4-vinylpyridine, quartz crystal

## CMPS-16

### **Carbon Isotope Composition of Acetic Acid in Vinegar, an Integrated Indicator of the Processes of Production**

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Fraudulent adulteration and or misrepresentation had been a problem for commercial vinegar in the Philippines. In this study, authentic vinegar samples were acquired, which were prepared by natural fermentation of sugar cane, pineapple juice, and mango juice. Another type of cane vinegar was prepared by fermentation of cane sugar using an acetator. Commercial vinegar samples from major supermarkets were likewise obtained. The C14 activities of the samples were measured in a 1414 Wallac Scintillation Counter and expressed as disintegrations per gram carbon or dpm/g C. Biogenic samples exhibit 12-15 dpm/g C activities while synthetic samples show 0-2 dpm/g C activities. The remaining portions of the samples were oxidized to CO<sub>2</sub> gas, and bled to an Isotope Ratio mass spectrometer. <sup>13</sup>C/<sup>12</sup>C ratios were determined and compared against a standard CO<sub>2</sub> gas (standardized against the International Pee Dee Belemnite Standard). Delta values of acetic acid obtained from C4 plants including sugar cane, and pineapple were between (-12.2) to (-15.9) per mil respectively. The vinegar obtained from mango, a C3 plant, gave (-20.1) per mil. The acetic acid produced from sugar cane using an acetator presented a fractionation (-10.2 permil.) which allows for it to be differentiated from cane vinegar produced via the conventional fermentation production, not using an acetator. Possible synthetic/petroleum-derived vinegars exhibit delta values beyond (-30) per mil. Five out of seven of the commercial vinegar brands were suspected to be made of synthetic acetic acid. Isotope ratio mass spectrometry and liquid scintillation counting are promising tools for revealing the botanical origin

and method of production, and detection of synthetic acid adulteration in vinegar samples.

**Keywords:** acetic acid, isotope ratio mass spectrometry, liquid scintillation counting, vinegar.

## CMPS-17

### **Authentication of Origin of Fermentative Ethanol in Philippine-Made Beverages by C,H,O Isotope Abundancies**

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This paper demonstrated the expediency of radiocarbon liquid scintillation counting for detection of synthetic ethanol adulteration in Philippine- manufactured wines/alcoholic beverages. The impure wines were distinguished from the pure beverages by radiocarbon assay, taking advantage of the anticipated minor <sup>14</sup>C content of synthetic ethyl alcohol in comparison to the natural <sup>14</sup>C abundance of the plant-derived, biogenic products. Biogenic samples gave 12-15 dpm/g C activities, while synthetic samples exhibited 0-2 dpm/g C activities. The research moreover explored the utility of Deuterium, Oxygen 16 and <sup>13</sup>Carbon/<sup>12</sup>Carbon isotope ratio analysis in the authentication of the botanical and geographical origins of beverages. Initial investigations revealed the mean of  $\delta^{18}\text{O}$  in the Metro Manila area for precipitation, surface waters and ground waters to be  $-6.09 \pm 2.9$ ,  $-1.59 \pm 2.2$ , and  $-6.64 \pm 0.7$  per mil, respectively.  $\delta^2\text{H}$  in Metro Manila for precipitation, surface waters and ground waters were  $-43.8 \pm 1.2$ ,  $-11.9 \pm 16.2$ ,  $-45.0 \pm 4.8$  per mil respectively.  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  values from precipitation, surface and ground waters in the country, were imperative in the establishment of geographical origin of the samples. Vital information such as detection of illegal dilution with water, or enrichment using other sugars before and after fermentation, misrepresentation of geographical origin, and adulteration with petroleum-derived ethanol were generated from the isotopic data.

**Keywords:** alcohol, carbon 14, deuterium, ethanol, isotope, oxygen 18, wines



## CMPS-18

### **Biological Activities and Chemical Constituent of the Non-Polar and Semi-Polar Fractions of the Bark of *Cinnamomum mercadoi* Vidal (Fam. Lauraceae)**

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The limited scientific data on *Cinnamomum mercadoi* Vidal, a medicinal plant endemic to the Philippines prompted this research to be undertaken.

The crude methanolic extract of the bark was tested for toxicity, analgesic, antioxidant, anti-inflammatory and antimicrobiological activities. The LD<sub>50</sub> of the crude extract administered orally to female Sprague-Dawley rats is  $5.27 \pm 0.22$  g/kg body weight. By Plantar test, the crude extract showed analgesic activity of 84.0% protection at 500 mg/kg body weight. It exhibited 91.76% antioxidant activity at 0.04 µg/mL concentration using the ferric thiocyanate method.

By Kirby-Bauer Disc Diffusion method, *Staphylococcus aureus* was found to be highly susceptible to the essential oil and moderately susceptible to the crude extract and major fractions. *Escherichia coli* was moderately susceptible to the crude extract, hexane and dichloromethane fractions and essential oil. Strong antifungal activity was exhibited by the oil.

By GC analysis, 19 fatty acids were identified in the esterified hexane fraction, with myristic acid (63.32%) as the main component. GC analysis of the oil showed methyl eugenol (57.55%), safrole (17.21%) and eugenol (6.27%).

Three compounds namely safrole, methyl eugenol and eugenol were isolated from the non-polar and semi-polar fractions by chromatographic techniques and identified by NMR and GC-MS analyses.

**Keywords:** analgesic activity, *C. mercadoi*, methyl eugenol, NMR

## CMPS-19

### Coconut (*Cocos nucifera* L.) 11S Globulin Exhibits Gene Sequence and Structural Homologies with Known Legumins

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The 11S globulin (cocosin) is the major storage protein that accumulates in the coconut endosperm during fruit development. This work describes the isolation, cloning and structural analysis of the cocosin gene. Putative cocosin gene was initially isolated through PCR using primers designed from amino acid consensus of 11S globulins of other monocots. The amplicon was gel-purified, ligated into pGEM®-T Easy vector, and transformed into *E. coli* JM109 cells. The positive transformants were subjected to plasmid miniprep and sent to Macrogen for sequencing. Out of twenty clones, two cocosin partial cDNA isoforms (*Cos-1* and *Cos-2*) were identified. *Cos-1* and *Cos-2* span 697 bp and 863 bp, respectively, and are 93% identical with each other at the nucleotide level. The deduced amino acid sequences of *Cos-1* and *Cos-2* manifest significant homology with reported glutelins from *Elaeis guineensis* (91% and 92%, respectively), *Oryza sativa* (47% and 51%, respectively) and other monocots and dicots, and would be the second set of sequence to be reported among 11S globulins of species under the Order Arecales and the sixth among those of monocots. The highly conserved splice site (NG[L/F]EET) is present in both isoforms and divides the partial polypeptide into expected acidic and basic subunits with pI values of 5.74/5.47 and 9.85, respectively. A bicupin domain, which is a conserved barrel found in 11S and 7S plant seed storage proteins, is detected in the primary structure of both isoforms. Rapid amplification of cDNA ends (RACE) experiment is being conducted to clone the full-length genes.

**Keywords:** coconut, 11S globulin, cocosin, storage protein, legumin

## CMPS-20

### Fatty Acid Profile and Stability of Oil from *Moringa oleifera* Lam. Seed Philippine Variety

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*Moringa oleifera* Lam. has been shown to be a rich source of oleic acid oil stable to oxidation and may decrease the risk of coronary heart disease. The study aims to determine the fatty acid profile of oil extracted from *Moringa oleifera* Lam. and to compare its stability with commercially available oil. Hexane was used to extract the oil from the powdered seed of *Moringa oleifera* Lam. and the fatty acid  $\alpha$ -carotene and Vitamin E content were determined. Oxidative stability of oil was compared with olive, canola and corn oil during storage at 55 °C for five days using peroxide value, headspace oxygen, conjugated diene, infrared absorption and *trans*-fatty acid content. Seed powder with particle size of 0.65 mm and 2.98% moisture content yielded 34.28% oil. Extracted oil was found to contain 75.75% monounsaturated, 2.70% polyunsaturated and 21.55% saturated fatty acid dominated by palmitic (6.72%) and behenic (6.37%). Moringa oil also contain 20.80  $\mu\text{g/g}$  oil  $\alpha$ -tocopherol, 10.06  $\mu\text{g/g}$  oil  $\beta$ -tocopherol, 9.79  $\mu\text{g/g}$  oil  $\gamma$ -tocopherol, 27.52  $\mu\text{g/g}$  oil  $\delta$ -tocopherol without  $\alpha$ -carotene. Based on the oxidative stability test performed, Moringa oil was more stable than olive, canola and corn oil. Moringa and olive oil were found to contain zero *trans*-fatty acid. Moringa oil has a better oxidative stability compared to olive, canola and corn oil. Moringa oil can compete with oils rich in monounsaturated fatty acid shown to have some preventive effects on the risk of cardiovascular disease and other chronic diseases.

**Keywords:** *Moringa oleifera* Lam., fatty acid, oxidative stability, high oleic oil

## CMPS-21

### Novel Bioactivities of *Ent-kaurenoic Acid* from *Smallanthus sonchifolius*

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Yacon (*S. sonchifolius*) has medicinal properties associated with the management and better control of chronic diseases like diabetes, cardiovascular diseases and prevention of cancer. Ent-kaurenoic acid (1) was isolated as a major component of the young leaves and tubers of Yacon.

Duck (*Anas platyrhynchos*) chorioallantoic membrane (CAM), mouse tail-flick & writhing,  $\beta$ -carrageenan lung pleurisy model, prophylactic and hypoglycemic assays were used to evaluate the antiangiogenic, analgesic, anti-inflammatory, anti-toxic and hypoglycemic activities of 1, respectively. Results were analyzed using one-way ANOVA at  $\alpha=0.05$ .

Compound 1 yielded high embryo mortality (83.3%) and effectively inhibited blood vessel formation on treated CAM characterized by petechial vessels, hemorrhaging and reduced vascular sprouting. Maximum analgesic (68.5 $\pm$ 19.9%) and anti-inflammatory (98.1 $\pm$ 2.0%) responses were observed in mice treated with 1. Reduced mortality (0% at 3h and 50% at 5h) was observed in mice treated with 1 when exposed to DMSO over a 5h observation period. Single IP injection of 1 in normoglycemic mice had hypoglycemic effect starting at 1.0h progressing up to 2.5h.

This is the first report on the antiangiogenic and prophylactic properties of 1. However, the analgesic, anti-inflammatory and hypoglycemic properties of 1 isolated from other plant sources have been previously reported.

**Keywords:** *Smallanthus sonchifolius*, antiangiogenic, analgesic, anti-inflammatory, prophylactic, antidiabetes, antimicrobial

CMPS-22

**On the Closed Geodetic Numbers of the Corona and Composition of Graphs**

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Given two vertices  $u$  and  $v$  of a connected graph  $G$ , the closed interval  $I_G[u, v]$  is that set of all vertices lying in some  $u-v$  geodesic in  $G$ . If  $S \subseteq V(G)$ , then  $I_G[S] = \cup \{I_G[u, v] : u, v \in S\}$ . A set  $S$  of vertices in  $G$  is called a *geodetic cover* of  $G$  if  $I_G[S] = V(G)$ . Suppose that in constructing a geodetic cover  $S$  of  $G$ , we select a vertex  $v_1$  and let  $S_1 = v_1$ . Select a vertex  $v_2 \notin S_1$  and let  $S_2 = v_1, v_2$ . Then successively select a vertex  $v_i \notin I_G[S_{i-1}]$  and let  $S_i = v_1, v_2, \dots, v_i$  until there is some positive integer  $k$  for which  $S_k = S$ . Any such geodetic cover of  $G$  obtained in this way is called the *closed geodetic cover* of  $G$ . The *closed geodetic number* and the *upper closed geodetic number* of  $G$  are, respectively, the smallest and the largest cardinality among the closed geodetic covers of  $G$ . A closed geodetic cover  $S$  of  $G$  is a *minimal closed geodetic cover* of  $G$  if no proper subset of  $S$  is a closed geodetic cover of  $G$ . The *minimal closed geodetic number* is the maximum cardinality of a minimal closed geodetic cover of  $G$ . It is shown that every three positive integers  $m, k$ , and  $n$  with  $2 \leq m < k < n$  are realizable as the closed geodetic, minimal closed geodetic, and upper closed geodetic numbers, respectively, of a connected graph. This paper determines the closed geodetic, upper closed geodetic, and minimal closed geodetic numbers of graphs resulting from a corona and a composition of connected graphs.

**Keywords:** connected graphs, geodetic numbers, geodetic cover

CMPS-23

The Closure and Tutte's Synthesis of Harary Graphs  $H_{k,n}$

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A Harary graph is a  $k$ -connected graph  $H_{k,n}$   $k$  and  $n$  are positive integers, and the construction of the graph  $H_{k,n}$  begins with an  $n$ -cycle graph, whose vertices are consecutively numbered  $0,1,2,3,\dots,n-1$  clockwise around its perimeter. Adjacency between two vertices  $i$  and  $j$  in the graph  $H_{k,n}$  is determined by the distance between  $i$  and  $j$  along the perimeter of the  $n$ -cycle. This distance is the length of the shorter of the two  $i$ - $j$  paths on the perimeter and, hence, is the smaller of two values  $|j-i|$  and  $n-|j-i|$ . We call this **mod  $n$  distance** between  $i$  and  $j$ , denoted by  $d_{i,j}$ . Adjacent vertices of the graph of  $H_{k,n}$  depends on the parity of  $k$  and  $n$ .

Let  $G$  be a graph of order  $n$ . A **closure**  $c(G)$  of  $G$  is a graph obtained by recursively joining pairs of non-adjacent vertices of  $G$  whose degree sum is at least  $n$  until no such pairs remain. This paper proves the closure of the Harary graphs  $H_{k,n}$ . We also use **Tutte's synthesis** to show that the Harary graph  $H_{k,n}$ ,  $n \geq 5$  is 3-connected.

1. If  $k$  is even,  $c(H_{k,n}) = \begin{cases} H_{k,n} & \text{if } n-k > \lfloor \frac{n}{2} \rfloor \\ K_n & \text{if } n-k \leq \lfloor \frac{n}{2} \rfloor \end{cases}$
2. If  $k$  is odd and  $n$  is even,  $c(H_{k,n}) = \begin{cases} H_{k,n} & \text{if } n-k > \frac{n}{2} \\ K_n & \text{if } n-k \leq \frac{n}{2} \end{cases}$
3. If  $k$  and  $n$  are both odd,  $c(H_{k,n}) = \begin{cases} H_{k,n} & \text{if } n-k > \lfloor \frac{n}{2} \rfloor \\ K_n & \text{if } n-k \leq \lfloor \frac{n}{2} \rfloor \end{cases}$

**Keywords:** adjacent, closure, distance, Harary graph, Tutte's synthesis

## CMPS-24

### On the Differential of a Graph

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A game is played on an arbitrary graph  $G = (V(G), E(G))$  and the objective of this game is to maximize player's profit. Using the concept of differential in graphs, this study shows that for any graph  $G$  of order  $n \geq 2$ , the maximum profit is between 0 and  $n - 2$ . Graphs which yield a maximum profit of  $n - 2$  are characterized and maximum profits for games played on the join and composition of two graphs are also determined.

The following main results have been generated in this study:

1. Let  $G$  be any graph of order  $n \geq 2$ . Then  $0 \leq \partial(G) \leq n - 2$ .
2. Let  $G$  be any graph of order  $n \geq 2$ . Then  $\partial(G) = n - 2$  if and only if there exists a vertex  $v$  of  $G$  such that  $v \in N(x)$  for all  $x \in V(G) \setminus \{v\}$ .
3. Let  $G$  and  $H$  be graphs of orders  $n$  and  $m$ , respectively.
  - (a) If either  $G$  or  $H$  is complete, then  $\partial(G + H) = n + m - 2$ ;
  - (b) If  $G$  and  $H$  are non-complete, then  $\partial(G + H) = \max \{n + m - 4, \partial(G) + m - 1, (H) + n - 1\}$ .
4. Let  $n \geq 2$  and  $m \geq 2$  be integers. Then  $(K_{m,n}) = \max \{m + n - 4, n - 1, m - 1\}$ .
5. Let  $G$  be a connected graph of order  $n$  and  $m \geq 3$ . Then  $\partial(G[K_m]) = nm - 2\gamma(G)$ ,  
where  $\gamma(G)$  is the domination number of  $G$ .

**Keywords:** differential, join, composition, domination

CMPS-25

**Weak Solution of the Weighted Eigenvalue Problem for the Operator  $L_\mu$**

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We consider the weighted eigenvalue problem with a singular weight

$$L_\mu u = \Delta(|\Delta u|^{p-2} \Delta u) - \frac{\mu}{|x|^{2p}} |u|^{p-2} u = \lambda |u|^{p-2} u f \quad \text{in } \Omega \tag{1}$$

$$u = \Delta u = 0 \quad \text{on } \partial\Omega$$

where  $f \in F_p$

$$F_p = \left\{ f : \Omega \rightarrow \mathbb{R}^+ \mid \lim_{|x| \rightarrow 0} |x|^{2p} f(x) = 0 \quad \text{with } f \in L_{loc}^\infty(\overline{\Omega} \setminus \{0\}) \right\}$$

$\Omega$  is a bounded domain in  $\mathbb{R}^n$ ,  $1 < p < n$ ,  $0 \leq \mu < \left(\frac{n-2p}{p}\right)^p \left(\frac{np-n}{p}\right)^p$

and  $\lambda \in \mathbb{R}^n$ . We look for a weak solution  $u \in W = W^{2,p}(\Omega) \cap W_0^{1,p}(\Omega)$

of this problem and study the asymptotic behaviour of the first eigenvalues

for different singular weights as  $\mu$  increases to  $\left(\frac{n-2p}{p}\right)^p \left(\frac{np-n}{p}\right)^p$

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



**CMPS-26**

**Super-Open Sets and Super-Continuity of Maps  
in the Product Space**

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Recently, Al-Hawary characterized super continuity and gave relationships between super continuity and the other well-known variations of continuity such as strong continuity, semi-continuity, and closure continuity.

In this study the concepts of super-open and super-continuity in the Cartesian product with the Tychonoff topology have been studied. In particular, a characterization of super-continuity of a function from an arbitrary topological space into the product space has been obtained.

Among others, the study had generated the following results:

1. A function  $f : X \rightarrow Z$  is super-continuous on  $X$  if and only if  $f^{-1}(B)$  is super-open in  $X$  for every basic open set  $B$  in  $Z$ .
2. Let  $O$  be a non-empty open set in the product space  $Y = \prod_{\alpha \in \Omega} Y_{\alpha}$ . Then  $p_{\alpha}(O) = Y_{\alpha}$  for all but at most finitely many  $\alpha$ , and  $p_{\alpha}(O)$  is super-open for every  $\alpha \in \Omega$ ,  $p_{\alpha}$  is the projection map onto  $Y_{\alpha}$ .
3. Let  $S = \{\alpha_1, \alpha_2, \dots, \alpha_k\}$  be a finite subset of  $\Omega$  and let  $O_{\alpha_j}$  be a non-empty subset of  $Y_{\alpha_j}$  for each  $\alpha_j \in S$ . Then  $\langle O_{\alpha_1}, O_{\alpha_2}, \dots, O_{\alpha_k} \rangle$  is super-open in  $Y$  if and only if each  $O_{\alpha_j}$  is super-open in  $Y_{\alpha_j}$  for each  $j = 1, 2, \dots, k$ .
4. Let  $(X, \tau)$  be a topological space and  $Y = \prod_{\alpha \in \Omega} Y_{\alpha}$  with the Tychonoff topology. A function  $f : X \rightarrow Y$  is super-continuous on  $X$  if and only if each coordinate function  $p_{\alpha} \circ f$  is super-continuous on  $X$ .

**Keywords:** topology, super-open, super-continuity, product space

## CMPS-27

### Vertex Cover of the Power of Cycles

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For a simple graph  $G$ , there is a subset  $U$  of the vertex set of  $G$  such that all the edges of  $G$  are incident to some elements of  $U$ . Such subset is a vertex cover of  $G$ . The minimum cardinality of a vertex cover of  $G$  is its vertex covering number.

The  $m^{\text{th}}$  power of a cycle is the graph  $H$  with the same vertex set as the cycle, but two vertices in  $H$  are adjacent whenever their graph-theoretic distance in the cycle is at most  $m$ .

The study established an algorithm in determining the vertex covering number  $\acute{a}$  of the  $m^{\text{th}}$  power of a cycle. If the order of the cycle is  $n$ , then  $\acute{a}$  is either  $n - 1$  or  $n - q$ , where  $q$  is the quotient when  $n$  is divided by  $m + 1$ .

**Keywords:** vertex cover, vertex covering number, power of graph, cycle, vertex independence

## CMPS-28

### On Secondary Normal and Secondary Unitary Matrices

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If  $A = (a_{ij}) \in M_n(\mathbb{C})$ , then the secondary transpose of  $A$ , denoted  $A^s$ , is  $A^s = (b_{ij})$ , where  $b_{ij} = a_{n-j+1, n-i+1}$  while the conjugate secondary transpose of  $A$ , denoted  $A^{\theta}$ , is  $A^{\theta} = \overline{A^s}$ . That is, with respect to the secondary diagonal, reflection of all the entries of  $A$  on one side to the other side and vice versa yields the secondary transpose of  $A$ . A matrix is then called

secondary normal and secondary unitary, respectively, if,  $A A^\theta = A^\theta A$  and  $A A^\theta = A^\theta A = I$ , respectively. This paper provides some characterization of the secondary normal and secondary unitary matrices.

**Keywords:** secondary transpose, conjugate secondary transpose, secondary normal, secondary unitary, secondary unitarily equivalent.

CMPS-29

### On “GOOD” Graph Connectivity

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A connected finite graph  $G$ , undirected and weighted, has a “GOOD” connectivity property if the center of the graph has an optimal degree and minimum weight.

Furthermore, this paper will establish an algorithm in finding the “GOOD” connectivity of a graph  $G$ . In line with this, the time complexity of this algorithm will be computed to determine its accuracy.

This study also investigates how to lessen connectivity cost thus providing efficient optimal data transmission over a computer network.

**Keywords:** “GOOD” connectivity, graph, algorithm, time complexity, optimal data transmission, network

## CMPS-30

# Electrical Response of Electrodeposited Zinc Oxide on Graphite Rods to Hydrogen Sulfide Gas

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The objective of the study is to fabricate nanostructured zinc oxide (ZnO) via electrodeposition and to investigate its electrical response when exposed to hydrogen sulfide (H<sub>2</sub>S) gas. ZnO was deposited on a pencil graphite substrate from 0.5 M solution with varying voltage (300 V, 500 V and 700 V) and deposition time (5 min, 7.5 min, 10 min, 12.5 min, 15 min and 17.5 min). The morphology of the samples was investigated through scanning electron microscopy (SEM). Grain sizes of the electrodeposited ZnO ranged from 250nm–350nm. A circuit setup was made to test the sensitivity of the electrodeposited ZnO to H<sub>2</sub>S and was connected to a regulated power source, nanovoltmeter and a closed setup for H<sub>2</sub>S. The ZnO deposited onto pencil graphite was then exposed to constant H<sub>2</sub>S gas concentration inside the closed setup. The sensitivity of the electrodeposited ZnO to constant concentration of H<sub>2</sub>S gas was determined through the electrical response which represented changes in voltage readings in the nanovoltmeter. The initial results suggest that the electrodeposited ZnO is sensitive to H<sub>2</sub>S gas through changes in its voltage response. Mean voltage was determined in each ZnO sample electrodeposited with varying voltage and deposition time exposed with H<sub>2</sub>S gas and the results were plotted using the Microsoft excel. It was observed that with ZnO samples prepared with prolonged electrodeposition duration, the gas response also increased. The gas response increased until it reached the maximum gas response at 12.5 min deposition time. Surprisingly, further increase in the deposition duration after 12.5 min led to lower gas response. The electrodeposited ZnO showed H<sub>2</sub>S sensitivity ranging from 5.72180 and 82.84032 depending on electrodeposition voltages and time. Among the different samples of ZnO deposited, the sample which was deposited at 700 V and 12.5 min showed the highest H<sub>2</sub>S sensing performance of 82.84032.

**Keywords:** ZnO, H<sub>2</sub>S, UV radiation, gas sensor, electrodeposition

## CMPS-31

### **Effect of Elastomeric Adhesive Concentration on the Morphology of Electrospun Polyaniline Fibers**

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The effect of elastomeric adhesive concentration on the morphology of electrospun polyaniline fibers was investigated. Polymeric solutions composed of dimethyl sulphoxide-dissolved polyaniline mixed with five different concentrations of elastomeric adhesive (25%, 37.5%, 50%, 62.5%, and 75%) were prepared. These solutions were drawn into fibers by electrospinning at a constant applied voltage of 20 kV.

Fibers were observed to form only from the solutions prepared with 50%, 62.5% and 75% elastomeric adhesive (EA). Captured scanning electron microscope (SEM) images of the electrospun fibers from solutions with 50%, 62.5% and 75% EA showed, respectively: relatively few beads along the length of the fibers, but not necessarily evenly spaced; no beads but an observable difference on their fiber diameters and lastly; more beads as compared with the first two electrospun fibers. The measured mean fiber diameters for the three solutions (with 50%, 62.5% and 75% EA) are 0.763  $\mu$ m, 2.819  $\mu$ m, and 1.027  $\mu$ m, respectively.

It can be observed that the reduction of beads was seen only for the first two resulting electrospun fibers, as the EA concentration was increased. The pattern was broken with the electrospun fibers from the solution with 75% EA. It can be said that the principal component now of this last solution is essentially elastomeric adhesive, thereby changing the way the solution reacted with the application of the applied voltage, and consequently the resulting formation of beads and its quantity. The occurrence of beads which were observed in the captured SEM images can be attributed to the surface charge density.

**Keywords:** conducting polymer, elastomeric adhesive, electrospinning, polyaniline

## CMPS-32

### **Analysis of Vasomotion Spectra in Insulin Perfused and Non-Insulin Perfused Monkeys**

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This work examines the vasomotion spectra of monkey taken using Laser Doppler Velocimetry. The Laser Doppler flow rates were measured using a Perimed Periflux 5000 system with a sampling time of 0.031 s from the dorsum of the foot of anesthetized monkeys after an overnight fast. Monkeys were subjected to a heat treatment with temperatures gradually changing from 29 °C to 44 °C and then held constant. There are three subjects considered: a normal, a prediabetic and a diabetic monkey. Vasomotion data were taken before and after the subjects were perfused with insulin. This study aims to characterize the changes of the power spectral density of the vasomotion of the monkeys during heat treatment, and to understand how these characteristics are altered upon perfusion of insulin. The spectra were analyzed using Fast Fourier Transform executed using SCILAB software. The power spectral density of the vasomotion was then characterized by comparing the mean fraction of the spectral power around 1 Hz to the mean fraction of spectral power around 2 Hz.

Initial result on the power spectra analysis indicates that upon perfusion of insulin, the peak location of the diabetic subject approaches the peak location of the prediabetic state. This analysis may be a useful technique in examining the onset and progression of diabetes.

**Keywords:** diabetes, prediabetic, vasomotion, power spectral density, fast Fourier transform, laser Doppler velocimetry

**ENGINEERING SCIENCES  
AND TECHNOLOGY**

## **EST-1**

# **Predicting the Hydrologic Response of the Laoag River Basin to Climate Change Using the SWAT Model**

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Understanding the different hydrologic processes within a watershed as affected by climate change is very important for assessing its future environmental conditions and for developing policy interventions and sound mitigation and adaptation mechanisms to climate change. Soil and Water Assessment Tool (SWAT), a river basin scale model developed to quantify the impact of land management practices and climate change on water, sediment, and agricultural chemical yields, was parameterized and calibrated to simulate the hydrologic responses of the Laoag river basin to various climate change scenarios.

Results showed that SWAT adequately predicted the streamflow of the test watershed with Nash-Sutcliffe Efficiency (NSE) of 0.29. Both the peaks and monthly temporal variation of streamflow were adequately captured by the model. Simulation of climate change scenarios using the calibrated model showed that 10 percent and 20 percent change in precipitation will significantly affect the hydrology of the basin. A 20 percent decrease in precipitation will result to 27.2 percent and 15.0 percent reduction in streamflow and groundwater recharge, respectively. A 20% increase in precipitation on the other hand, will increase the streamflow, runoff and groundwater recharge by 27.8 percent, 31.1 percent and 12.7 percent, respectively. Also, increase in temperature up to 2°C will slightly decrease the streamflow, runoff volume and groundwater recharge. Doubling the carbon dioxide level will increase streamflow, runoff, and groundwater recharge, but its effect is quite modest compared with precipitation and temperature change.

**Keywords:** Climate Change, Hydrologic response, Laoag River, Streamflow, SWAT modeling



## EST-2

### **Bamboo Charcoal as Water Filter**

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Crushed bamboo charcoal filter improves the quality of Cebu Technological University (CTU) water based on biological parameters particularly total bacterial count in colony forming unit per ml, and total coliform count in most probable number per hundred milliliter, and physico-chemical parameters including pH, temperature in degrees celcius, density in gram per milliliter, alkalinity in milligram per liter, salinity at 15°C in parts per thousand and calcium hardness in milligram per liter sample. The water sample filtered using Crushed Bamboo Charcoal Filter had the least bacterial count in colony forming unit per milliliter sample and total coliform in most probable number per hundred milliliter sample compared to the CTU water samples before filtering, water samples filtered using powdered bamboo charcoal and commercial filter. The electrometric method for pH and temperature tests revealed that the water filtered using crushed bamboo charcoal is within the range with proper pH levels at ambient temperature. The alkalinity level and calcium hardness in mg/liter of filtered water increases compared to the rest of the research samples including unfiltered CTU water which contained least level using Titrimetric method and EDTA-Titrimetric method, respectively. The desalination of water was done since there was decreasing trend of salinity at 15°C level, in parts per thousand of the filtered water.

**Keywords:** bacteriology, bamboo charcoal filter, desalination, physico-chemical

## **EST-3**

### **Effects of Operating Factors on the Removal of Chromium in a Model System Sodium Sulfite Reduction and Alkali Precipitation**

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Chemical process industries such as chrome-plating and chrome-tanning generate chromium-containing wastewater which contains high concentrations of trivalent chromium (Cr(III)) and a small portion (but still above the DENR-DAO 35 standard) of hexavalent chromium (Cr(VI)). When disposed into a receiving water body, the less toxic and relatively immobile trivalent chromium can be oxidized to its carcinogenic hexavalent state especially in the presence of Manganese. Hence, removal of both trivalent and hexavalent chromium in any chromium-containing wastewater must be done prior to its disposal. Chemical reduction (by sodium sulfite) and alkali precipitation (by sodium hydroxide) can be a cost-effective alternative for the complete removal of chromium. However, the interaction of operating variables such as time, dose, and pH need to be known in order to design an efficient treatment process.

In this study, the effect of operating variables (mentioned above) for chromium removal by sulfite reduction and alkali precipitation was investigated in a model system. Independent effects of operating conditions (sulfite dose and pH) were also evaluated based on Cr(VI) reduction efficiency. Results showed that maximum Cr(VI) reduction was attained after 20 minute-reaction time. Moreover, Cr(VI) concentration increases with sulfite dose and decreases with pH. Maximum Cr(VI) reduction efficiency (100%) was attained at pH 1.0 and 2g/L sulfite dose. For alkali precipitation, minimum residual total chromium (1.6 ppm) and Cr(VI) (0.023 ppm) concentrations can be attained at a pH range of 8 to 12. The treated synthetic solution complied with the DAO 35 limit of 0.1ppm for Cr(VI), however, the total chromium concentration was still above the 0.5ppm standard. Based on the optimum conditions obtained for sulfite

reduction and alkali precipitation, the treatment cost is estimated Php12.00/g Cr(VI) removed and Php2.07/g total Cr removed, respectively.

**Keywords:** alkali precipitation, chrome-plating industry, hexavalent chromium, sulfite reduction, tannery

## EST-4

### **Alkali Precipitation of Gold Smelting Wastewater and Cement-Based Solidification/Stabilization of Its Wet Copper Sludge Using Rice Hull Ash as Admixture**

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An evaluation of the feasibility of alkali precipitation for the removal of heavy metals, with copper as primary consideration, from gold smelting wastewater was performed. Removal efficiencies and final dissolved concentrations of copper, and other heavy metals, in the effluent were used as performance indicators. The optimum pH to which the heavy metals can be simultaneously precipitated, with copper as the main concern, is obtained. Also, the use of solidification/stabilization technology to the sludge formed from alkali precipitation was evaluated. The effects of varying the proportions of ordinary Portland cement, rice hull ash, and wet sludge on the unconfined compressive strength, durability, and leachability properties of the blocks were evaluated.

Results for alkali precipitation showed that the optimum pH for copper and other heavy metals removal is at pH 11.5 where copper, lead, and chromium removal efficiencies are found to be 99.998%, 99.763%, and 88.593%, respectively. At the optimum pH, the final dissolved concentrations of the metals are 0.18 ppm, 0.47 ppm, and 1.07 ppm for copper, lead, and chromium, respectively. Copper and lead final dissolved concentrations fell within DENR standards, while that of chromium did not. The alkali dose at the optimum pH is 9.583 g NaOH per liter of wastewater. The amount of sludge produced is 11.88 g sludge per liter of wastewater.

Results for the solidification/stabilization of alkali precipitation sludge showed that all the blocks produced passed the 50 psi-standard for unconfined compressive strength. For the durability test, only design mix E (0.54:0.23:0.23), F (1.0:0.0:0.0), H (0.65:0.0:0.35), and I (0.77:0.11:0.12)

passed the strict limit of 10% weight loss. All blocks passed TCLP based on the 1 ppm standard set by USEPA 40 CFR 141; Japanese legislation and Thai Legislation. Preliminary costing analysis showed that 0.41 Php is needed per liter of wastewater, for the whole treatment process.

**Keywords:** alkali precipitation, copper, rice hull

## **EST-5**

### **A Cellular Automata Approach for Wide-Area Simulation of Runoff and Flooding: The Case of the Laguna Lake Catchment**

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We constructed a model of the surface runoff of water based on cellular automata (CA) to simulate the surface flow, surface storage, and finally inundation of water in a very large water catchment area. The purpose of the model is to characterize a given catchment area based on the dual plots of rainfall and flood graphs. Our CA model of surface runoff simulates unsteady flow by utilizing three factors: (1) conservation of mass, (2) the Manning's equations, and (3) an algorithm to delay water movement from one unit area to the next unit area. We have utilized the digital elevation model (DEM) at a resolution of 30 meters (30m x 30m pixel) of the Laguna Lake catchment area from the surface data of Shuttle Radar Topography Mission (SRTM). The surface runoff and storage in the catchment area is modeled by  $50 \times 10^6$  CA cells, each corresponding to a 30m x 30m area, over a catchment of approximately  $4.5 \times 10^6$  hectares. From the simulation, given a particular rainfall intensity and duration, we have identified several areas that are prone to flash floods. From these areas, we have compiled their respective rainfall-lag time relations from flood graphs. These graphs provide information as to when flash floods will hit an area given the onset of a rainfall of known intensity and duration.

**Keywords:** cellular automata, Laguna Lake catchment, surface runoff, wide-area flooding

## EST-6

### **Anaerobic Treatability of Combined Wastewater from Acid Esterification and NaOH-Methanol Transesterification of *Jatropha curcas* L. Oil Using Upflow Filter Bed Reactor**

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With the passage of the Biofuels Act, the government has mandated the use of liquid biofuels (biodiesel and bioethanol). For biodiesel, it should be blended with diesel ( 1%, then 2%). Using biodiesel blend can help reduce our country's dependence on foreign oil imports. The advantages of biodiesel include the following: 1) it can be used directly in any existing, unmodified diesel engine; 2) feedstock for biodiesel is not imported; 3) biodiesel produces fewer emissions of carbon monoxide, particulate and toxic chemicals that can contribute to different environmental and health hazards; and 4) it reduces carbon dioxide emissions resulting in less global warming.

*Jatropha curcas*, L. is a non-food feedstock for biodiesel production. For this emerging industry, it is important to guarantee the adoption of appropriate technology for wastewater treatment.

In general, the biodiesel plant generates about 8 to 10 liters wastewater for every liter of biodiesel produced. For the wastewater generated from acid esterification and NaOH-methanol transesterification of oil from *J. curcas* , the chemical oxygen demand (COD) is 61,465 mg/L; the biochemical oxygen demand (BOD) is 35,563 mg/L; and its pH is 4.23.

In this study, anaerobic digestion was employed to examine the effects of increasing organic loading rate ( OLR) : 800, 1000, and 1200 mg/L-day; and initial pH of the substrate, gas production and % COD reduction using filter bed reactor. An upflow filter bed reactor with an effective volume capacity of 5.0 L was fabricated using stainless steel capped with 0.63 cm-thick plexiglass. The cylindrical reactor had dimensions of 11.9 cm I.D. and total height of 54 cm ( 9 cm of the total height was the 20% void volume or headspace). The total volume of the reactor was 6.0 L with a headspace volume of 1.0 L. The effluent from the reactor was collected daily for analysis.

Increasing OLR caused some fluctuations in pH and temperature but the range was still suitable for anaerobic digestion. The % COD reduction from OLR of 800 to 1000 mg/L-day, decreased but eventually increased at OLR of

1200 mg/L-day. Highest % COD reduction (90 %) and good gas production were achieved in filter bed reactor at OLR of 1200 mg/L-day. With 90% COD reduction and good gas production, it may be concluded that the anaerobic filter bed is efficient.

**Keywords:** biodiesel, bioethanol, *Jatropha curcas*, wastewater

## EST-7

### Electrolytic Recovery of Silver From Gold Smelting Wastewater

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Effluents coming from the gold smelting industry in Meycauayan, Bulacan contain considerable amounts of valuable heavy metals such as silver, which is traditionally by copper-displacement method. This process however produces copper-rich effluent which cannot be disposed directly to the river; and also, the copper bars used in this method incur additional operating cost. To eliminate the use of valuable and yet hazardous copper metal, one of the alternative technologies which may be used in silver recovery is electrodeposition.

The electrodeposition of silver from gold smelting wastewater was investigated. The effects of operating current and time on silver removal efficiency were investigated using residual silver concentration plots. Secondary effects were also observed from temperature, and pH profiles. Higher silver removal rates and silver removal efficiencies were observed at increased operating currents. Electrodeposition at 9A operating current showed 98.67% silver recovery after 30 minutes. Also, a maximum of 75% co-deposition of copper during the process was also noted. Increase in temperature and decrease in pH were observed during the operation. Charge dose for silver electrodeposition which will be used as a scale-up operating factor was found to be approximately 1.24 coulombs/mg metal removed. The computed energy requirement was found to be in the range of  $5.56 \times 10^{-4}$  to  $6.12 \times 10^{-4}$  kWh/mg metal removed while the maximum energy cost was approximately 127.41 PhP/m<sup>3</sup> wastewater.

**Keywords:** charge dose, electrodeposition, energy requirement, Gold smelting, silver

## EST-8

### **Production and Assessment of Physical and Chemical Properties of Particleboard from *Cocos nucifera* (Coconut) with Polyethylene and Polystyrene as Binders**

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Coconut husk is the fibrous mesocarp which lies between the tough exocarp or outer covering and the endocarp or hard shell which encloses the kernel. The main value of coconut husks lies in its fibre content. The coir fibers are extracted from the fruit coconut. It grows in the part between the husk of the coconut and its outer shell. The color of this fiber is golden; therefore it is also known as golden fiber. Coir fibers are water-proof in nature. The main objective of this research was to produce a particle board made from coir fibers of coconut palm (*Cocos nucifera*) with polyethylene and polystyrene as binders or polymer matrix. The coir fibers were obtained from coconut copra harvested from the province of Pangasinan. The polymer binders that were used were from polystyrene cups and polyethylene plastic bags purchased from SM supermarket. The particleboards that were made from the coconut husk fibers/ polystyrene (PS) and coconut husk fibers / polyethylene had the following weight-weight ratio of 20:80, 30:70 and 40:60. The fiber and the polymer were mixed on the roll milling machine to form a homogenous mat. The tests made were: chemical resistance analysis, tensile strength, breaking strength test, density, moisture, infrared spectra and scanning electron microscope.

The 40:60 ratios of the fiber/ polymer gave a slight change in the size and texture upon exposure to 10% H<sub>2</sub>SO<sub>4</sub> and 10% NaOH. It was due to the larger amount of fiber present in the composite which leads to the absorption of both acid and base making the sample to swell and deteriorate. The 30:70 fiber/polystyrene can support an average load of 167.86 lbs, unlike fiber/polyethylene composite which can only support an average load of 71.76 lbs. The results shows that the fiber/polystyrene was also superior compared to fiber/polyethylene composite in terms of flexural strength.

Fiber/polystyrene composite can withstand an average load of 58.67 lbs and the fiber/polyethylene composite can only hold an average load of 17.33 lbs. Among the composite ratio, 30:70 and 40:60 fiber/polystyrene composite gave almost the same result in flexural strength and were better than the 20:80 fiber/polystyrene composite. As the ratio of the fiber against the polymer increases, the denser the particle board becomes. The density of the fiber/polystyrene 20:80 was  $0.9695\text{g/cm}^3$  compared to the fiber/polyethylene  $0.8905\text{g/cm}^3$ . The moisture content ranged from 0.19 to 0.75% for all the different ratios of the particleboard. The scanning electron microscope was used to characterize the surface morphology of the specimen and to check the distribution of the fibers on the particleboard. The magnifications used were: 150, 750, 1500, and 3,500.

**Keywords:** particleboard, polyethylene, polystyrene, scanning electron microscope.

## **EST-9**

### **Body Formulations and Forming Techniques of Ceramic Products Utilizing Clay Materials in Ilocos Norte**

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Clay materials in Ilocos Norte had been used as raw materials for the local and traditional manufacture of ceramic products. These clays have been mined for several years and their physical characteristics have not been determined, hence the ceramic body formulations and forming techniques have not been established. Samples of clay materials were taken from Nangguyudan, Paoay; Bayog, Burgos; Barabar, San Nicolas; and Macayepyep, Banna and their physical properties and mineralogy were determined. Ceramic body formulations and forming techniques were developed using the clay materials and other local additives like sand dunes and river sand. Plasticity index, drying shrinkage and slaking properties of the formed bodies were determined. The ceramic wares made of the different body formulation and their corresponding forming techniques were fired at  $850^\circ\text{C}$ ,  $900^\circ\text{C}$ ,  $950^\circ\text{C}$  and  $1000^\circ\text{C}$  to establish their optimum firing



temperature, porosity, fired shrinkage and strength. The results of the experiments were presented in a matrix which can be easily used by the local ceramic manufacturers.

**Keywords:** ceramics, clay, drying, firing, mineralogy, plasticity, shrinkage

## EST-10

### **Mineralogical and Chemical Characterization of White Clay Deposits in Ilocos Norte for Use in High-Grade Ceramics**

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This research focuses on the chemical and mineralogical suitability of white clay deposits in Ilocos Norte for use in high-grade ceramics. Clay samples gathered from Solsona (ELSOL1 & 2) and Pagudpud (PAGPAS & PAGPAN) were elutriated prior to X-ray Diffraction (XRD) and X-ray Fluorescence (XRF) analyses. All four samples were shown in the XRD analyses to contain kaolinite as the dominant mineral phase with impurities such as quartz and illite. The XRF chemical analyses reflect the dominance of the kaolinite as indicated by the proportional amounts of  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  as the major oxide constituents. Minor oxide chemical constituents include  $\text{MgO}$ ,  $\text{CaO}$ ,  $\text{TiO}_2$ , total Fe,  $\text{Na}_2\text{O}$ , and  $\text{K}_2\text{O}$  with trace amounts of  $\text{MnO}$  and  $\text{P}_2\text{O}_5$ .

The results of this study are very useful in determining the appropriate beneficiation process for the improvement of the quality and significant property of white clay deposits in Ilocos Norte for its utilization in high-grade ceramics.

**Keywords:** chemical composition, mineralogical composition, white clay, XRF, XRD

## EST-11

### Characterization of Ceramic Water Filter Specimen Made from Nangguyudan Red Clay and Saw Dust

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Water is one of the most essential elements in our everyday living. However, nowadays, the quality of potable water supplied by our local water authority and the quality of deep-well water as well is critical and unsafe for drinking due to extreme population growth and waste that are generated daily.

Various types of filter elements ranging from organic materials, to metals, and to ceramics are used to make water potable. Ceramics are preferred because these materials are inert, heat resistant, lightweight and porous. Its porosity can be designed to different sizes; hence, it can be used for various applications.

The study therefore, generally aims to characterize the physical properties of the ceramic water filter specimen made from Nangguyudan red clay and sawdust and to test if the water filtered from the prototype filter is potable. The materials were: screened Nangguyudan red clay as the main raw material and screened sawdust as pore forming agent. Three different mixtures were prepared and mixed at 10% moisture. Specimens were formed through pressing and oven dried at 110°C and finally fired at 1000°C.

Results showed that the higher the sawdust content in the formulation the higher the percent water absorption and percent apparent porosity were obtained. The resulting bulk density showed that the higher the percent sawdust the lower bulk density was obtained. Analysis of the filtered water showed that the prototype ceramic water filter made can filter out bacteria (*E. Coli* and *Coliform*) ranging from 22.32% to 33.93%. Local raw materials like Nangguyudan red clay and sawdust were found promising for ceramic water filter production.

**Keywords:** ceramic, clay, filters, sawdust, water

## EST-12

# **Engineering Properties of Briquette Produced from Agricultural Wastes Exposed to Different Processing Temperatures**

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The study was conducted to produce briquettes composed of rice hull ash with carabao manure as the binding material.

The sample briquettes produced were subjected to three treatment temperatures; 700°C, 900°C and 1100°C respectively. After exposure to the processing temperatures, the briquettes were subjected to different engineering properties such as bulk density determination, compressive strength analysis and scanning electron microscopic (SEM) analysis, ash content determination, volatile combustible matter and fixed carbon analysis, sulphur content determination and calorific value determination.

The briquettes subjected to the different processing temperatures had the same color (black). The odor of the samples exposed to 900° and 1100°C have the same odor of a typical charcoal, but the odor of the manure was still observed on the samples in 700°C. It is due to the fact that some of the major substances that contribute to the odor of the briquette had not been driven-off at temperature of 700°C.

Physical test showed that when the processing temperature increased, the bulk density of the sample increased due to the formation of fine particles which relatively minimized the void spaces between the briquette particles. Compressive strength analysis showed that the optimum temperature that the briquette must be subjected is from 700 – 900°C, to produce a strong material that cannot be easily distorted or broken down.

Scanning Electron Microscopy SEM analysis on its surface morphology showed the internal microstructure of the briquette. Samples exposed to 900°C had the highly compacted structure due to the presence of small pores. Loosen structure was observed in the briquettes exposed to 1100°C which account for its low compressive strength.

Chemical test showed that the increasing processing temperature had no significant effect to the ash content, sulphur content, fixed carbon and calorific value of the briquette. The volatile combustible matter on the

sample decreased upon subjection from 700°C to 1100°C due to the extreme effect of increasing temperature.

**Keywords:** briquettes, bulk density, compressive strength, fixed carbon volatile combustible matter

## EST-13

### Design and Development of BPRE Quick Sorter

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Responding to the need of the onion growers for a cheaper and locally-available sorter, the BPRE implemented a study to develop a quick onion sorter that is technically and financially viable when used under our local conditions. The BPRE quick sorter consisted of four (4) assemblies, namely; frame, drive, grading and conveying assemblies. The hopper has a slatted floor so that onions to be graded can also be cleaned. The grading cylinders are detachable for wider range of application to similarly-shaped crops like citrus and some varieties of potato. The results of field testing revealed that the BPRE quick sorter when used as a sorter alone has a grading capacity and efficiency of 253 bags/day and 93.21 percent, respectively at a grading roller speed of 9 rpm. The financial profitability analysis shows that as owner/operator and rentee of BPRE quick sorter has a return generated of P47.25/bag and P43.32/bag, respectively. However, the investor that will acquire the machine for custom services will have a total income and return on investment of P11,589.30 and 33.11 percent for 3 months of operation; respectively. The investment cost can be recovered in 3.02 years. The developed technology could substantially reduce drudgery in grading, increase labor productivity, facilitate timeliness of operations and provide better buyer protection. The use of mechanical sorter could also facilitate the adoption of onion grades or standards in the market.

**Keywords:** sorter, quick, capacity, efficiency, financial profitability analysis

## EST-14

### The Multi-Commodity Heat Pump Dryer

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A multi-commodity heat pump drying system was designed, developed and commissioned using the basic principles of refrigeration and air conditioning.

The system has two compartments: Compartment A is the dehumidifier consisting of a 2.0 hp, heavy duty compressor, condenser, evaporator, expansion valve and 2 auxiliary fans while, compartment B is the drying chamber with the following: 21 drying trays where samples to be dried are laid for drying.

Heat sensitive fruits, vegetables, marine products and other bulb crops were dried and to evaluate the drying, dehumidifying and thermal efficiencies of the system. Results showed that all the considered samples exhibited the same appearance with respect to reduced color degradation and were very safe either for storage or for secondary processing to be used as ingredients to other foods.

Favorable drying, thermal and dehumidifying efficiencies of the system contributed to dehydrated, hygienic, nutritious and healthy food products.

**Keywords:** dehumidifying efficiency, drying efficiency, heat pump drier, latent heat, sensible heat, thermal efficiency

## **EST-15**

### **Body Formulations and Forming Techniques of Ceramic Products Utilizing Clay Materials in Ilocos Norte**

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Clay materials in Ilocos Norte had been used as raw materials for the local and traditional manufacture of ceramic products. These clays have been mined for several years and their physical characteristics have not been determined, hence the ceramic body formulations and forming techniques have not been established. Samples of clay materials were taken from Nangguyudan, Paoay; Bayog, Burgos; Barabar, San Nicolas; and Macayepyep, Banna and their physical properties and mineralogy were determined. Ceramic body formulations and forming techniques were developed using the clay materials and other local additives like sand dunes and river sand. Plasticity index, drying shrinkage and slaking properties of the formed bodies were determined. The ceramic wares made of the different body formulation and their corresponding forming techniques were fired at 850°C, 900°C, 950°C and 1000°C to establish their optimum firing temperature, porosity, fired shrinkage and strength. The results of the experiments were presented in a matrix which can be easily used by the local ceramic manufacturers.

**Keywords:** ceramics, clay, drying, firing, mineralogy, plasticity, shrinkage

## EST-16

### **Design and Development of Corn Row-Crop Cultivator**

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The general objective of the study was to develop a corn row-crop cultivator with fertilizer applicator that is technically and financially viable under local conditions. Results showed that the developed corn row-crop cultivator is a 2 in 1 machine. It can cultivate and apply fertilizer at the same time. . The machine attained a theoretical and actual capacity of 3.0 and 1.24 ha/day, respectively at an average forward speed of 5.3 km/hr. The investment cost of P15,088.00 can be recovered in 1.24. Moreover, the machine is profitable with a benefit cost ratio (BCR) and internal rate of return (IRR) of 2.90 and 77.91%, from the assumption that an investor shall acquire the machine for custom services. The developed machine could substantially reduce the production cost, human drudgery and labor requirement, facilitate efficient and timeliness of operations, can be substituted to imported cultivator, and increase productivity among corn farmers.

**Keywords:** economic viability, fertilizer application rate, increase productivity, row-crop cultivator, technical efficiency

**EST-17**

## **Effects of Hermetic Storage in the Saclob and Super Bag on Quality of Rice Seeds and Milled Rice of Different Rice Varieties in the Philippines**

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PhilRice's SACLOB and IRRI's super bag are hermetic storage systems for prolonged grain storage. SACLOB is a 1 ton-capacity enclosure for storage bags while super bag is a plastic liner inside 50 kg-storage bag. This study was conducted to determine the effect of hermetic storage in SACLOB and super bag versus conventional storage with or without ordinary plastic liner on quality of seed stored for 6 or 12 months. The experiments were conducted at the PhilRice warehouses in all stations and in Iloilo using five inbred varieties in Nueva Ecija, two in Agusan, and one each in other locations. The seeds were stored in SACLOB, super bag, and conventional bag with and without ordinary liner. Treatments were replicated five to nine times or two and three times/variety in Nueva Ecija and Agusan, respectively. Initial samples were taken prior to storage and final samples after storage. Initial MC ranged from 11.7 to 13.6% and germination from 91 to 99.6% across locations.

Moisture exchange between the surrounding air and the grains exceeded beyond 14% in Negros, Agusan, and for NSICRc148 in Nueva Ecija. The super bag and SACLOB in Agusan effectively reduced MC with 0.9% increase compared with 2.3% in the control resulting in improved seed germination from <1% to 31 to 55%. Super bag outperformed SACLOB in Negros with 2.2% increase in MC compared with 3% increase in the control. Correspondingly, germination rate increased from 0 to 65%. High germination rate (>90%) was maintained for 6 months in Iloilo, Bukidnon, and Midsayap where increases in MC were low (0.2 to 0.7%) and for NSICRc150 and 134 in Nueva Ecija. The SACLOB and super bag effectively reduced the number of living insects to 9 kg<sup>-1</sup> without using pesticide. In the conventional storage, insect levels increased to 174 kg<sup>-1</sup> in Agusan, 49 kg<sup>-1</sup> in Midsayap, and 98 kg<sup>-1</sup> in Negros. Milling recovery did not differ among treatments across locations but differed among varieties. This study showed that hermetic storage provides a simple way to lower



insect infestation and improve seed germination and that ordinary system may also work well with properly maintained warehouses.

**Key words:** hermetic, oxygen level, SACLOB, seed quality, super bag

## EST-18

### **Influence of Calamansi and Virgin Coconut Oil as Active Reagents on the Acceptability of Liquid Handwash**

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The newly formulated liquid handwash with calamansi extract and 5 grams virgin coconut oil enhance its odor and foam-forming ability, respectively. The product had the liquid handwash qualities, light yellow in color, moderately pleasant odor, slightly thick in viscosity and very foamy based on the sensory evaluation using descriptive testing as evaluated by twenty trained panelists. The general acceptability rating of the most preferred liquid handwash with calamansi extract was “Like Moderately”, while “Like Slightly”, for liquid handwash with virgin coconut oil as active reagents, based on the 9-point hedonic scale as perceived by 50 consumer panelists. The preference rating of the most preferred sample significantly differs as to its odor and foam-forming ability using Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT) at 5% level of significance; however its quality is comparable with the liquid hand wash of the Department of Science and Technology – Industrial Technology and Development Institute (DOST-ITDI). The product had a pH value of 6.50 and a bacterial count of  $2.00 \times 10^3$  cfu/g sample, per result of laboratory analysis. The preparation of liquid handwash with calamansi extract and virgin coconut oil lowers the cost of hand washing activities of the schools, colleges and universities to prevent the influenza A(H1N1), the country's lifestyle disease, which respond the Department of Education Management Memorandum to all schools, colleges and universities in Cebu Province to motivate the students to observe hand washing before and after eating and most especially before and after using the comfort rooms.

**Keywords:** calamansi extract, foam-forming ability, liquid hand wash, odor, virgin coconut oil

# **HEALTH SCIENCES**

## HS-1

### Prevalence of *CYP3A4\*18*, *GSTM1 0/0* and *GSTT1 0/0*: A Preliminary Study of Gene Polymorphism as Biomarkers for Drug Therapy Among Filipinos

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The inter-patient difference in drug metabolism is documented to be attributable to heritable genetic variations in the nucleotide sequence and deletion of genes coding for these drug metabolizing enzymes involved in drug transport, metabolism and action. The finding of the existence variant alleles and knowledge about their genotypic/allelic frequency in specific ethnic groups are important to lead to individualized drug dosing and improved therapeutics. This study aimed to detect SNP in *CYP3A4* and the homozygous deletion (*0/0*) of *GSTM1* and *GSTT1* in a Filipino population. One-hundred and forty two Filipino subjects were genotyped of the *CYP3A4\*18* SNP by using PCR-RFLP with *HpaII* endonuclease and the *GSTM1 0/0* and *GSTT1 0/0* by basic PCR with  $\alpha$ -globin as internal positive control, all were followed by AGE. The sample DNA pool conformed to the Hardy-Weinberg equilibrium ( $\chi^2=0.01685$ ) based on the gathered genotype frequencies. In the group of 142 sample DNAs, the frequency of the *CYP3A4\*18* variant allele found in the Filipino population was 2.11%. The percentage of *GSTM1 0/0* observed was 64.08%, while that for *GSTT1 0/0* was 48.59%. Relative to studies done that evaluated some ethnic group worldwide, the frequency of the variant allele of the *CYP3A4\*18* cannot be said to be significantly different with the Korean, Japanese and Malaysian studies. The percentage of *GSTM1 0/0* observed in Filipinos was significantly higher than Indians, Chinese, Japanese, Korean and Caucasian while that of *GSTT1 0/0* was significantly higher than Indians and Caucasians but significantly lower than Chinese, Japanese and Koreans.

**Keywords:** *CYP3A4*, *GSTM1*, *GSTT1*, metabolism, polymorphism

## HS-2

### **Clinical and Cytogenetic Profile of Turner Syndrome Patients in a Tertiary Hospital in the Philippines: Prevalence of Variant Karyotypes and Other Undiagnosed Cases**

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Turner Syndrome (TS) is a genetic disorder occurring in about 1 out of every 2000 live births and is generally characterized by the presence of a single X chromosome (45,X), as opposed to a normal female karyotype of 46, XX. Typical clinical features of TS include, short stature, gonadal dysgenesis, webbed neck, low posterior hairline, broad chest with widely-spaced nipples and a high incidence of renal and cardiovascular diseases. In this study we report a total of 68 patients referred to the laboratory from 1996-2008 for cytogenetic study based on various clinical symptoms/manifestations. Peripheral blood samples were extracted from these patients and were processed following the short-term lymphocyte cell culture and GTG banding techniques. Image capture and identification of the chromosomes were done using the Cytovision Imaging System. Results showed that 33 patients (48%) have abnormal karyotypes. Of these 10 carried the classical TS karyotype (45,X); 4 were 46,X,i(Xq); 5 were 45,X/46,XX; 1 was 45,X/46,X,i(Xq); 9 were mosaic 45,X/other X abnormalities and 1 was mosaic of 46,XX and other X abnormality. Although majority of these patients presented the typical TS stigmata, in some cases these clinical features were not distinctly observed. Early cytogenetic screening will greatly help physicians in managing TS patients as chromosomal constitution (e.g. variants) is clinically significant. Moreover, in this study we observe a higher number of variants over the classic TS karyotype. The presence of cytogenetic variants in Turner syndrome supports the claim that the syndrome results from a complex interaction of genes in the X chromosomes and is not only due to the absence of one X chromosome. Despite these established karyotypes, the molecular genetics of TS is still not completely understood. Nevertheless, these cytogenetic

findings form an important dimension in understanding the complete etiology of the syndrome.

**Keywords:** cytogenetic, diagnosis, karyotype, Turner Syndrome, variant

### HS-3

## **On Rats and Students: Effects of *Ginkgo biloba* and Glutaphos on Learning and Memory**

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Two randomized placebo-controlled experiments were done to examine and compare the effects of drugs (*Ginkgo biloba* and glutaphos) on learning and memory. In experiment 1, the effects of *Ginkgo biloba* and glutaphos were measured based on the escape latency and learning performance of 15 white male rats in the water maze and wood maze. Drugs and placebo were administered daily at 70 mg/kg for eight weeks. Four sessions, which were two weeks apart, were conducted within the 2-month drug administration. Each session consisted of 9 trials in each of the mazes. The escape latency and learning performance were recorded in the water maze and wood maze respectively. Results in the water maze show that *Ginkgo biloba* improved learning and memory as compared to glutaphos and placebo. Subjects administered with *Ginkgo biloba* significantly had better escape latencies than the glutaphos and placebo. Glutaphos, although better than placebo, was ineffective in improving learning and memory in the water maze. In the wood maze, both *Ginkgo biloba* and glutaphos as compared to placebo showed benefits in the learning performance of the subjects. Glutaphos, like *Ginkgo biloba*, was able to improve learning performance in the wood maze. Mean scores of subjects administered with glutaphos were significantly better than placebo. Escape latency in the water maze and learning performance in the wood maze were highly correlated indicating consistency on the effects of the drugs. In sum, Experiment 1 confirmed the cognitive benefits of *Ginkgo biloba* as past studies have shown and showed that glutaphos is less effective than *Ginkgo biloba* in improving learning and memory.

In Experiment 2, the effects of the drugs were studied on two primed recognition tasks (recognition-to-sample and recognition-to-nonsample )

among 41 college students. The two tasks approximated explicit and implicit memory processes respectively. Drug dosage was 3 tablets/capsules/day within a period of two months. Two sessions (4<sup>th</sup> and 8<sup>th</sup> week) were done for both recognition tasks. In the recognition-to-sample, participants were asked to complete 30 fragmented words based on the words presented in the study phase (explicit task). Results show that *Ginkgo biloba* improved the recognition of words based on the words presented as compared to glutaphos and placebo. In the recognition-to-nonsample, participants were asked to complete the 30 fragmented words without specifically referring to the words presented in the study phase (implicit task); instead, they were to supply the missing letter based on any suitable words that came to their minds. Results show no significant differences among *Ginkgo biloba*, glutaphos, and placebo. In sum, the results suggest that *Ginkgo biloba* has limited cognitive benefits while glutaphos, although better than placebo, appears to have negligible effect in improving learning and memory.

The two experiments show that the enhancing effects of *Ginkgo biloba* on learning and memory seem to be limited to some cognitive tasks, for example, explicit memory tests, while benefits for glutaphos seem small. However, the possibility that some factors, for example, dosage employed and the dependent measures used, contributed much to the nonsignificant result for glutaphos. Results show that in all the measures in both experiments, glutaphos is consistently higher than placebo suggesting that it may also improve learning and memory but did not reach significance level.

**Keywords:** *Ginkgo biloba*, glutaphos, rats, learning performance, cognitive tasks

## HS-4

### **Dietary Supplement from *Moringa oleifera* (Malunggay), *Syzygium cumini* (Duhat) and *Musa sapientum* (Saba)**

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Based on literature and initial studies conducted; *Moringa oleifera*, *Syzygium cumini* and *Musa sapientum* were reported to be potential sources of the bioactive substances responsible to the blood sugar lowering effect. Studies on the development of a dietary supplement using a combination of the 3 plants were therefore undertaken.

Polarity-based fractionation of the extracts from *Moringa oleifera*, *Syzygium cumini* and *Musa sapientum* was carried out using petroleum ether, ether, chloroform and ethyl alcohol. The different fractions obtained were subjected to thin-layer chromatography and phytochemical analysis.

Based on the number of compounds present as shown by Thin-Layer Chromatography (TLC) profile, the ethanol fraction was used to investigate the blood glucose lowering effect of the three (3) plants. Results of the phytochemical analysis showed the presence of flavonoids, alkaloids, saponins, amino acids, tannins, glycosides and anthraquinones.

Guided by the TLC and phytochemical analyses, a dietary supplement was developed by combining the ethanol fractions from the three (3) plants in 1:1:1 proportion. This dietary supplement was subjected for blood sugar lowering test using Alloxan-induced diabetic rats. Results showed that the developed dietary supplement exhibited significant blood sugar lowering effect at 400 mg/kg body weight comparable with the positive control Glibenclamide at 30 mg/kg body weight. It is noteworthy to mention that the dietary supplement exhibited its lowering effect to the very high reading ( $\pm 600$  mg/dL) of blood glucose. This shows that the dietary supplement works wonder towards severe hyperglycemia (high blood glucose).

**Keywords:** Alloxan-Induced diabetes, Dietary supplement, *Moringa oleifera*, Severe hyperglycemia

## HS-5

### **Hypoglycemic Activity Determination and Characterization of Potential Active Metabolite(s) from the Leaves of *Zizyphus mauritia* Lam (Manzanitas)**

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*Zizyphus mauritiana* Lam belongs to kingdom Plantae and Family Rhamnaceae. The plant is a vigorous grower and has a rapidly – developing taproot. It may be a bushy shrub 4 to 6 feet high or a tree 10 to 30 ft tall; erect or wide spreading with gracefully drooping branches and down zigzag branchlets, thornless or set with short, sharp, straight or hoofed spines. It may be evergreen or leafless for several weeks in hot summer. The leaves are alternate, ovate, or oblong – elliptic, 1 to 2½ m long, ¾ to 1½ in wide; on the upper surface, they are very gloss, dark-green, with 3 conspicuous, depressed, longitudinal veins and there are very fine teeth on the margins. This study was undertaken to investigate the hypoglycemic activity of the bioactive component from the leaves of *Zizyphus mauritiana* Lam.

The homogenized dried leaves of *Zizyphus mauritiana* Lam were soaked in methanol for 5 days, filtered and concentrated under reduced pressure using a rotary evaporator. It is then subjected to polarity – based partitioning and yielded semi-crude extracts: hexane extract labeled as M<sub>1</sub>, ethyl acetate extract labeled as M<sub>2</sub> and water extract labeled as M<sub>3</sub>. Glucose peroxidase test results of the hexane extract (M<sub>1</sub>), ethyl acetate extract (M<sub>2</sub>) and water (M<sub>3</sub>) extract yielded 47.06%, 60.0 % and 39.24% decrease in Blood Glucose Level respectively from the serum of the Swiss Webster strain Albino mice. The ethyl acetate crude extract (M<sub>2</sub>), showed the highest and significant decrease of blood glucose level which suggested that the ethyl acetate extract (M<sub>2</sub>) is the most active among the three (3) extracts and the plausible active metabolite (S) may be found on it.

Chromatographic separation of M<sub>2</sub> yielded 5 significant fractions labeled as MH, MI, MK, and ML. Glucose Peroxidase test of MH, MI, MJ, MK and ML gave 38.5, 46.7, 61.3, 44.7 and 42.9% decrease in blood glucose level respectively. This suggested that the ethyl acetate fraction MJ is the most active among the four (4) fractions and it suggests that the active



metabolite (S) can be found in MJ. These results confirm that the ethyl acetate extract of the leaves of manzanitas has an antidiabetic activity.

Further fractionation of MJ yielded MJ<sub>2</sub>. Chemical characterization by infrared spectra confirmed an aromatic C-H stretch at 2924.82 cm<sup>-1</sup> and a methyl C-H stretch at 2924.82cm<sup>-1</sup>. The weak absorption band for C=O is at 1737.21 cm<sup>-1</sup> and a strong absorption band for C=O, stretching for normal dimeric carbonyl at 1655.55 cm<sup>-1</sup> and 1623.26 cm<sup>-1</sup> and a medium absorption band for C-O-H in plane. A medium absorption band at 1230.52 cm<sup>-1</sup> shows the possibility of an amide N-H and a weak absorption at 701.13 cm<sup>-1</sup> for N-H out-of-plane wagging. The frequency at 3377.38 cm<sup>-1</sup> showed an absorption of O-H stretch for carboxylic acid dimer. The UV spectrum of the isolate had a maximum wavelength at 320 nm with the absorbance of 0.167 and the minimum wavelength at 234 nm with the absorbance of 1.412. The results of the gas chromatography-mass spectra of the isolate revealed that 4-methylesculetin might be responsible for the hypoglycemic activity and this belongs to the family of coumarin which is abundantly found in the green leaves of the plants

**Keywords:** coumarin, gas-chromatography, hypoglycemia, infrared spectra, ultraviolet spectra, 4-methylesculetin,.

## HS-6

### **Isolation and Preliminary Screening of Locally Isolation Actinomycetes and Other Bacteria from Mangrove Soil in Surigao Del Sur**

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Microorganisms are a prolific source of structurally diverse bioactive metabolites and have yielded some of the most important products of the pharmaceutical industry. The most important property of Actinomycetes is its ability to produce various antibiotics and bioactive compounds valuable for medical, veterinary and agricultural use. *Streptomyces* spp. produce more than 50% of known antibiotics and various types of biologically active

compounds including antibiotics, antitumor agents, antifungal agents, antiparasitics and immunosuppressants. In response to this important medical challenge, the search for new antibiotics has been intensified and new bacterial targets are being sought and used for screening. Fifty-three Actinomycetes and 217 other bacteria were isolated from 15 soil samples collected from mangrove areas in Surigao del Sur. Preliminary screening was done by agar plug method against *Staphylococcus aureus* B-1823, *Bacillus cereus* B-1509, *Escherichia coli* B-1825, *Pseudomonas aeruginosa* and *Ralstonia solanacearum*. Actinomycete isolate #25 greatly inhibited the growth of *E. coli* and *S. aureus* (11,9mm and 26mm, respectively). However, isolate #206 inhibited *B. cereus* by 24,5mm and isolate #151 inhibited *R. solanacearum* by 16.6mm. Bacillus isolate #209, #158 and #53 produced broad spectrum antibiotics because it inhibited both gram positive *S. aureus* (12.6mm, 24.7 and 16.4mm, respectively), *B. cereus* (13.9mm, 19mm and 18.3mm) while gram-negative *R. solanacearum* (12.8mm., 15.6mm and 15.9mm). These isolates will be further studied for the possible source of novel bioactive compounds which can be cheaper and effective than existing antibiotics.

**Keywords:** Actinomycetes, *Pseudomonas*, *Ralstonia*

**HS-7**

## **Calliphorid Larval Secretions as Naturopathic Antiseptic**

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There is a significant increasing public interest of the use of alternative therapies for wound management due to the emergence and continued rise of bacterial resistance and the persisting controversy regarding current commercial antiseptics. Maggots of the Calliphorid flies were previously used as alternative and complementary therapy for the treatment of wounds. However, high quality scientific evidence that clearly establishes the efficacy of this alternative intervention is lacking. Thus, this study investigated the in vitro efficacy of Calliphorid larval secretions/excretions against potentially pathogenic bacteria commonly associated with wounds:

*Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli* and *Enterococcus faecalis*. Disc diffusion assays demonstrated that maggot secretions/excretions (ES) were inhibitory to three out of the four bacterial models: *E. coli* being the most susceptible and *E. faecalis* was observed to be resistant to all dilutions of the larval ES. However, the suspension from two-day old larvae was found to be more effective (zones of inhibition ranged from 7mm – 14mm) than the ES collected from three-day old maggots (mean zone of inhibition of 7mm). Although the antibacterial activities of the larval exudates were considered significant, the selected commercially available antiseptics still exhibited superior inhibitory effect. Nevertheless, the low mutagenic potential of the ES infers its safety for human utilization. The results provided baseline information of the inhibitory activity of maggot secretions in vitro against common pathogens and could in turn be further developed and refined by future researches as a low-cost alternative medicine which could remedy the problem of expensive wound treatments.

**Keywords:** antiseptic, calliphorid larvae, larval secretions/excretions, wound treatment

## HS-8

### **Prevalence of CTX-M Extended Spectrum $\hat{\alpha}$ -Lactamase Among Enterobacteriaceae at a Private Tertiary Hospital in Southern Philippines**

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Extended spectrum  $\hat{\alpha}$ -lactamase (ESBL)-producing Enterobacteriaceae are one of the growing global healthcare concerns due to their increasing incidence and resistance to a broad range of  $\hat{\alpha}$ -lactams and other common antimicrobial agents. Infection caused by these bacteria has complicated treatment strategies and compounded health care cost. In order to evaluate the prevalence of ESBL-producing Enterobacteriaceae, clinical isolates

were collected from period September 2005 to September 2008 at Mindanao Sanitarium and Hospital, southern Philippines. Strains of *Escherichia coli*, *Klebsiella* species and *Enterobacter* species showing resistance or reduced susceptibility to third generation cephalosporins were screened and confirmed for ESBL production. From a total of 583 isolates, 30 (5.1%) were confirmed ESBL-producers. Most (60%) of the isolates produce CTX-M type ESBL. Sixty three percent (12/19) of the *Escherichia coli*, 40% (2/5) of *Klebsiella* spp., and 67% (4/6) of *Enterobacter* spp., produce CTX-M  $\beta$ -lactamase. Eighty nine percent of the ESBL-producing Enterobacteriaceae co-express resistance to quinolones and all are still sensitive to carbapenems. Major risk factors include length of hospital stay (> 3 days), presence of comorbid illness and invasive medical devices. Of the admitted patients, 2.4% were colonized with ESBL-producing Enterobacteriaceae.

**Keywords:** clinical samples, CTX-M, ESBL, Enterobacteriaceae, prevalence, resistance

## HS-9

### **Amylase-Homolog Gene (Blo t 4) from *Blomia tropicalis*: cDNA Cloning, Expression and Allergenicity**

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*Blomia tropicalis* is a clinically important house dust mite in the tropics and subtropics responsible for sensitization of up to 90% of atopic individuals. This study describes cDNA cloning of the group 4 allergen of *B. tropicalis* (*Blo t 4 allergen*), expression in *Pichia pastoris* and the evaluation of its allergenicity. Using the Smart RACE cDNA amplification kit, a 1,607 bp cDNA fragment was cloned with 65% nucleotide sequence homology to group 4 mite amylase allergens. from a *B. tropicalis* cDNA library. The cloned Blo t 4 cDNA sequence codes 495 amino acid protein with a predicted molecular weight of 56 kDa. The Blo t 4 gene sequence was cloned into the

Xho 1 and Not 1 sites of the pPIC9 vector and was transformed into *Pichia pastoris*. A highly soluble recombinant Blo t 4 (rBlo t 4) allergen was expressed with estimated protein yield of 20-30 mg/Liter of yeast culture. Sensitization profile analysis using enzyme linked immunosorbent assay to detect rBlo t 4-specific IgE showed differential allergenicity linked to geographical regions. Differences in IgE reactivity were identified in three different population including 28% (28/100) IgE reactivity in asthmatic cohort from Chengdu China; 20% (90/458) IgE reactivity in asthmatic cohort from Manila, Philippines; and 4% (2/49) IgE reactivity in asthmatic cohort from Singapore. Group 4 allergen from *B. tropicalis* (Blo t 4) may be an important dust mite allergen in certain distinct populations.

**Keywords:** allergenicity, *Blomia tropicalis*, amylase, DNA

## HS-10

### Development of Loop-Mediated Isothermal Amplification for the Rapid Detection of *Entamoeba histolytica*

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Amebiasis, caused by the intestinal parasite *Entamoeba histolytica*, is responsible for the estimated 100,000 deaths annually worldwide. Polymerase chain reaction is currently the most reliable means of detection but requires expensive thermal cyclers and electrophoresis to confirm results, machines not readily available in some endemic areas. Loop-mediated isothermal amplification (LAMP) is a recent technique able to rapidly, specifically, and cost efficiently amplify DNA by exploiting the strand-displacing capacity of *Bst* polymerase and the activity of designed primers that target a segment of the amebic 18S SSU rDNA of the HK-9 strain. A 25 $\mu$ L reaction mixture composed of 1x reaction buffer, dNTPs (1.4mM), *Bst* polymerase (8U), 2 inner primers (3.2 $\mu$ M each), 2 outer primers (0.4 $\mu$ M each), 2 loop primers (1.6 $\mu$ M each), and 5 $\mu$ L extracted DNA was maintained at 63°C for 90 minutes. Addition of SYBR Green I determined a successful reaction with a green luminescence under UV light. Negative tubes containing the DNA of a nonpathogenic but morphologically similar species, *Entamoeba dispar*, as well as the protozoans *Blastocystis*

*hominis*, and *Trichomonas vaginalis* revealed a dull yellow orange color. Electrophoresis of the products yielded a unique ladder pattern for the positive tubes indicating products with varied sizes while no bands appeared for the negative tubes. Thus, LAMP is a viable tool for the specific, rapid, and cost-efficient detection of *E. histolytica*.

**Keywords:** diagnosis, *Entamoeba histolytica*, loop-mediated isothermal amplification, polymerase chain reaction

## HS-11

### Variability and Heritability Analysis of Eating Behavior Among Ethnic Groups in Iligan City, Philippines

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Obesity is an increasing problem in the Philippines and is a major risk factor for chronic diseases such as diabetes, hypertension and cardiovascular diseases. However, very little is known about the heritability of behavioral traits, particularly that of eating behavior, that are tightly associated with obesity. This study was conducted to determine variability and heritability of eating behavior among ethnic groups in Iligan City, Philippines. The sample is comprised of people from diverse cultural backgrounds including Filipino Chinese, Ilonggo, Cebuano, Iliganon, Maranao, Tausog and Lumads. The Eating Behavior Questionnaire (EBQ) was used as an instrument to assess eight dimensions in eating style: food responsiveness, enjoyment of food, emotional overeating, desire to drink, satiety responsiveness, slowness in eating, emotional under-eating and fussiness. Heritability coefficients ( $h^2$ )

were calculated and associations between the eating behavior of the parents and the offspring were also computed using Pearson's *r*. Results showed differences in the heritability values among the eight dimensions of eating style across ethnic groups. Also, variations in the eating behavior were observed based on the results of the MANOVA of the EBQ score matrix. The results of this study are discussed in the light of how heritability of eating behavior would differ among populations that differ in the distribution of environmental risk factors for obesity.

**Keywords:** eating style, eating behavior questionnaire, ethnic groups, heritability, obesity

## HS-12

### **Quality of Life and Health Status of Local Residence Near the Linamon Sanitary Landfill, Mindanao, Philippines**

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The health status and quality of life of the locals living near a sanitary landfill in Barangay Purakan, Linamon, Lanao del Norte, Philippines was surveyed. The sanitary landfill in Barangay Purakan is a closed 1-hectare lot located atop a mountain with full to partial hydro geological isolation to reduce leakage from the base of the site. It is managed by the Local Government of Linamon and maintained under the Basura Atras Linamon Abante sa Kalambuan (BALAK) program. The results of the study showed a high average quality of life index for the locals for all domains (Health and functioning: 27.44/30; Family: 26.50/30; Psychological and Spiritual: 22.59/30; Socioeconomic: 19.83/30). The success of the BALAK program can also be seen from the low frequency of pulmonary diseases among the respondents surveyed. Only 3% among the males and 2% of the females were seen to have tuberculosis, asthma, and seasonal cough. Medical intervention

in the form of Botika ng Bayan program of the local government is very effective in addressing these health problems. Proper waste segregation is also practiced among the locals and no scavengers and waste pickers are around the area. The results of this study will serve as baseline information for comparison of and evaluation of the health implications of solid waste disposal in other dump sites in Northern Mindanao.

**Keywords:** health check, quality of life, sanitary landfill, solid waste management

## HS-13

### **Comparative Study on the Information Transfer Patterns in Human EEG**

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This study is about measuring the net information transfer and determining directed exchange of information between different regions of the human brain. Specific goal of the study is to calculate net transfer entropy for two conditions: eyes open and eyes closed.

Free running electroencephalographic (EEG) signals were taken from 11 healthy adults. Ten channels were used in the analysis. The channels are the scalp electrode placements located in the frontal lobe (F3, F4, Fz), parietal lobe (Pz, P3, P4), occipital lobe (Oz) and central portion of the brain in line with the left and right ears (C3, C4, Cz). Transfer entropy calculation used 45 combinations of channel pairs, i.e. Oz Fz, Fz Oz, etc., and averaged over all channel pairs in all subjects. The algorithm utilized adaptive binning technique in giving estimates of transfer entropy. The calculation was performed using Scilab software.

Result shows that the average net transfer entropy oscillate in the range [-0.271, 0.222] bits for eyes closed and [-0.581, 0.466] bits for eyes open.



The mean values are 0.015 and -0.024 bits, respectively. The standard deviation,  $\sigma$ , on both ranges shows that it is nearly doubled at eyes open condition. It has been found out that information transfer is much activated from the occipital lobe (channel Oz) going to the other regions of the brain in the eyes open condition.

From this study, transfer entropy established measures of information transfer in human EEG. It is found out that 64% of the number of human subjects shows that information transfers from channel Oz are greater in the eyes open condition which confirms present knowledge on the actuation of primary visual cortex at the occipital lobe.

**Keywords:** EEG, information transfer, occipital lobe, primary visual cortex, transfer entropy

## HS-14

### **Diabeat-IT Telehealth Nursing Program: A Preliminary Study on its Effects on Diet and Physical Activity Compliance, Body Mass Index and Capillary Blood Glucose Levels Among Diabetes Mellitus Type 2 Clients**

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Telehealth nursing refers to the use of telecommunications and information technology for providing nursing services in health care whenever large distances, time constraints, transportation problems, interfere between patients and the delivery of quality health care. The use of Telehealth Nursing in the Diabeat-It TeleHealth Nursing Program was not effectively utilized on lowering the body mass index and capillary blood glucose levels because of insufficient time thus proving no significant differences with or without telehealth as an intervention. Both body mass indexes and capillary blood glucose levels for the pretest and post-test of the telehealth and non-telehealth group had only little difference when compared. However, regarding diet and physical activity compliance, the use of telehealth nursing was effectively utilized thereby proving a significant difference with the program as intervention. With diet compliance, the telehealth group ingested more food that is healthier and

more proper for diabetics compared to the control group. The group had a higher intake of fruits, vegetables, low-medium glycemic index carbohydrates, and lean meat than the non-telehealth group. With physical activity compliance, the telehealth group spent a longer duration on physical activity than the non-telehealth group.

**Keywords:** Diabetes mellitus, dietary module, Lifestyle modification, Telehealth Nursing

# **SOCIAL SCIENCES**

SS-1

## **Framing in Legislation: The Case of Population Policy in the Philippines**

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Examination of framed products and framing processes has contributed greatly to how we understand the dynamics of public discourse and its influence on policies and on public opinion. This paper investigates political framing of population in policy discourse through an analysis of legislative documents filed in Philippine Congress from 1987 to 2008. The legislative documents for this study includes bills and resolutions related to population, family planning, maternal and child health, reproductive health, or contraception. Policy texts were classified into three sets: population management, reproductive health and family planning (FP), and anti-abortion and anti-FP. Semantic network analysis was conducted using a textual analysis program called CatPac which uses word frequencies and distances to estimate patterns of association. Each of the three sets of texts was analyzed separately with each set yielding different world clusters. Analysis reveals that while the “population management” frame focuses on social and economic consequences of uncontrolled population growth, the “reproductive health” frame defines the problem from a health perspective. This shift in problem definition of the population issue reflects the political actors' active framing of a policy issue. Both sets of policies propose aggressive FP programs but each frame uses distinct political rhetoric and semantic approach to argue its position and solutions. The “anti-abortion and anti-FP” frame meanwhile identifies two main problems: increase in incidence of abortion and an existing policy that prohibits health professionals from refusing patients information on contraception. Right to life is invoked as the central value with the state having an obligation to protect the life of the unborn. By invoking a moral argument and anchoring on rights, anti-abortion and anti-FP policies challenge the problem and solutions identified by the population management and the reproductive health frames. Practical and methodological implications are discussed.

**Keywords:** Framing, Legislation, Population Policy, Semantic Network Analysis, Textual Analysis

SS-2

## **Is Income Growth Enough to Reduce Fertility Rate? Empirical Evidence from Regional Panel Data**

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The population debate in the country has been dynamic and contentious. On the one hand, proponents of population management say that the rapid population growth in the Philippines has hindered the country's economic development; on the other hand, those against it are saying that population growth is uncorrelated with economic growth. The idea behind the link between population and economic growth is the demographic transition, a change from a situation of high fertility and high mortality to one of low fertility and low mortality and speeding up the demographic transition placed emphasis on the need of public efforts to speed up the voluntary reduction in fertility rates. This paper looks at the relationship between per capita income and total fertility rate (TFR), controlling for other factors, using a regional panel econometric model using data from the National Demographic and Health Survey (NDHS), among others. The results show that increasing per capita income indeed reduces TFR: a 1% growth in per capita income decreases TFR by 0.027. If per capita income growth increases at an average rate of 2% per year, the country will have to wait until 2030 before hitting the replacement rate. The paper also shows that higher educational level of household heads reduces TFR. If the percentage of household heads with at least a high school diploma increases by 2 percentage points each year, and if real per capita GDP also grows at an average rate of 2% per year, the replacement rate can be achieved in ten years. This paper shows that while income growth reduces total fertility rate, the impact of income alone is not enough to speed up the demographic transition. Therefore, proactive government policies are important to trigger and accelerate the demographic transition process.

**Keywords:** Demographic Transition, Fixed Effects Model, Income Growth, Panel Data Analysis, Total Fertility Rate

SS-3

## **Caring for My Baby's Baby: The Lived Experiences of Mothers Whose Adolescent Daughters Also Became Mothers**

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A descriptive thematic analysis was conducted to describe the lived experiences of grandmothers in families with teen mothers. The study was done to five mothers of five teen mothers. Interviews were conducted and revealed emerging themes namely, Deem, Direction, Dear, and Deed. The coding themes explains the initial view of the mother regarding the daughter and her pregnancy, the help the mother gave in attaining the growth and productivity of the daughter, the relationship of the mother with her daughter and the feelings the mother portrayed during the course of pregnancy and child rearing. These have implications for the grandmothers' ability to handle the situations they face. This would help educators, nurse practitioners, the families of the mothers of adolescent mothers, the government sector and the nursing organizations in dealing with the emerging problems associated with the increase in teenage pregnancy.

**Keywords:** Adolescent mothers, caring for baby, early pregnancy, lived experiences

SS-4

## **Food Inflation, Underemployment and Hunger Incidence in the Philippines: A Vector Autoregressive (VAR) Analysis**

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The high level of hunger incidence in the country is one of the most pressing issues that need to be addressed by our policy makers. Official government statistics and data from perception-based surveys show an increasing trend in hunger incidence among Filipino households. Data from National Statistical Coordination Board (NSCB) shows that the percentage of subsistence poor households in the country increased to 14.6 percent in 2006 from 13.5 percent in 2003, while data from the Social Weather Stations (SWS) perception surveys show an increasing trend in hunger incidence, reaching an alarming level of 20.3 percent in June 2009. This paper looks at the impact of food inflation and underemployment on hunger incidence in the Philippines using data from the SWS quarterly surveys from 1999 to 2009. One probable cause of the increasing trend in hunger incidence is the rising food prices, similar to what we experienced in 2008. An econometric model based on the vector autoregressive (VAR) model is used to determine the effect of shocks (or increases) to food inflation and underemployment on hunger incidence. Results show that an increase in food prices at the current quarter increases hunger incidence in the succeeding three quarters. In particular, a one percentage point increase in food inflation at the current quarter increases hunger incidence by about 1.15 percentage points in the next quarter. Shocks to underemployment will also increase hunger incidence but the effect lasts for only two quarters. The model estimates that a one-percentage point increase in the underemployment rate at the current quarter increases hunger incidence by about 0.41 percentage point in the next quarter. The results from this study provide relevant information that will be useful to the Hunger Mitigation Program of the government.

**Keywords:** food inflation, hunger incidence, impulse response function, underemployment, variance decomposition, vector autoregressive models

SS-5

## **Balancing Between Cash and Food: The Case of Rainfed Rice Farmers Affected by Climate Change**

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Rice farmers in rainfed areas have become even more vulnerable with increasing occurrence of extreme climatic conditions such as typhoons and drought; but they continually need to adapt for the household's subsistence. For low-income rice farmers, balancing between producing rice for food and for cash is a problematic task. This study aims to estimate the economic returns from rice; assess farm household's rice allocation; identify farming adaptation practices to climate change and; recommend alternative agricultural systems to improve incomes.

The study was conducted in selected rice farms in San Juan, Batangas and utilized primary and secondary data. Primary data sources include surveys and direct observations. Profitability and whole farm analyses were done to determine the economic performance of different rice-based farming systems. Qualitative analysis was used to describe the adaptation practices and household's allocation of rice.

Changes in cropping patterns and calendars due to either shortage or too much rainfall were the most significant consequences of climate change in rainfed farms. As a result, farmers face enormous risks in their crop production as they live through minimal incomes. Rice yield was lowest at 0.70 ton/ha/cropping. Where turn-around time and water are more favourable, rice yield was 3.8 tons/ha, resulting in higher gross value of production. Net incomes from rice sales are nil after quantities are saved for food, credit payments and seeds. When farmers opt to sell rice, they have little cash but not enough food. Farmers continue to take risks primarily for the household's food security. Cash is constantly a predicament, but somehow farmers adapt by producing livestock, vegetables and other upland crops. Farmers, however, need not be impoverished with climate change. Agricultural systems technologies can be introduced to help farmers cope. These may include short duration and high yielding rice varieties, improved cropping systems and crop diversification.

**Keywords:** climate change, farming systems, food security



SS-6

## **Assessment of Equity in Two Community Based Forest Management Projects in Nueva Vizcaya, Philippines**

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The study assessed the CBFM participants' perception of equity, relationships between the participants' characteristics (gender, educational attainment, economic status and type of membership) and perceptions of CBFM goals (improved living condition and forest condition), and differences in the perception of equity and CBFM goals in the two tenure regimes namely: CBFM Project in Banila and Co-management Project in Barobbob, Nueva Vizcaya. Household survey and key informant interviews were employed to obtain information. Results of the intra-community study revealed that equity across gender, educational attainment, economic status and type of membership in the People's Organization (PO) generally exists in the sharing of leadership roles, livelihood opportunities, PO services, access to forest-based resources, sharing of cost and responsibilities in community forestry activities, and in the implementation of CBFM policies in the two tenure regimes. Similarly, CBFM goals were also noted to have improved along with the perceived equity on these dimensions. Using correlation tests, there were few significant relationships distilled between the participants' characteristics, perception of equity and CBFM goals. Likewise, results of the t-tests revealed significant differences in the participants' perceptions of equity and CBFM goals. These information therefore highlighted the strong and weak points of each tenure regime where policy improvements should also be done.

**Keywords:** CBFM, equity policy, tenure regime

SS-7

## **Preserving Indigenous Agricultural and Natural Resource Strategies Through Participatory Communication Approaches in Barangay Amganad, Banaue, Ifugao**

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Indigenous knowledge embedded in community practices, institutions, cultural values and belief systems is a key concept in the sustainability of agriculture and the environment. The community plays a vital role in the preservation of such knowledge. The paper presents participatory communication approaches as tools for the development of communication materials in preserving Indigenous Agricultural and Natural Resource Strategies (IANRS) in Barangay Amganad, Banaue, Ifugao.

Key Informant (KI) interviews were conducted to solicit information on IANRS in the study area. Focus Group Discussion (FGD) workshops with selected participants were also conducted for the development of communication materials on two IANRS, *Muyong* and *Payew*, respectively. Another set of meeting was also conducted to present, validate and improve the developed communication materials. The community members identified community poster, comic story booklet and radio plug as the most effective forms of communication materials to preserve and popularize their IANRS. Evaluation of the community poster (*Muyong* and *Payew*), showed that the message was generally well understood and perceived to be intended for the Ifugao farmers and their families. For the comic story booklet, participants showed high comprehension and enjoyed the story they conceptualized during the workshops. Suggestions from the community for the improvement of the materials on various aspects such as image sizes and color were considered and used as inputs for the revision of the materials.

The communication materials produced through participatory communication approaches are highly understandable, acceptable and attractive to the participating community. It also fosters synergy among experts, semi-technical staffs, government workers and the community. These types of communication materials if properly disseminated could help

in the preservation of IANRS in the area for both the present and future generations.

**Keywords:** Indigenous knowledge, *Muyong*, natural resource, participatory communication approaches, *Payew*

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