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ABSTRACTS of PAPERS

Presented during the
33rd NAST Annual Scientific Meeting

*Meeting the Challenges of
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AGRICULTURAL SCIENCES

AGRICULTURAL SCIENCES DIVISION

AS-01

MANAGEMENT PRACTICES OF GROUPEL CAGE CULTURE IN NEGROS OCCIDENTAL

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The study was conducted to evaluate the farming practices of 68 grouper cage growers in the four grouper growing LGUs in Negros Occidental. A research questionnaire was formulated to investigate the farming practices from stocking until harvest and marketing. The purpose of the study was to provide insights about the strengths and weaknesses of grouper cage culture. It further paves the way for an effective management and production intervention in the context of sustainable aquaculture. The data gathered can be used as a baseline reference for the local government units and concerned government agencies to promote long term livelihood opportunities for small scale fish farmers. Results showed that the industry is still dependent on wild caught grouper fry with poor survival rates. Relatively large number of farmers stocked their cages at low stocking density and still used trash fish as food for the fish. Almost all farmers revealed that mortalities do occur in their cages which were attributed to poor environmental conditions and diseases. Also, majority of the farmers had limited technical knowledge on husbandry and health management resulting to low production. This study suggested that practical training courses on grouper culture should be initiated by the academe in collaboration with the LGUs and other government agencies to enhance competencies in managing grouper cage culture.

Keywords: management practices, grouper cage culture, stocking, feeding, sampling, monitoring of water parameters, disease control and prevention, harvesting

AS - 02

**FINANCIAL ANALYSIS AND RISK
ASSESSMENT OF GROUPEL CAGE CULTURE SYSTEMS
IN NEGROS OCCIDENTAL**

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The study assessed the financial and risk exposures of grouper cage farming in Negros Occidental. Through survey questionnaires administered to 68 grouper cage growers in the four grouper growing areas in Binalbagan, Himamaylan, Hinigaran, and Sagay, the study appraised the feasibility and viability of grouper cage farming and established a benchmark for cage farmers in making crucial investment decisions in mariculture development. Data on the financial analysis and risk indicators were analyzed using the mean, range, and standard deviation. Data were presented by province and by LGUs. Results of the study showed that a return of investment (ROI) of 29.95% was realized which was far behind the ROI of some aquaculture projects like shrimp hatchery (40%) and grouper culture in ponds (82%). Further, the analysis showed a payback period of 3.88 years which seem not economically feasible as it posed a high risk of payment default when capital is sourced from banks. It was also noted that the length of the cropping cycle is prolonged from normally 8 months to 10.6 months average and had a long recovery period (3 years and 6 months) for the capital invested. Though the project is not financially attractive in some variables, the project was still feasible in most important variables like profit per crop (Php26541.76) and profit margin (29.91%). Among the four LGUs, Binalbagan showed to have the best performance in both financial analysis and risk indicators- indicating that the area is attractive for mariculture project. To promote competition in the buying and selling of groupers so that the best price of groupers could benefit the farmers, government should take steps to invite more businessmen to get involved in the live fish trade by providing incentives in the form of negotiated freight rates, tax discounts and soft loans.

Keywords: financial analysis, risk assessments, mariculture, grouper cage culture, risk exposure indicators

AS - 03

**THE EFFECT OF GREEN MUSSELS (*Perna viridis*)
AS BIOFILTERS IN THE REDUCTION OF
TURBIDITY IN PRAWN POND**

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Green mussels (*Perna viridis*) at average weight of 10 g were tested as biofilters for 45 days inside the prawn nursery ponds at 12,000 pcs of mussels /ha, stocking rate. Mussels in cultches were placed in net bags and were hanged along the series of bamboo plots installed in the middle of the pond. Water transparency and other parameters like pH, temperature, salinity, and dissolved oxygen were monitored twice daily at 7:00-7:30 am and 5:00-5:30 pm. Results of the study showed that average transparency readings in the treated ponds (stocked with mussels) were 56 cm for Nursery Pond-2 and 45 cm for Nursery Pond-13 while in the control ponds (without mussels) showed 26 cm for Nursery Pond-1 and 32 cm for Nursery Pond-14. In NP-2, transparency reading greater than 56 cm was observed in 21 consecutive monitoring days. Transparency was only reduced when inorganic fertilizer was applied to hasten plankton growth. It was apparent that planktons grew densely in the control ponds as indicated in the low transparency of greenish to yellowish green color of the water. Average DO reading however, was lower in the treated ponds. The decrease of DO could have been the effect of mussels as additional biomass and competitors of oxygen. Moreover, metabolic wastes from green mussels resulted to additional organic loads which caused the increase of chemical oxygen demand. There were no marked difference on pH, salinity and temperature in all ponds. The study suggested that to efficiently filter water, mussels should be placed in the ponds' reservoir or in the water supply canal instead of placing them inside the nursery or rearing ponds.

Keywords: biofilters, transparency, planktons, biomass, dissolved oxygen

AS - 04

**GOOD AQUACULTURE PRACTICES AT RESOURCES
PRODUCTION TECHNOLOGY, INCORPORATED: BASIS
FOR EXTENSION SERVICES DEVELOPMENT**

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The study was conducted in 2009 to the employees of the Resources Production Technology (REPROTECH), Inc. in Manjuyod, Oriental Negros to find out the company's level of compliance to good aquaculture practices (GAQP) in marine fish cages and fish ponds as preliminaries of accreditation. The questionnaire, a five-point Likert Scale, had been used in similar studies. The areas in the fish cages rated, based on principles and guidelines in Fisheries Administrative Order (FAO) 214 s. 2001 (the Code of Practice for Aquaculture) and on certification guidelines for Best Aquaculture Practices (BAP), were the following: site selection, design and construction; feeds, feeding, and seed health management; seed selection, stocking; harvesting and product handling; farm management; records; traceability; and workers safety and employees' relations. The computed grand mean obtained by the company when assessed in areas for good aquaculture practices in fish cages, based on tabled range values and interpretations, was 4.12 or highly satisfactory. The areas in fish ponds rated, based on the mentioned guidelines, were the following: site selection; pond design and construction; water usage and effluent management; use of drugs, chemicals, toxic pesticides and fertilizers; seed selection; seed health and farm management; records; traceability; mangrove conservation and biodiversity protection; feeds, feeding, and water management; harvesting and product handling; worker's safety and employees' relations. The grand mean obtained by the company when assessed under areas for good aquaculture practices in fishponds was 4.06 or highly satisfactory. When taken together, REPROTECH's performance on good aquaculture practices in fish cages and in fish ponds was highly satisfactory, much better than its moderately satisfactory performance obtained before this study. The recommendation was to develop Sanitation Standard Operating Procedures (SSOP) as another step of the company to conform to Hazard Analysis Critical Control Point (HACCP) to satisfy its quest for accreditation.

Keywords: GAQP, HACCP, REPROTECH, Inc., marine fish cage, aquaculture practices

AS - 05

**LOW-VOLUME, HIGH-DENSITY CULTURE OF MILKFISH
(*Chanos chanos*, Forsskal) IN MARINE NET CAGES AT
NORTH BAIS, BAY, ORIENTAL NEGROS**

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The study was conducted in 2008 at Resources Production Technology (REPROTECH), Incorporated, an integrated aquaculture business in the north Bais Bay (Manjuyod side), Oriental Negros. It aimed to find out the feasibility and viability of milkfish (*Chanos chanos*, Forsskal) cultured in five 180-m³ (6m x 6m x 5m) low-volume high-density (LVHD) marine net cages and to establish a benchmark for cage milkfish farmers using a promising technology that can have significant contribution to socio-economic growth and food security. The results showed that the cultured milkfish attained an average body weight of 376.32 grams after 163 average culture days, a survival rate of 100%, and a 2.4 feed conversion ratio - satisfactory enough to generate a profit in a cropping period. The average production per 180-m³ cage reached 2,480 kg or 13.78 kg/m³. The profit was Php 34.94 per kilogram, indicating an earning even if milkfish price per kilogram dropped by 10%. Milkfish production in high-volume, low-density (HVLD) floating cages was economically viable for small- and medium-enterprise fish farmers and offered an estimated 64.18% return of investment and a 0.4 year payback period. It was recommended that generated technology on milkfish culture in LVHD marine net cages be shared through training and extension programs of Carlos Hilado Memorial State College-Binalbagan.

Keywords: stocking density, mariculture, milkfish culture, marine net cage, LVHD

AS - 06

**SPECIES PREFERENCE OF FISH PEN FARMERS
IN HIMAMAYLAN CITY: AN ENRICHED EXTENSION
PROGRAM OF CARLOS HILADO MEMORIAL STATE
COLLEGE-COLLEGE OF FISHERIES**

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The study surveyed the species preference of fish pen farmers in Himamaylan City, Negros Occidental in 2009 as basis to enrich the extension program of Carlos Hilado Memorial State College-College of Fisheries. The questionnaire gathered selected personal variables of the respondents for profiling, their culture practices, species preference, the factors affecting their species choice, and their fish-farming problems.

The results were as follows: the fish pen farmers were middle-aged, dominantly male and married; majority reached college; their experience in fish pen farming was reasonably long but not very long; with a sizable combined average annual family income above poverty line; all engaged in monoculture with intensive production scale; stocked between 16 to 20 fishes per square meter; used commercial feeds; culturing their stock between 5 to 7 months; sourced their fry from the wild and hatchery; fed their stock to satiation twice daily; commonly practiced partial or selective harvesting; sampled their stock irregularly; most grew milkfish. The influencing factors modifying species preference were environmental parameters like pen location, economics like feed supply and harvest prices, biology of the cultured species, and technical factors like site proximity to markets. The occurring problems but seldom encountered were turbidity, salinity, low dissolved oxygen, and unstable supply of fry. The recommendations: extension program for fish pen farmers in Himamaylan City should focus on providing education and information on modern fish culture methods, perils of overstocking, effects of overfeeding, etc.; and stocking manipulation to avert mass mortality likely to occur during neap tides.

Keywords: species preference, fish pens, extension program, fish farming, surveys

AS - 07

FISHER FOLK ORGANIZATIONS AND RESOURCE REHABILITATION: A UNIFIED THRUST

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The study, using a questionnaire, surveyed the participation and capability of fisher folk organizations to rehabilitate coastal resources in three coastal towns of Fifth Congressional District of Negros Occidental during the second quarter of 2010. Results will serve as bases to formulate a unified thrust for coastal resources rehabilitation. The results of the study showed that the vision, mission, goals, and objectives of the fisher folk organizations were well stated and agreed with the provisions of R. A. 8550; the most notable problems met by the fisher folk were illegal fishing, overfishing, and pollution; the fisher folk's extent of participation in coastal resource rehabilitation was generally moderate; they assessed themselves as highly capable in coastal resource rehabilitation. The conclusions: the fisher folk were not as well-involved in coastal resources rehabilitation as they ought to be; and their capabilities and potentials not fully tapped. Recommendations included involvement of all the members in resource rehabilitation activities including attendance to training and seminars, and the creation of a federation of fisher folk organizations in the Fifth Congressional District for a unified thrust.

Keywords: survey, fisher folk organizations, coastal resources, resources rehabilitation

AS - 08

**THE EFFECT OF DIET SUPPLEMENTATION WITH
Cnidaria Scyphozoa Aurelia SOFT TISSUE ON THE MOLT-
DEATH SYNDROME OF *Scylla Serrata* MUD CRAB**

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Molt-death-disorders crop up during molting of the mud crab, *Scylla serrata*, and the probable cause of such mortality is typically attributed to inappropriate sustenance. The effects of supplementation using dried jellyfish, *Cnidaria Scyphozoa Aurelia* soft tissue on survival and molting success of *Scylla serrata* was investigated. One hundred *S. serrata* with body weights between 100-150 grams, were captured from coastal estuaries in Batan, Aklan, using baited traps and maintained communally at a stocking density of 3 heads/m², in bamboo pens constructed in a mangrove mudflat. One group (50 heads) was fed with trash fish for two weeks, starved for two days, prior to experimental feeding with trash fish complemented with dried *Cnidaria Scyphozoa Aurelia* jellyfish meat; control group was fed with trash fish for two weeks, starved for two days, before returning to trash fish diet without jellyfish supplementation. Feeding rate was computed at 10 percent of average body weight once daily for both groups. The test group was given jellyfish meat supplementation at satiety once daily in the morning. The duration of the research lasted for 60 days since the 2 day fasting phase. Individual weight was obtained by dividing the weight measured by the number of heads in the population. There were no significant differences ($P > 0.05$) in growth, apparent feed conversion ratio (FCR), among the two groups, following the 60 day experimental period. In both the control and supplemented groups, the crabs weighed between 330-350 g after 60 days of rearing. Survival rate after molting, was 85% in the supplemented group and was significantly ($P > 0.05$) higher than 65% observed in the control group. The mean carapace radius was appreciably ($P > 0.05$) higher in the supplemented group (3.2 in) than in the non-supplemented group (3.0 in).

Keywords: Molt-death-syndrome, *Scylla serrata*

AS - 09

**MICROWAVE-ASSISTED EXTRACTION OF
CARRAGEENAN FROM RED SEAWEED
(*Kappaphycus Spp.*)**

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This study compared the efficiency of the conventional heating procedure and the relatively rapid microwave-assisted technique in extracting carrageenan from red seaweeds. Different combinations of microwave power level and exposure time were employed in the microwave-assisted extractions (ME): ME₁ (80 watts, 1 min); ME₂ (80 watts, 2 min); ME₃ (80 watts, 3 min); ME₄ (240 watts, 1 min); ME₅ (240 watts, 2 min) and ME₆ (240 watts, 3 min).

Microwave-assisted extraction yielded carrageenan extracts ranging from 31.35 to 43.14 %. Conventional heating method produced only 26.72% extract.

All the carrageenan extracts were dried into chips and were subjected to physical and quality tests. Physical analyses of the carrageenan in terms of color, odor, texture and solubility were done. Meanwhile, the quality of the carrageenan was evaluated in terms of gel formation, viscosity, gel strength, type of carrageenan produced and microbial test.

The carrageenan chips were odorless, yellow to brown and had a coarse texture. Solubility test showed that carrageenan samples were soluble in water, milk solution and salt solution at temperature above 80°C. All samples showed formation of gels. Both the conventional heating and microwave-assisted extraction produced good quality of carrageenan gel in terms of viscosity and gel strength. The carrageenan is safe for human consumption based on methylene blue test.

Based from the results, carrageenan can be extracted with high percentage yield, high viscosity and gel strength by exposure of *Kappaphycus* species to microwave extraction at 240 watts for one (1) minute.

Keywords: carrageenan, microwave-assisted, extraction, seaweed, gel

AS - 10

BALANCING NUTRIENT REQUIREMENTS AND MANURE ODOR MANAGEMENT IN GROWING COBB BROILERS

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The responses of broilers to low crude protein diet with synthetic amino acid supplementation were investigated. A feeding program was designed for five hundred experimental single comb Cobb broilers, using a low protein feedstuff but supplemented with amino acids: isoleucine, leucine, glycine, histidine, methionine, cysteine, tyrosine, lysine, phenylalanine, threonine, and tryptophan. A control group was fed with a three phase feeding program (starter 1-15 days; grower 16-28 days; and finisher at 29-40 days). The objective of the study was to determine the effect of a low protein diet on broilers which were supplemented with dietary amino acids. The parameters compared were: average daily weight gain, food conversion ratio (FCR), thigh base weight, and serum proteins. The same averages of 5g/dL total serum protein, an index of visceral protein status, were obtained for both the control and experimental groups. Average weight gain per day of birds fed with the test diets and those fed with commercial formulations, were 4.7g/d and 4.6 g/d, respectively. Feed conversion ratio, FCR, were 2.1 kg feed/kg meat and 1.8 kg/kg meat from the experimental and control groups respectively. Average thigh ash weight of the experimental feeding group (16 ± 0.04 g) was heavier than in the commercial diet group (12 ± 0.04 g). Manure nitrogen emission was estimated weekly, on air filters, through a colorimetric comparison using bromphenol blue indicator. This study was able to demonstrate that poultry management employing very low crude protein diets supplemented with amino acids can significantly reduce manure nitrogen emissions, without compromising Cobb broiler health and economic productivity.

Keywords: amino acid supplementation, protein, Cobb broiler

AS - 11

USE OF THE AQUATIC WEED *Pistia stratiotes* FOR EARTHWORM AND VERMICOMPOST PRODUCTION

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The aquatic weed *Pistia stratiotes* is a major plant pest in lakes and ponds in the Philippines. No economical use for the harvested weed is available. The study was conducted to determine the usefulness of the plant for the production of earthworm biomass and vermicompost through vermiculture.

Plastic-lined outdoor beds were used for the vermicomposting of fresh *P. stratiotes* collected from infested ponds with the "African night crawler" (*Eudrilus eugeniae*). Earthworm breeders were stocked in the beds and cultured for 30 days. A comparative analysis of the compost (without earthworms) and vermicompost (with earthworms) was done. The compost and vermicompost were also tested in a pot experiment using upland **kangkong** (*Ipomea reptans*) as the test plant.

The results showed that there was a mean increase of 173% in the production of *E. eugeniae* in the beds. Mean vermicompost recovery was 46%. The percentages of the N, P, K, Ca and Mg were higher in the compost than those in the vermicompost as a result of their incorporation into the earthworm biomass. The plants fertilized with vermicompost had better survival and more uniform growth compared to the plants fertilized with compost possibly because of better nutrient availability.

Considering the results and the value of the earthworm biomass and vermicompost produced, it is concluded that the use of the aquatic weed for vermiculture is efficient and economical.

Keywords: aquatic weed, *Pistia stratiotes*, earthworm, vermicompost, vermiculture

AS - 12

**YELLOW CORN (*Zea mays* L.) INBRED
SCREENING FOR SALINE SOIL TOLERANCE**

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Development of salt tolerant crops is the most practical way of ensuring the sustainability of crop production in agricultural areas located along coastal regions. In these areas, corn remains as one of the popular crops although it is very susceptible to salt injury. To address this problem, a project was undertaken to develop yellow corn hybrids that would be tolerant to saline soils. Thus, a series of greenhouse and field trials were conducted to identify the yellow corn inbreds that could be used as parents for developing corn hybrids with salinity tolerance. Thirty yellow corn inbreds were evaluated during the screening using sand-culture and nutrient-culture techniques where the nutrient solutions used had different degree of salinity. Treatment combinations were laid out in randomized complete block design with salinity level as the main plot and inbred as the subplot. Results of greenhouse screening showed APS 9B-B-37-2-2-B, Tupi Yellow (D) 63-1-1-1-B, APS 17B-B-33-2-2-B, Tupi Yellow (D) 86-2-1-1-B and APS 19B-B-55-1-2-B were the inbreds that produced the highest shoot and root biomass among the inbreds under the salinity level of 10 dS m⁻¹. Normally, corn plant would be injured permanently and even die if exposed to salinity level of 4 dS m⁻¹. Further screening under field condition resulted in the selection of six inbreds, namely, APS 15B-B-37-1-1-B, APS 15B-B-70-2-1-B, APS 15B-B-70-2-2-B, Tupi Yellow (D) 63-1-1-1-B, Tupi Yellow (D) 86-2-1-1-B and APS 19B-B-55-1-2-B. The latter two inbreds also exhibited good growth under nutrient solution culture. All these selected inbreds will be used as parents in the diallel crosses that will eventually result in new yellow corn hybrids with better salinity tolerance for growing in salt-affected areas.

Keywords: corn inbreds, breeding, salinity tolerance, screening

AS - 13

INDIGENOUS KNOWLEDGE SYSTEMS AS STIMULUS TO A BETTER SOIL HEALTH AND BIONETWORK

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There have been increasing concerns worldwide on the adverse effects of highly intensive farming activities on the quality and safety of food, the environment, and their contribution to global warming. To address these issues, there must be a concerted effort among various stakeholders to promote the adoption of environment-friendly farming technologies. A project was conducted to document the indigenous practices and existing technologies in selected rice-based farming areas in Southern Luzon Philippines. Practices/strategies and technologies that focus on the improvement of soil health and the conservation of the remaining farm resources are importantly realized. Indigenous practices can be referred as unique practices belonging to a specific community or local group and that the people in a given community have developed over time, and still continue to develop. These practices are based on experience, often tested over years of use, adapted to local culture and environment and as their basis for natural resource management. The worsening ecological conditions of rice and vegetable farms in the project sites and the technological constraints affecting the soil quality were documented. This study showed that there are existing technologies which originated from traditional practices but were modified through time, or changes were made to fit the ecological conditions. Several farmers have been documented to employ innovative practices and approaches to control pests and diseases.

Food security and nutritional adequacy are important indicators of a stable and sustainable farming household and must be the major feature in any attempt to evaluate success in the future. The intensification of production must not be undertaken through ecologically destructive approaches, in which the indigenous knowledge systems may apply. Food security and nutritional adequacy are important indicators of a stable and sustainable farming household and must be the major feature in any attempt to evaluate success.

Keywords: soil health, ecosystem health, indigenous knowledge, sustainable farming system, farming practices

AS - 14

EFFECT OF HUMAN GEOGRAPHY ON SOIL AND ECOSYSTEM HEALTH

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In the Philippines the increasing demand for food, fiber, and energy vis-à-vis the declining hectareage of arable lands has been pressuring the agricultural sector to be more productive and meet the demand of the increasing population. The objective of this paper is to present an assessment of the contribution of human geography on soil and ecosystem health in selected sites in Laguna and Quezon, Philippines. The agricultural issues deliberated are focused on 'soil quality' and the impacts on the surrounding environment. The methodology employed in the study included resource assessment, physical observations, and surveys consisting of open- and close-ended questions including land use and cover changes and their relations to human population. The questionnaire was administered to each of the municipality under study and information obtained from the surveys were complemented through interviews with local officials in the relevant departments.

Research findings showed that the quantities of land available for agriculture are declining in all study sites. The deterioration of agricultural water quality in the country has rapidly proceeded with the vast increase in population accompanied by development and change in land use. Environment contaminants, particularly in soil and water, affect the well-being of the environment. This was brought about by the careless dumping of waste materials, excessive use of chemical fertilizers and pesticides, and increased agricultural activities to meet people's demand in terms of quantity and quality improvement of agricultural produce and food diversification. Since there is a growing demand for organic foods, driven primarily by consumers' perceptions of the quality and safety of these foods, it is important that governments, industry, and consumers carefully examine issues related to organic food quality and safety and ensure necessary interventions to protect the consumers.

Keywords: soil health, ecosystem health, soil quality, water quality, organic foods

AS - 15

**PROPORTION OF PHOSPHORUS, POTASSIUM, ZINC AND
MOLYBDENUM IN RELATION TO CORN
(*Zea mays L.*) GROWTH ON LIMESTONE-DERIVED SOILS**

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Limestone-derived soils or calcareous soils contain high amounts of CaCO_3 that effervesce when treated with 0.1 N HCl and which inherently possess several nutritional problems. Such unique chemical condition makes it one of the problem soils that generally have very low productivity. But the need to produce more food because of the increase in population coupled with the reduction of arable land per person makes it necessary to utilize these soils more effectively and efficiently.

This study was conducted to evaluate the physical and chemical attributes related to nutritional problems of corn on a CaCO_3 -derived soil and quantify the specific limitations and possible corrections.

A field experiment on the effect of fertilization, quantities and balances of phosphorus, potassium, zinc and molybdenum on the yield of corn on a limestone-derived soil from El Salvador, Misamis Oriental was conducted.

The pH of the surface and subsoil of the Bolinao clay were strongly acidic and moderately acidic, respectively, while the C horizon was alkaline. Free CaCO_3 was low in Bolinao clay especially at the solum which refers to the A (top soil) and B (subsoil) horizons (or zone of soil development) and does not include the C horizon. The surface soils were low in P and organic matter.

On a very weak calcareous Bolinao clay, corn responded only to P fertilization up to 120 kg P_2O_5 /ha. There were no significant yield increments attributed to K, Zn and Mo applications indicating that 0.8 meq K/100g and 10.9 ppm Zn were sufficient. The corresponding proportion of K on the exchange site was 1.6 % which produces Ca/K ratio of 20.5. High grain yields were associated with 0.29 % P and 2.0 % K in the earleaf. The corresponding nutrient proportions were 6.7 to 7.5 for K/Ca and 5 for K/Mg. Contrary to some results, Zn concentration in the earleaf, stover and grains increased as more P was applied.

Keywords: Corn, limestone, calcareous soils, problem soil, fertilization

AS - 16

**DEVELOPING LOW INORGANIC FERTILIZER
RECOMMENDATION FOR BANANA CVS. SABA
AND LAKATAN IN QUEZON PROVINCE**

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Banana is the most economically important fruit crop in the Philippines and the only locally grown fruit available year-round. Banana is grown in adverse environments in the country from the lowlands, flat and sloping uplands to the marginal hilly lands. Most banana plantations are found in Mindanao, well fed with inorganic fertilizers. This study was conducted to develop a low inorganic fertilizer recommendation for banana for low income farmers in Quezon Province. Three-month old tissue cultured banana cvs. Saba and Lakatan seedlings, half of which were pre- inoculated with biofertilizers (BF) Mykovam and BioN in the nursery during pricking, were outplanted in three farmers' farms in General Nakar and Infanta, Quezon Province. The experimental design was RCBD with four blocks. Planted seedlings were applied with either 100% Recommended Inorganic Fertilizer (RF = 250N:30P2O5:350K2O kg/ha) or 25% RF. Results show that, in all farms, the onset of fruiting and harvesting was earlier (556-570 days) in the 100%RF treated plants but not significant as compared with 25%RF+BF (588-663 days). Likewise, the number and weight of hands per bunch and the number of fingers per hand were generally higher in 100%RF than the 25%RF+BF but not significant from each other. However, the number of bunch harvested in the 100%RF was two to three times more than in 25%RF+BF. Total weight of hands per bunch in 100%RF ranged from 7.19-10.11 kg while in the 25%RF ranged from 5.28-5.87 kg. Results showed the feasibility of substituting more than half of the inorganic fertilizer recommendation with BF and maintaining the same performance as that of 100% RF.

Keywords: tissue-cultured banana, biofertilizers, Mykovam, Bio-N

AS - 17

**CRITICAL SOIL MOISTURE REQUIREMENT OF BANANA
CV. LAKATAN (*Musa acuminata* Colla.)**

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Most of the recommendations for banana production are based on the studies of banana cv. Cavendish. Studies for local banana cvs are necessary. A pot experiment in screen house was conducted to determine the critical soil moisture requirement of Lakatan banana at different growth stages. Three-month old tissue-cultured Lakatan banana seedlings were planted in half drums with 70-kg Lipa clay loam surface soil sample. The experiment was laid out in Randomized Complete Block Design (RCBD) with four soil moisture treatments (20, 25, 30, and 35% moisture by weight). Soil moisture treatments were maintained throughout the growing period of banana. Soil moisture was monitored semi-weekly and water was added to maintain the required water moisture level treatments. Agronomic parameters were collected monthly covering the different growth stages of the banana starting one month after transplanting. Plant biomass samples were partitioned and nutrient contents of each partition were analyzed. Nutrient content of the soil was analyzed monthly. Banana with 30 and 35% soil moisture levels were significantly taller, have broader leaf area, and larger pseudostem diameter compared with those with lower moisture levels. Plants with less than 30% soil moisture content tend to develop more roots due to water stress. Nutrient contents of the partitioned plant biomass with lower moisture contents (20 and 25%), showed high total nitrogen and phosphorus in the plant corm and stem while at higher moisture contents (30 and 35%) the nutrients were evenly distributed. Total phosphorus showed no distinct differences within the treatments. The 30% moisture level appeared to be optimum for the growth of banana. At 25% soil moisture content, the plants showed signs of water stress and a drastic reduction in growth rate and eventual death of the plants at 20% moisture content. This means that Lakatan banana growers need to maintain soil moisture near or at field capacity.

Keywords: banana, lakatan, soil moisture requirement, pot experiment

AS - 18

ENHANCING COCONUT GROWTH AND SURVIVAL IN THE FIELD WITH BIOFERTILIZER AND BIO-ORGANIC MATERIAL APPLICATION

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Coconut-based products serve as one of the top ten dollar earners of the country. However, land conversion and aging coconut plantations threaten to deplete coco-based products' supply. Transplanting new coconut seedlings was encouraged by the Federation of Free Farmers (FFF) in its 17 anchor farms in support of the Coconut Farm Development Program (CFDP). The members of the coconut farmer cooperatives were trained on the use of biofertilizer products namely Mykovam and BioGroe and bio-organic soil amendments to decrease dependence on chemical-based inputs. Three anchor farms became researcher- managed demonstration sites, while the rest of the anchor farms became farmer-managed demonstration trials.

Results of inoculation trials, after one year and six months in the field in Quezon and Zamboanga showed that very slow growth rate was observed, with an average of only 20 cm and only one additional frond per plant, per quarter. In the Quezon site, leaf nutrient analysis showed that although nitrogen (N) content was similar for all treatments, potassium (K) content was significantly highest in Mykovam (M) and BioGroe (B) singly inoculated plants. Phosphorus (P) content was significantly highest in combined MB treated seedlings at 2,660.97 ppm, 41% increase over the control. In the Bohol and Zamboanga sites, extreme summer condition affected plant growth by decreasing total number of actively photosynthesizing leaves that led to shorter plant height. However, leaf N and P content was highest in Mykovam+ RRC (Recommended Rate of Chemical Fertilizers) treated plants followed by ½ RRC treatment. This is equivalent to a 26% increase in N and 10% increase in P content compared to the control plants, while K content was highest in Mykovam +1/2 RRC. These results imply that biofertilizer inoculation can assist coconut seedlings extract nutrients better and survive in the harsh field conditions.

Keywords: coconut, mykovam, biofertilizers, biogroe, fff

AS - 19

**THE EFFECTS OF VERMICOMPOSTS, MYCORRHIZA,
AND INORGANIC CHEMICAL FERTILIZERS ON GROWTH
PARAMETERS OF CORN (*Zea mays*)**

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Corn is second to rice in terms of hectareage production due to its use as food and as animal feed. Continuous research on alternatives to chemical fertilizers is of utmost importance. Two greenhouse trials were established to determine the potential of using vermicompost and Mykovam for corn production along with three levels of chemical fertilizers. In the second trial, five different inoculation methods of Mykovam and vermicompost were evaluated.

Results showed that height growth and dry matter production of corn plants were comparable in the three chemical fertilizer treatments (0, $\frac{1}{2}$ RRC as 60-30-30 and full RRC as 120-60-60 kg NPK/ha). Soil amendment treatments such as Mykovam (M) alone, vermicompost (V) alone or combined Mykovam and vermicompost (M+V) significantly promoted shoot dry matter weight by 9%, 28% and 22%, respectively over the control. In terms of height increment, $\frac{1}{2}$ RRC + M gave the biggest height increment at 93.97 cm or a 15% increase over the uninoculated and unfertilized control (0 fertilizer). Best shoot dry matter production was observed in the following treatments: $\frac{1}{2}$ RRC + M, $\frac{1}{2}$ RRC with M+V and full RRC with V or M+V. Heaviest cob yield was in full RRC + Mykovam, followed by full RRC and M + V. This indicated that Mykovam and vermicompost can potentially improve vegetative growth and enhance corn yield and are effective soil amendments to chemical fertilizers for better corn growth and dry matter production. Benefit cost ratio analysis showed that the best treatment was in RRC + Mykovam + Vermicompost treatment.

In the second corn trial, the combination of Mykovam and vermicompost in liquid form was found to be the best preparation in terms of shoot and cob dry weight. The banding method of applying Mykovam was also comparable with the application of Mykovam in tablet form. Further studies should be done to explore more efficient inoculation methods for corn.

Keywords: corn, mykovam, vermicompost, chemical fertilizers

AS - 20

TAPPING OF PILI (*CANARIUM OVATUM* ENGL.) FOR SUSTAINED RESIN YIELD

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This study is a combination of R&D and techno-transfer activities on the improved tapping of pili (*Canarium ovatum* Engl.) in the Bicol Region.

The effect of tapping length, ethylene concentration and rainfall on resin yield was determined by tapping 36 pili trees growing in Barangay Calomagon, Bulan, Sorsogon. The study used three tapping lengths (15 cm, 20 cm and 30 cm) at the same width (2 cm) and same depth (enough not to reach the cambium) and four levels of ethylene application using the brand name "ethrel" at 0%; 0.5%; 1.5%; and 2.5% concentrations. Retapping after the weekly resin harvest was done immediately above the previous cut. Each treatment was replicated thrice.

Increasing tapping length increased resin yield with 30 cm giving the highest yield. Ethrel concentration likewise affected resin yield which was highest at 2.5%, while monthly rainfall did not.

The development of *Canarium* resin tapping as an alternative source of livelihood option for farmers and pili growers will rely on the following identified strengths: a) supply of resin is expected to be plenty as evidenced by the tremendous number of *Canarium* trees growing in the area and resin yield collected in this study following FPRDI tapping techniques and b) concerned farmers and pili growers have been trained on proper methods of *Canarium* resin tapping.

Further, resin yield of trees with ethrel application increase by 37.5%, thus additional revenue income for farmers and resin tappers.

The farmers' active participation in the seminar/training was evident following the correct tapping procedures. The technology's adaptability may indicate a bright and sustainable *Canarium* resin production in the entire province of Sorsogon.

Keywords: *Canarium* trees, pili, Manila clemi, resin tapping, Bicol, Sorsogon, tapping length, ethylene concentration, rainfall

AS - 21

**FINALLY, FROM WEED TO CROP? *Cassia tora* L.
(MANI-MANI): ECOTYPIC DIVERSITY AND
UTILIZATION IN BUKIDNON**

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Cassia tora L. is locally known as mani-mani, a common weed in the Philippines that usually grows in pasturelands and farmlands with other weeds. Mani-mani is a phenotypical variable in 12 municipalities of Bukidnon. Analysis of variance showed highly significant differences among ecotypes for plant height, number of primary branches per plant, number of mature pods per plant, number of seeds per pod, and weight of 100 seeds. Shannon-Weaver's Diversity Index showed high diversity ($H' > 0.75$) for 10 of the 13 traits evaluated including percent crude protein. Protein concentration of seeds from Libona (20.40%) and Malithog (19.50%) were comparable with most mungbean varieties (usually from 20% to 22%). In 5 municipalities, uses of mani-mani were documented in this study: relief for stomachache, menstrual pain and muscle pain, component vegetable for viands, and component for swine feed. It is therefore possible to select for an acceptable ecotype or to breed for improved lines with available genetic diversity to increase its economic adaptability as a new crop in the country.

Keywords: *Cassia tora*, mani-mani, genetic diversity, Bukidnon, weedy legume, ecotypic diversity

AS - 22

**PHENOTYPIC VARIATION IN MORPHOLOGICAL TRAITS,
FRUIT, SEED AND OIL OF JATROPHA (*Jatropha curcas*)
FROM THREE PROVENANCES**

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Jatropha (*Jatropha curcas* L.) is a promising crop for large-scale production of biodiesel. In recent years, it has become a focus of research and development investments in many relevant government agencies and private companies in the Philippines. Heightened attention to *jatropha* was driven by the belief that it can be made to yield the desired quantity of product in marginal lands; and growing it in marginal lands would prevent the food and fuel competition. Widely distributed across the country, identification of provenances that will give higher seed yield and oil content is deemed necessary before large plantations are established.

Eight trees from each of the three provenances planted in Mt. Makiling in Los Baños, Laguna were selected from among the experimental plants to examine tree-to-tree variation. The provenances were Bacolod, South Cotabato, and Talisay.

Variability was large in all morphological traits, the highest being in length of 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 ($P < 0.05$) of three seed size parameters, namely: length, breadth and thickness. Among the seed traits, seed length was significantly correlated ($r = 0.498$) with oil content. The oil content in kernel ranged from 41.40% to 59.26%.

Keywords: *Jatropha curcas* L., provenances, oil content

AS - 23

**HERITABILITY OF AND RELATIONSHIP
AMONG SELECTED SEED TRAITS OF THREE
PROVENANCES OF *Jatropha curcas* L.**

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Due to its high oil yield per hectare and its ability to grow in a wide range of environment, *Jatropha* is on top of the promising potential crops as biofuel feedstock. However, *Jatropha*'s full potential is yet to be realized due to lack of systematic improvement/breeding programs aimed at increased oil yield.

Improvement programs require knowledge on variability and genetic parameters. Thus, this study intended to determine the extent of variation and relationship between seed traits.

Data on seed traits for the three provenances, namely, South Cotabato, Bacolod and Talisay, were obtained from Vallesteros (2009). Analysis of variance showed no considerable difference between provenances in seed length and breadth at $P < 0.05$. Seeds from South Cotabato were found to be significantly thicker than the other two provenances.

Heritability estimates obtained for all the seed traits were high (>80%). High genotypic coefficients of variations (GCV) indicate that traits are less amenable to changes due to environmental flux. Seed thickness had the highest heritability and GCV (721.3%). In general, variation among the provenances in terms of the seed characters studied is low, which indicates narrow genetic resource of *Jatropha* in the country. Unproductive breeding is expected unless introduction of material from other sources, especially from the center of origin of the plant, is done.

Keywords: Heritability, *Jatropha curcas*, provenances

AS - 24

**VARIATION IN PHYSIOLOGY AND WATER USE
EFFICIENCY AMONG *Musa balbisiana* GENOTYPES
IN RESPONSE TO DROUGHT**

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Musa balbisiana genotypes are reported to have traits that confer field drought tolerance. However, the natural variation in these traits is relatively unknown, and therefore cannot be exploited in breeding programs. This paper reports on the variation of the effects of drought on the growth and physiology of twenty-nine wild and edible *M. balbisiana* genotypes from the Philippine and Southeast Asian germplasm collection.

Two batches of tissue-culture derived seedlings were potted out and established in the greenhouse from March to May 2010. Drought was imposed after three months. Pots were weighed at soil field capacity and periodically during progressive drought. Stomatal conductance determination showed that stomatal openings closed on the third and sixth day after water was withheld in April and May 2010, respectively. The stomatal conductance was significantly affected by the interaction between genotype and stress condition.

Water use efficiency (WUE) differed significantly among genotypes during drought, which ranged from 8.9 to 19 g dry matter kg⁻¹ water used. Genotypic differences in relative water content (RWC) were observed in April 2010 trial, but not in May 2010 when temperatures were much higher. RWC ranged from 80-96% even when leaves were already wilted. Genotypic variation in plant and root growth and accumulation of dry matter were also observed.

Keywords: *Musa*, banana drought, physiology, water use efficiency, stomatal conductance

AS - 25

DIFFERENTIAL RESPONSE OF OPEN-POLLINATED AND HYBRID TOMATO VARIETIES TO PGPR INOCULATION UNDER FIELD CONDITION

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Enhancement of plant growth through inoculation with plant growth promoting rhizobacteria (PGPR) has been reported for various vegetable and agronomic crops. However, studies on varietal response to PGPR inoculation under field condition were limited. A field trial was conducted at UPLB to determine the response of ten open-pollinated (OP) and hybrid tomato varieties to PGPR inoculation under two levels of fertilization, recommended rate (138-47-60 NPK) and half the recommended rate. The following parameters were assessed at flowering and fruiting stage: plant growth, number of flower clusters and branches, nutrient uptake, dry matter and fruit yield.

Inoculation increased the number of branches formed by Improved Apollo by 33% for both fertilizer rates while Rosanna had a remarkable 40% increase with half-fertilizer rate application. Inoculation also increased the number of flower clusters of Rossana by 60% in the half-fertilizer treatment while 60-150% increases were obtained for inoculated Caraibo, Discovery and Atlas with full fertilization. The increase in root dry weight due to inoculation also increased the root shoot ratio of OP varieties, Northern Red and Improved Apollo. In general, inoculation increased P content of the evaluated varieties from 0.20 to 0.21% P which also resulted to enhanced P uptake. The increase in P content of inoculated tomatoes indicates P solubilising activity of PGPR. With inoculation, the total fruit weight of Rosanna was increased by 27% while Atlas showed 19% increase across fertilizer treatments.

The results showed the different responses of OP and hybrid tomatoes to PGPR inoculation. There were OP and hybrid tomatoes which responded positively to inoculation while there were varieties which did not show significant response. This variation needs to be verified under different field condition because a significant variety-PGPR interaction is crucial in the adoption of PGPR inoculation technology.

Keywords: PGPR, inoculation, tomato, phosphorus, open-pollinated

AS - 26

EFFECTS OF *Jatropha curcas* L. HEDGEROW AND VARIOUS MANAGEMENT PRACTICES ON THE YIELD OF MAIZE AND SOIL PROPERTIES OF AN ALLEY CROPPING SYSTEM

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The study was conducted to evaluate the growth performance of *Jatropha curcas* L. planted as contour hedgerow (spaced 0.5 meter along the contour and 4 meters between contours) and its effects on the various management practices on maize and soil properties of an alley cropping system. This was laid out in split-split plot experimental design replicated three times. Fertilizer treatments comprised the main plot, pruning as the subplot, while mulching treatments served as the sub-subplot.

Findings revealed that average height and diameter growth of *J. curcas* hedgerow were enhanced by higher pruning (75-cm) having 124.89 cm and 5.5 cm, respectively. The low pruning (50-cm) had only an average height of 84.89 cm and diameter of 4.9 cm.

Maize treated with organic biofertilizer had longer ear length (16.05 cm) and higher grain yield (2652 kg ha⁻¹) while those applied with pure inorganic fertilizer had shorter ears and lesser yield. Dry matter and grain yield of maize were enhanced with *J. curcas* mulch pruning with 3793.8 kg ha⁻¹ and 2570.8 kg ha⁻¹, respectively.

Improvement of the soil chemical and physical properties was observed when the contour hedgerows have stabilized. Findings revealed *J. curcas* hedgerow's potential of preventing sheet erosion in sloping farmland having soil accumulation ranging from 23.09 tons ha⁻¹ to 36.51 tons ha⁻¹ while the no hedge plot had a soil loss of 24.32 tons ha⁻¹. Soil accumulation was also observed to be higher when *J. curcas* pruning was applied as mulch with 37.63 ton ha⁻¹ while the plot with no mulching application had only 20.88 tons ha⁻¹.

Financial analysis showed that *J. curcas* hedgerows in an alley cropping system had the capability of providing profit to farmers. Treatments with hedges have higher Benefit Cost Ratio ranging from 2.7 to 3.1 as compared with the no hedge plot with only 2.1.

Keywords: agroforestry, alley cropping, *Jatropha curcas*, maize, hedgerow

AS - 27

HEALTH STATUS OF BANANA IN THE NATIONAL AND REGIONAL GERMPLASM COLLECTIONS

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A large collection of wild, edible, and introduced banana cultivars is being maintained in the national and regional germplasm collections at the Institute of Plant Breeding, UPLB and Bureau of Plant Industry, Bago-Oshiro, Davao City. *Banana bunchy top virus* (BBTV), *Banana bract mosaic virus* (BBrMV), and *Cucumber mosaic virus* (CMV) are the major viruses detected in the germplasm collections. Virus-infected accessions and/or cultivars were replaced with virus-free materials. Efforts to eliminate viruses through *in-vitro* techniques are also being exerted.

In BPI Davao, 10 out of 85 accessions were infected either by BBTV or BBrMV, hence, they were eradicated from the collection. In IPB, BBrMV and CMV were detected from wild *Musa balbisiana* collections. A total of 268 samples from 61 banana cultivars and accessions in *in-vitro* culture were indexed through ELISA. All samples were found to be negative to viruses except one sample from Grand Naine which was BBTV-positive. In the repository glasshouse, an *ex-situ* gene banking strategy, a total of 64 local and introduced banana cultivars were indexed against BBTV, BBrMV, and CMV. Of these, 32 accessions were newly recollected to replace the accessions that were lost either by natural calamities or disease infection. Moradong Puti, was BBTV-positive while one Pondol plant and two Moko plants were CMV-positive. Infected plants were eradicated from the collections.

Keywords: banana germplasm collection, *in-vitro* technique, field genebank, ELISA, virus indexing

AS - 28

**CHANGES ON THE ANTIOXIDANT ACTIVITY
AND TOTAL PHENOLICS CONTENT OF DIFFERENT
LEAFY AND FRUIT VEGETABLES AS AFFECTED BY
STORAGE TIME AND TEMPERATURE**

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Antioxidants are known to provide health benefits such as the prevention of diseases like cancer, cardio and cerebro vascular diseases. Vegetables contain considerable amount of antioxidants. This study shows changes in the levels of antioxidant activity and total phenolic content of malunggay, pechay, chili leaves, sweet potato tops, and kangkong and fruit vegetables okra, tomato, eggplant, ampalaya, sitao as they are affected by storage temperatures and time of storage.

Ten leafy and fruit vegetables were stored under cold and room temperatures and monitored for total phenolics content using the Folin-Ciocalteu method and antioxidative activity using the DPPH method until the end of marketability. Results were statistically analyzed.

The antioxidative activity of leafy vegetables stored both at room temperature and refrigerated temperatures showed that prolonged and cold storage decreased. The total phenolics content of leafy vegetables stored at refrigerated temperature showed varied effects with chili and malunggay decreased, while kangkong, sweet potato tops, and pechay increased. Generally, leafy vegetables stored at room temperature showed increasing trends while fruit vegetables exhibited decreasing total phenolics content except for okra and sitao.

Storage time and temperature affect the antioxidant activity and total phenolic content of leafy and fruit vegetables. The total phenolics content of vegetables at room temperature increased while those at refrigerated temperature decreased. Antioxidative activity behaves otherwise.

Keywords: Phenolics content, antioxidant activity, fruit vegetables, leafy vegetables, cold storage

AS - 29

NUTRITIONAL AND PHYSICAL REQUIREMENTS FOR MYCELIAL GROWTH OF *Agrocybe cylindracea* (DC.: Fr.) Maire

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Agrocybe cylindracea is a widely distributed edible mushroom that usually grows in fallen logs and agricultural wastes. This mushroom has great potential in the nutritional and pharmaceutical industries because of its hypoglycemic effects, anti-carcinogenic activity and antioxidant property. Although this mushroom is successfully cultivated in Japan and Taiwan, the production technology under Philippine condition has not yet been developed. The results generated from this study will serve as benchmark information for the development of production technology for growing this mushroom.

The research team evaluated different indigenous materials and physical factors (pH, aeration and illumination) and different grain materials for efficient and luxuriant mycelial growth and proliferation. Among the different indigenous culture media evaluated, sorghum sucrose gulaman registered very thin and widest mycelial diameter with a mean of 82.67 mm after 8 days of incubation while corn grit sucrose gulaman recorded very thin and smallest mycelial diameter with a mean of 40.67 mm. Moreover, coconut water gulaman is the most suitable medium for optimum mycelia growth with a mean mycelia diameter of 64 mm. Results further showed that *A. cylindracea* cultured on coconut water gulaman at pH 6 incubated in sealed and alternating light and dark conditions favored the mycelial growth and proliferation. Meanwhile, among the grains evaluated for mass production of fruiting bags, sorghum seeds recorded the shortest incubation period with a mean of 14 days while rice seeds had the longest incubation period with a mean of 41.33 days.

Keywords: *Agrocybe cylindracea*, biophysiology, indigenous culture media, grain spawn

AS - 30

**THE EFFECTS OF A SMALL-SCALE COMMUNITY
LIVESTOCK PRODUCTION ON THE DIVERSITY
OF THE FOREST FODDER SOURCE IN AN UPLAND
VILLAGE OF BATANGAS, PHILIPPINES**

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Livestock production has been an integral part of several small-scale integrated farming systems. Most of these utilized communal feed sources such as grasslands and forests as important sources of feed especially during the dry season when all other conventional feed sources become scarce. Extraction of the forests to supply feeds for the livestock involves the alteration of this ecosystem, which will eventually result to changes in the forest ecosystem and its capacity to provide ecosystem functions. There have been limited studies on the change in forest diversity as a result of utilizing them as livestock feeds; hence, measuring this change is therefore useful. The effects of livestock tethering on forest diversity was determined on a secondary growth *molave*-type forest, which have been exposed to long-term livestock tethering in the past. Tethering involved cutting of the fodder trees and feeding the foliages to the livestock. Forest diversity and similarity of species were measured and compared in two landscape locations with four and five sampling points on areas that were 'tethered' and 'not tethered' to livestock. Forest diversity index was negatively correlated (-0.50) with tethering but was significant only at 17.0% level. It should be noted however, that it was ten years since livestock tethering was stopped, forest regeneration may have already occurred. In both landscape locations, forest diversity was relatively higher in the 'not tethered' areas than the 'tethered' areas. A low similarity of species was observed between the 'not tethered' areas and a higher similarity between the 'tethered' areas. A higher percentage of the fodder species existed in the 'tethered' sites than the 'not tethered' site. The results suggest that long-term livestock tethering in the forest would reduced forest diversity and tend to leave similar species, more of fodder tree species.

Keywords: forest diversity, livestock production, integrated farming system, tethering

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***Lentinus tigrinus*, AN ADDITION TO NEWLY
RECORDED AND SUCCESSFULLY PROPAGATED
WILD STRAIN OF PHILIPPINE EDIBLE MUSHROOM**

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Most of the commercially cultivated mushrooms in the Philippines were imported from other countries and their cultivation technologies were modified to suit the local conditions. Though well accepted by most Filipinos, these imported strains are not always available in the local market and one of the strategies is to use our own mycological resources. In the past, we were successful in the domestication of *Collybia*, *Schizophyllum*, *Ganoderma*, *Coprinus*, *Auricularia* and *Volvariella*. Another wild locally growing mushroom with nutraceutical potential is *Lentinus tigrinus*, which are usually found growing on fallen logs. In our desire to develop a practical production technology for this mushroom, we initiated study on its biophysiology. The secondary mycelial growth and fruiting body performance were elucidated with special reference to the influence of different indigenous culture media, pH, aeration and illumination. The secondary mycelia grew best on coconut water gulaman with a pH of 8 while being incubated in sealed and dark condition. Among the evaluated granular spawn, palay seeds yielded very luxuriant mycelial growth having the shortest incubation period of 5 days. Highest biological efficiency of 15.93% was recorded in a formulation consisting of 8 parts of rice straw + 2 parts of sawdust. *Lentinus tigrinus* has a great potential for cultivation as another newly recorded and propagated Philippine wild edible mushroom.

Keywords: *Lentinus tigrinus*, biophysiology, secondary mycelia, mycelial growth, biological efficiency

AS - 32

**THE SUSCEPTIBILITY OF THE LACEWING BUTTERFLY,
CETHOSIA BIBLIS INSULARIS C & R FELDER
(NYMPHALIDAE: LEPIDOPTERA) TO CRY 1 AB PROTEIN**

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There are very few studies in the Philippines related to the risk assessment of Bt corn to non target organisms. The lacewing butterfly, *Cethosia biblis insularis* C & R Felder is a non target organism and an uncommon butterfly present in riparian areas (land immediately surrounding water source) where Bt corn is planted. It feeds on flowers where Bt corn pollen are deposited during pollen shedding. This study was conducted at NCPC-CPC Plant Quarantine Support Laboratory from January 2009 to May 2010 to find out the effect of Cry 1 Ab protein on the lacewing butterfly.

Bioassay using the maximum hazard dose (i.e approximately 10x the maximum Cry 1 Ab protein in Bt corn) was done. The estimated amount of Cry 1Ab protein in Bt corn pollen is 0.09 mg/g pollen. Whole leaves of *Adenia zucca*, the host plant of lacewing butterfly were soaked in Cry 1 Ab protein and air dried. Another set of leaves were dipped in 0.1 M carbonated buffer and these served as control group. Ten three day-old larvae were exposed per leaf. Nine trials or 450 treated larvae and 450 non-treated larvae were done. The percentage mortality range for the treated group was 0-10% with a mean of 3.11%. The percentage mortality range for the control group was 0-14% with a mean of 1.56%. The range of weight in grams of the treated group was 0.016-0.053 with a mean of 0.035 while the control group has 0.011-0.045 with a mean of 0.033, respectively. Differences on mean mortality and mean weight of treated control leaves using t-test with computed values of 0.704 and 0.315 were not significant. Hence, the Cry 1 Ab protein was not toxic to the lacewing butterfly.

Keywords: Cry 1Ab protein, Lacewing, Butterfly, Susceptibility, Lepidoptera

AS - 33

MARKER-AIDED TRANSFER OF GENES FOR β - CAROTENE BIOSYNTHESIS INTO POPULAR PHILIPPINE RICE VARIETIES

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Golden Rice accumulates β -carotene in the grains and is considered as a sustainable and effective food-based strategy to alleviate vitamin A deficiency. Through DNA marker-assisted recurrent backcrossing, Golden Rice1 (GR1) locus was introgressed into PSB Rc82 and NSIC Rc128 varieties. Selection in the progenies was based on yellow-colored dehulled grains after bleach treatment, presence of GR1-specific PCR amplicons, high recovery of the recurrent parent genome, good agronomic traits and high betacarotene content. Parental recovery was measured using phenotypic data and polymorphic simple sequence repeat (SSR) markers (98 for PSB Rc82 and 103 for NSIC Rc128 progenies). After 2-3 backcrosses and 3-4 selfing generations, nine introgression lines (four from PSB Rc82 and five from NSIC Rc128) were selected. SSR data revealed at least 80% genomic recovery of the recurrent parents. The highest β -carotene concentration in the progenies using samples stored for two months at ambient temperature was 1.80 μg per gram of milled grains compared to 1.62 $\mu\text{g}/\text{g}$ in the GR donor. These results illustrate the feasibility of transferring Golden Rice trait into popular local varieties using this approach. Concomitant with the work on GR1 was the introgression of Golden Rice2 event R (GR2-R, ~36 $\mu\text{g}/\text{g}$) into PSB Rc82. With higher betacarotene content, GR2-R will be used in line development, single- and multi-location field tests, biosafety and sensory evaluation, and other tests required for regulatory approval and varietal release. Activities towards combining GR2-R with resistance to tungro and bacterial blight in elite genotypes are underway.

Keywords: Golden Rice, vitamin A deficiency, beta-carotene, marker-assisted introgression, varietal evaluation

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**APPLICATION OF DIHAPLOID BREEDING TECHNOLOGY
IN VARIETY DEVELOPMENT AND QTL MAPPING
IN RICE (*Oryza sativa* L.)**

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Dihaploid technology has become a promising tool in breeding for producing homozygous lines more rapidly than most conventional breeding methods. Doubled haploids (DH) are also excellent materials for genetic studies because of their homozygosity and uniformity. A total of 313 DHs were generated thru another culture from the F1 of PSB Rc10 and Nipponbare. Characterization of these DHs revealed the very high homogeneity and stability at the DNA level using SSR analysis and under field conditions.

Field trials of 237 DHs in 2009 WS resulted in selection and advancement of 54 superior lines in 2010 DS and WS. Ten 10 DHs have been selected as promising lines based on high yield, phenotypic acceptability, tolerance to major pests, and uniformity which are better/comparable to the checks; PSB Rc10, PSB Rc18, and PSB Rc82. In less than 3 years, elite breeding lines were developed while conventionally, it takes 6-7 years for selected inbreds to reach yield trial. Stable and potential donor parentals were also developed and included in the germplasm pool based on resistance to blast (9), early maturity (3), enhanced grain quality (3), and short to medium plant height (10). On the other hand, a mapping population consisting of 219 DHs was used for identifying QTL for grain quality traits using 205 SSR markers. Thirteen QTLs were identified; three for amylose content and five each for gel consistency and gelatinization temperature. QTL mapping for drought tolerant traits such as days to maturity, spikelet fertility, early vigor, and green leaf retention is now ongoing using the same mapping population. Information on mapped QTLs associated with these traits and the SSR markers that have tight linkage to them may be used to speed up the process of breeding new rice varieties with better quality and drought tolerance through molecular marker-assisted selection (MAS).

Keywords: anther culture, QTL, doubled haploids, SSR markers, MAS

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***PWT3* - *Rwt3* INTERACTION UBIQUITOUSLY INVOLVED
IN THE INCOMPATIBILITY BETWEEN AN *Avena* ISOLATE
OF *Magnaporthe oryzae* AND CEREALS**

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Pwt3 (pathogenicity to wheat) is a locus conditioning the specificity of *Avena/Triticum* isolates of *Magnaporthe oryzae* on wheat identified among F₁ progeny derived from parent cross between an *Avena* isolate carrying the avirulence allele *PWT3* and a *Triticum* isolate carrying the virulence allele *pwt3*. To confirm the monofactorial segregation of *PWT3*, an F₁ culture was backcrossed with the *Triticum* isolate four times producing near isogenic lines of the *Triticum* isolate carrying *PWT3*. Several hexaploid and tetraploid wheat cultivars including barley inoculated with two parental isolates and a near isogenic line of *Triticum* isolate responded to *PWT3*. Representative cultivars of hexaploid and tetraploid wheat cultivars inoculated with 31 BC₄F₁ cultures were resistant to all *PWT3* carriers and susceptible to all *pwt3* carriers, suggesting that they recognize *PWT3*. Resistance gene *Rwt3* corresponding to *PWT3* was identified in wheat cultivars including a resistance gene in barley which may correspond to *PWT3*. These results suggest that *PWT3* could be ubiquitously involved in the avirulence of the *Avena* isolate on wheat and barley because of the possible ubiquitous distribution of *Rwt3* on these cereals. *PWT3* locus was mapped on chromosome 6 using SSR markers providing a starting point for cloning of this gene.

Keywords: avirulence gene, gene-for-gene interaction, *Magnaporthe oryzae*, resistance gene, wheat blast

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**GENETIC DIVERSITY, POPULATION STRUCTURE
AND DNA FINGERPRINTING OF ABACA (*Musa textilis* Nees)**

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Abaca, an indigenous fiber crop, is a major export commodity of the country. Assessing the genetic diversity of abaca is a prerequisite to a successful breeding program. Using microsatellite markers, the genetic diversity of abaca in Luzon, Visayas and Mindanao was determined to be highly diverse ($I = 0.67$). These variations present in abaca population are needed in widening the genetic background of the species, thereby, providing a wide selection of parents for abaca breeding programs. The genetic structure of abaca population is considered as genetically heterogeneous with 94% variability within population (AMOVA). Principal component analysis revealed sharing of alleles in three populations. Distance matrix analysis clustered abaca genotypes from Luzon, Visayas and Mindanao into three big groups and six small groups. This study also optimized SSR markers with high polymorphism information content (PIC) value (0.48 to 0.79). A combination of SSR markers that can differentiate T genome (*textilis*), B genome (*balbisiana*) and A genome (*acuminata*) of the genus *Musa* was also identified. Using these markers, some of the duplicate accessions of abaca in the gene bank were recognized. Likewise, these SSR markers can distinguish susceptible, tolerant and resistant genotypes to abaca bunchy top disease (AbBTD) which are crucial for marker-assisted breeding for AbBTD resistance trait. These results are useful for abaca varietal identification, germplasm characterization, marker-assisted selection, and for the development of DNA-based diagnostic kit for AbBTD disease.

Keywords: genetic diversity, phylogeny, microsatellites, molecular markers, fiber

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**GENETIC DIVERSITY AND CLUSTERING OF PINEAPPLE
(*Ananas comosus* (L.) Merr.) GENOTYPES USING RANDOM
AMPLIFIED POLYMORPHIC DNA (RAPD)**

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Genetic variation among 14 pineapple genotypes was assessed through molecular characterization using Random Amplified Polymorphic DNA (RAPD). RAPD was utilized to measure the genetic diversity and relationship among the different genotypes. The Doyle and Doyle extraction method was done in the DNA extraction of the 14 pineapple genotypes. Two Operon primers (OPY-15 and OPAV-06) were used in the PCR - based RAPD analysis of the different genotypes. Of the two primers used, OPY-15 (5'AGTCGCCCTT3') yielded consistent DNA polymorphic amplification in repeated trials and generated 11 banding patterns ranging from 0.40 – 3.00bp. Using primer OPAV-06 (5'CCCGAGATCC3'), banding patterns formed were not clearly identified. Cluster analysis was done by similarity matrix within the NTSys program using unweighted pair-group method with arithmetic averages (UPGMA) to determine values of genetic distance. A dendrogram of the 14 genotypes separated the pineapple cultivars and hybrids from the wild relatives. Based on the dendrogram at 0.76 similarity coefficient, the 14 genotypes were divided into four clusters: Cluster 1, *Ananas bracteatus*; Cluster 2, 'Smooth Cayenne', 'MD2', 'Aklan' and 'MG3'; Cluster 3, 'Red Spanish', 'Clone 74', 'NP2' and 'Queen'; and Cluster 4, 92-1 (hybrid), 'DM Gold', 92-2 (hybrid), 'Sweet 16' and Calauan (ornamental-like). At 0.51 coefficient similarity, 3 clusters were generated: Cluster 1, *Ananas bracteatus*; Cluster 2, 'Smooth Cayenne', 'MD2', 'Aklan', 'MG3', 'Red Spanish', 'Clone 74', 'NP2' and 'Queen'; and Cluster 3, 92-1 (hybrid), 'DM Gold', 92-2 (hybrid), 'Sweet 16' and Calauan (ornamental-like). The RAPD of the 14 pineapple genotypes studied could be an ideal tool for detection of variation and relationship among genotypes and hence, can be useful in the assessment of genetic diversity and cluster analysis of pineapple germplasm accessions and varieties.

Keywords: pineapple, genetic diversity, operon primer, cluster analysis, dendrogram, randomly amplified polymorphic DNA (RAPD)

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CHARACTERIZATION OF RESTORER AND MAINTAINER LINES USING MORPHOLOGICAL AND SSR MARKERS

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Genetic diversity is a prerequisite in any breeding program. Genetic diversity can be measured by different approaches such as pedigree analysis, morphological data and use of molecular markers. In this study, we evaluated the diversity of 175 parent lines (39 maintainer and 136 restorer) used in hybrid rice breeding program at PhilRice using 26 qualitative, 12 quantitative traits and 38 microsatellite or simple sequence repeat (SSR) markers. The data was analyzed using Unweighted Pair-group method with arithmetic mean (UPGMA). Morphological analysis revealed two major clusters with similarity coefficient of 3.09. Out of the 38 traits analyzed, eight gave significant contribution for the separation of some individuals and groups of genotypes. The percentage of contribution of each trait to total genetic variation was estimated through principal component analysis (PCA). Analysis based on SSR markers showed two major clusters with similarity coefficient of 0.71. Four maintainer lines represented one group whereas the other group consisted 36 maintainer and 56 restorer lines. Combined analysis also showed two major clusters with similarity coefficient of 0.42. One consisted of only two maintainer lines whereas other comprised 37 maintainer and 55 restorer lines. Overall, the results showed an average degree of variation among the hybrid parent lines indicating that there is a need for new germplasm source to improve the diversity of our hybrid breeding materials. In addition, the study provided important information for hybrid rice breeders on heterotic group identification and enhancement of heterotic F_1 combination.

Keywords: genetic diversity, heterosis, hybrid rice, SSR, UPGMA

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GERMPLASM COLLECTION BY DNA FINGERPRINTING

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The PhilRice Genebank was established in 1985 and holds 11, 259 collections. Most of the collections came from the elevated Cordilleras, from agricultural colleges and development centers as well as opportunistic collecting by PhilRice staff. However, with the limited resources such as finite storage space, low processing and maintenance outlay, there is an urgent need to identify duplicates and unique accessions for maximum resource utilization. The morphological characterization procedure presently employed in the PhilRice genebank is inadequate for this purpose because it represents a narrow portion of the genome and are influenced by the environment. The study aimed to: obtain DNA fingerprints of 427 rice germplasm accessions in the PhilRice Genebank using the multiplex SSR system, and determine the level of DNA polymorphism among the 427 rice accessions.

The dendrograms generated from UPGM and bootstrapping revealed 100% similarity coefficient for Binangkuro accessions from Occidental Mindoro. Binuhangin and Buntalan accessions also from Occidental Mindoro as well emerged to have 100% similarity coefficients. Bolig-bolig accessions from Palawan and Banate accessions from Iloilo both showed 100% similarity coefficients. Such accessions are hence considered as redundants. On the other hand, 22 unique accessions were detected in the germplasm. In conclusion, the allelic diversity revealed by multiplex PCR consisting of 4 SSR markers serves as baseline information of the genetic diversity of the 427 rice gerplasm accessions. Multiplex PCR enhances the efficiency of SSR markers, thus providing a marker system allowing heterozygosity assessment. The multiplex procedure was also found useful in determining redundancy in the germplasm.

Keywords: DNA Fingerprinting, germplasm, polymorphisms

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ANTIOXIDANT CAPACITY, PHENOLIC CONTENT AND SENSORY PROFILE OF PEANUT SKIN INFUSIONS

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The popularity of functional beverages led to the search for alternative sources of raw materials that provide both great taste and functionality to consumers. Peanut skins, a thin papery skin that encases the peanut seed, are a rich source of phenolic compounds and their utilization in beverage was exploited. The objective of this study was to determine the total phenolics (TP), antioxidant capacity (AOC), phenolic content and descriptive sensory profile of peanut skin infusions and evaluate the relation between these properties.

Raw peanuts were blanched at 100°C, 10 to 20 min, and skins were collected. Hot water infusions were prepared and AOCs were measured using TP and Trolox equivalent antioxidant (TEAC) and oxygen radical absorbance capacity (ORAC) assays. Reversed-phase HPLC was used to determine phenolic acids, stilbenes and flavonoids. Trained panels evaluated the sensory profile of peanut skin infusions.

Principal component (PC) analysis showed that the cumulative percent of variability accounted for by the first three PCs is 87.9%. PC1, accounting for 44.2% of the variance, appears to be associated with TP, TEAC, ORAC, the compound resveratrol and the descriptive attributes 'woody', 'bitter' and 'astringent'. PC2 explained 31.0% with large loadings relating to the attribute 'clarity', and the compounds protocatechuic and caffeic acids, and quercetin. PC3 (12.8%) appears to be associated with the compounds catechin, epicatechin and p-coumaric acid. Distribution of skin infusions for the first two PCs reveals two sample groupings. These findings suggest that peanut skin type may significantly alter AOC properties, phenolic composition and sensory properties. Beverage products with peanut skins, as an alternative health beverage, may deliver beneficial effects to human health.

Keywords: peanut skin, infusions, phenolics, antioxidant capacity, descriptive test

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ABOVEGROUND BIOMASS ESTIMATION OF TIMBER RESOURCES IN PERMANENT FIELD LABORATORY AREA (PFLA 2) IN MT. MAKILING FOREST RESERVE, PHILIPPINES

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The potential role of tropical forests to sequester atmospheric carbon is considered to be the most practical and effective way to reduce the release of CO₂ in the atmosphere. The study focused on the estimation of the aboveground biomass of timber resources in PFLA 2 located at Mt. Makiling Forest Reserve which is characterized by moderate to steep topography. The elevation of the reference point is 261.371 meters above sea level and the vegetation is dominated by balobo, kaong, rattan, and shrubs. In the study, biomass estimate in PFLA 2 in the year 2008 was 402.62 tons per hectare, 351.88 tons/ha in 2006 and 217.44 tons/ha in 2004. The established database through Arc View 3.2a displays the map of PFLA 2 and the locations of the trees as well as the biomass per tree species. Points (individual tree) and polygons (grids) on the map can be associated with its various descriptions in the database.

This study aimed to: (1) to estimate the biomass of timber resources; (2) to determine the biomass changes in the area, and; (3) to develop a GIS-assisted biomass database for PFLA 2. The data were collected from one hectare plot of PFLA 2 using grids of 10m x 10m where the diameter at breast height (eⁿ 5 cm) of trees was measured. Secondary data in 2004 and 2006 were obtained from the Office of the Coordinators for Research Extensions and Linkages (OCREL). Biomass was estimated using the formula: $Y = \exp \{-2.134 + 2.530 * \ln (D)\}$. The data were analyzed, stored and manipulated through Arc View GIS software. A database of trees in the PFLA 2 was produced.

The estimation of biomass or biomass density is necessary tool to explain the flow of carbon (energy) in the ecosystem.

Keywords: arc view, biomass, CO₂, climate change, GIS

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**DYNAMICS OF ENDOMYCORRHIZAS AND ASSOCIATED
FOREST WIDLINGS IN THREE PERMANENT FIELD
LABORATORY AREAS IN MT. MAKILING,
LOS BANOS, LAGUNA, PHILIPPINES**

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This study assessed the dynamics of endomycorrhizal fungi and estimated fine root biomass of forest wildlings through soil coring within 2x2 m regeneration plots in three permanent field laboratory areas of Mt. Makiling to determine the possible correlation among endomycorrhizal fungal diversity, percentage root colonization, fine root biomass, and diversity of forest wildlings. Four genera (*Acaulospora*, *Gigaspora*, *Glomus*, and *Scutellospora*) and 14 species of isolated spores of endomycorrhizal fungi were characterized. *Glomus* species was dominant comprising 90% of the total density of endomycorrhizal spores. The diversity of endomycorrhizal fungi in three PFLAs was relatively low to moderate, most probably due to good condition of the areas. Also, endomycorrhizal fungi were possibly more specific to soil type than to host type, thus, comprehensive studies of soil properties such as soil pH, texture, nutrients, organic matter, moisture and soil organisms should be made. Roots of forest wildlings collected from three PFLAs exhibited specialized structures such as arbuscules and vesicles, and non-septated hyphal strands suggesting endomycorrhizal associations. Fine root biomass obtained from three permanent plots was comparatively low for a tropical rainforest. Although, the turn out could be attributed to certain procedural lapses. Therefore, in the estimation of fine root biomass procedures should be permutated and magnified to increase fine root recovery. A total of 46 species of forest wildlings were recorded in three PFLAs. The diversity of endomycorrhizal fungi was not significantly correlated to the diversity of forest wildlings. Overall, further studies should be undertaken to determine and establish the relationship of endomycorrhizal fungi and forest wildlings to fully understand their dynamics.

Keywords: dynamics, endomycorrhizas, endomycorrhizal fungi, forest wildlings, fine roots

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DETECTION OF EPISOMAL *Banana streak badnavirus* (BSV) IN PHILIPPINE *Musa* GERMPLASM COLLECTION BY IMMUNOCAPTURE-POLYMERASE CHAIN REACTION (IC-PCR)

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Banana streak badnavirus (BSV), one of the five described viruses infecting banana (*Musa* sp), is currently being considered a serious threat and major constraint to *Musa* genetic improvement and germplasm movement. The virus occurs as non-infectious endogenous, wherein viral sequence is incorporated naturally on *Musa* genome, or infectious episomal, which can originate through activation from the endogenous sequences triggered by abiotic stress like tissue culture and drought condition. Accurate detection method must be developed/adapted and used to index the existing germplasm for the presence of episomal BSV. Virus detection was done using Immunocapture-Polymerase Chain Reaction (IC-PCR), which specifically detects episomal virus. Using purified BSV antibody and BSV F1/R1 primers, IC-PCR showed that 18 out of the 22 cultivars tested (82%) gave an amplification product of 220bp indicating the presence of episomal virus. Only 4 cultivars (18%) were negative to BSV. It was noted that all the leaf samples collected from the germplasm came from plants with no typical symptoms of virus infection. Based on the results of IC-PCR, it is very important to use an accurate and effective detection method to determine the presence of episomal BSV in the germplasm collection as part of tight integrated management measures.

Keywords: *Banana streak badnavirus*, Immunocapture-PCR, *Musa* germplasm, endogenous, episomal

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**COMPARATIVE STUDY ON POPULATION DYNAMICS OF
MAJOR INSECT PESTS AND THEIR NATURAL ENEMIES
IN INBRED AND HYBRID RICE IN DIGOS, DAVAO**

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The average population of major insect pests and their natural enemies in inbred and hybrid rice was compared during wet season in Digos, Davao del Sur, Philippines. Field survey and monitoring was conducted on 50 selected farmers' field at weekly interval throughout the cropping season. Samples were collected using sweeping method and were transported to laboratory for proper taxonomic identification. Data on average population were subjected to t-Test. White stemborer (*Scirpophaga innotata* Walker, green leafhopper (*Nephotettix* spp.) and brown planthopper (*Nilaparvata lugens* Stal.) were recorded as the dominant insect pests. Results showed that average population of leafhopper and planthopper both in hybrid and inbred rice was highest at 35-42 days after transplanting (DAT). Significant difference between leafhopper population in hybrid and inbred rice was recorded at 5% level. Highest stemborer eggmass count was recorded 35 and 63 DAT for inbred and hybrid, respectively. Adult stemborer incidence was highest at 70-77 DAT. Total average population of predators (*Coccinellidae*, *Miridae*, *Tetragnathidae*, and *Linyphiidae*) and parasitoids (*Ichneumonidae* and *Pipunculidae*) was 57 percent higher in inbred than in hybrid. It was noted that the abundance of these natural enemies is dependent on the availability of their host at a given crop growth stage. This study confirmed that insect pests are important component in the population dynamics of natural enemies.

Keywords: Davao del Sur, hybrid rice, inbred rice, insect pest, natural enemies

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A MULTIPLEX PCR DESIGN FOR THE DETECTION OF THE ABACA BUNCHY TOP VIRUS (ABTV) IN LEAF SAMPLES

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The abaca bunchy top virus or ABTV is one of the most devastating pathogens that infect abaca today. A key element in preventing its spread is early detection and disease indexing of planting materials. To this end, a design for a multiplex PCR able to detect the presence of ABTV DNA has been developed. Four primer pairs were used: Three primer pairs target ABTV genes, namely the coat protein, movement protein, and replication initiation protein (Rep) genes. In addition, a fourth primer pair targets a region in the chloroplast NADH dehydrogenase subunit (*ndhB*) gene, which is conserved in diverse plant taxa. Amplification of the *ndhB* gene serves as an internal positive control. In the detection of plant viruses, the PCR template is often the total DNA extracted from plant samples. Hence, the amplification of an internal positive control would determine if PCR conditions are favorable to amplification of DNA and to an extent, if the quality of the DNA template is acceptable. Each primer pair used for multiplex PCR yields an amplicon of a unique size to ensure unambiguity. An ideal result for the said multiplex PCR design would be the amplification of the *ndhB* intron in all samples (healthy and infected) and at the same time, the amplification of ABTV only in infected samples. The multiplex PCR design outlined above have been tested on 30 leaf samples taken from Bicol and Leyte. Results of the test have so far corroborated with parallel assays using ELISA (enzyme-linked immunoassay).

Keywords: abaca bunchy top virus, ABTV, multiplex PCR, virus detection, coat protein gene, movement protein gene, replication initiation protein, *ndhB* gene

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PCR-BASED IDENTIFICATION OF POTYVIRUSES IN INFECTED ABACA PLANTS USING CODEHOP PRIMERS

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The abaca fiber industry is one of the most lucrative businesses in the country since the Philippines supplies 84% of the total demand in the international market and earns US \$ 80 M annually. However, in recent years, the abaca industry suffers from severe infestations caused by different plant viruses. Most viral diseases are identified based on symptomatology alone. Most viruses belonging to the same family often show the same symptoms particularly the potyviruses. Infected leaf samples showing symptoms typical of bract mosaic infection were collected from Bicol and Davao were used in the study. A new approach was developed in the identification of potyviruses. CODEHOP or consensus degenerate hybrid oligonucleotide primer was designed based on the consensus sequence targeting the C-terminal half of the coat protein, which has the most conserved sequences in a potyviral genome. The CODEHOP forward was paired with a published degenerate N1 primer to specifically amplify the C-terminal half of whichever potyvirus present in the sample. The Bicol isolate produced a 700 bp amplicon while the Davao isolate produced an 800 bp amplicon. Both amplicons were cloned into PCR 2.1 cloning vector (Invitrogen) for sequencing. Sequences were analyzed using internet based programs, Blast and Multalin. Blast sequences revealed that Bicol isolate showed 98% identity with banana bract mosaic virus while Davao isolate showed 98% identity with sugarcane mosaic virus, recently identified as abaca mosaic virus. These results proved that even though both isolates were morphologically identified as bract mosaic, based on CODEHOP PCR, the two isolates, Bicol and Davao, were infected with two different viruses, banana bract mosaic virus and abaca mosaic virus respectively.

Keywords: potyvirus, symptomatology, CODEHOP, coat protein, banana bract mosaic virus, and abaca mosaic virus

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MINIMIZING BACTERIAL LEAF BLIGHT AND OTHER DISEASES IN RICE USING ORGANIC PESTICIDE

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The current agricultural system calls for organic-based pesticides to avoid health and environmental hazards. Hence, we evaluated lactic acid labeled Antica against two important diseases of rice, the bacterial blight (BLB) and tungro. On-farm trial in RCBD was conducted using NSIC Rc156 and PSB Rc72H in Nueva Ecija and Isabela, respectively. Treatments were Antica as spray at 5, 10, 15, and 20 ml/L water, Antica as seed coat (SC), copper hydroxide [Cu(OH)₂] at 3.75 g/L water, and untreated control. Cypermethrin, was used in Isabela instead of [Cu(OH)₂]. Seed treatment was also excluded. Application was done at 2-week intervals 5 days after transplanting (DAT) until heading. Diseases, arthropods, and phytotoxicity were assessed 1 week after treatments. Antica at 5 ml/L water reduced BLB incidence by 17.5% and severity by 33% at 42 DAT compared with the untreated control. As disease progressed, Antica-plots remained to have lesser BLB incidence and severity. At 75 DAT, BLB incidence and severity were lowest in plots sprayed with 5 ml Antica/L water with 33.7% reduction in incidence and 25% reduction in severity. Incidence of tungro, although low, was also reduced in Antica-treated plots with as much as 50%. In Isabela, BLB was lower but data showed 17-25% reduction in incidence in Antica sprayed-plots. Bacterial leaf streak, which occurred in higher frequency in Isabela was also reduced by 25-39%. SC-plots were not statistically different from control. Antica also reduced the number of herbivores such as green leafhoppers, brown planthoppers, and white-backed planthoppers without affecting the predators and parasitoids, except for coccinelids whose densities dropped in plots treated with 20 ml Antica. No phytotoxicity were observed in all plots indicating that Antica is safe for use in rice. Antica gave a yield advantage of 7.3 to 13.87 % over the other treatments. In most instances, Antica was effective at the rate of 5 ml/L water.

Keywords: Antica, lactic acid, disease, BLB, BLS, tungro, herbivores, rice

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FUSARIUM EAR ROT: MOLECULAR CHARACTERISTICS OF THE PATHOGEN AND HOST RESISTANCE

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The fungi *Fusarium moniliforme* Sheldon and *Fusarium proliferatum* (Matsushima) Niren, the cause of Fusarium ear rot, were reported to produce a series of toxins on corn which include the fumonisins, of which fumonisin B₁ and B₂ have cancer promoting activity. Other mycotoxins produced include moniliformin, fusarin C and fusaric acid. Fumonisin B₃ has been shown to be responsible for most of the toxicological affects observed from ingesting corn infected by toxigenic isolates of these fungi. *F. moniliforme* occurs in all parts of growing corn plant throughout the season.

To appropriately manage Fusarium ear rot in corn, isolates of the causal pathogen must be accurately characterized and identified. Based on morphology, the collected four isolates belong to *Fusarium* sp. To determine the species, they were molecularly characterized by PCR using ITS-rDNA primers and by homology analysis of the nucleotide sequence through BLAST to compare with other reported *Fusarium*-causing ear rot in corn. Results showed that three isolates (from UPLB experiment station, Northern Cotabato and from CMU, Bukidnon) were highly related to *F. moniliforme* from China while one (from South Cotabato) was highly related to *F. graminearum*.

Resistance is still the most economical method to control these pathogens. The identified resistant varieties or inbreds can be used for improvement of corn to ear rots or they can also be directly used by farmers or growers in the case of identified resistant hybrids or populations. Results of resistance evaluation to Fusarium ear rot using ear injection method showed that out of twenty entries evaluated, two inbreds (S3YB 137-1-1-B and TUPI (S3) 15-2-B) were moderately resistant, 14 inbreds and hybrids were moderately susceptible and four were susceptible. None was found highly resistant to the disease. Further evaluation of germplasm is needed to identify highly resistant sources to avoid fumonisin production in corn kernels.

Keywords: Fusarium ear rot, *Fusarium moniliforme*, host resistance, corn

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**EVALUATION OF GAMMA IRRADIATED ABACA
(*Musa textilis* Nee.) FOR RESISTANCE TO ABACA BUNCHY
TOP VIRUS AND BANANA BRACT MOSAIC VIRUS
UNDER SCREENHOUSE CONDITION**

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Abaca (*Musa textilis* Nee.) is the source of natural strong fiber in the Philippines. There has been decreasing production of abaca fibers in the last decade since the available commercial varieties are susceptible to the two major viral diseases, namely bunchy top and bract mosaic. *In vitro* technology coupled with gamma irradiation (^{60}Co) were sought in order to develop varieties with resistance to these two viruses.

To start with the irradiation of two varieties, namely Tinawagan Pula and Tangongon, the optimum dose level or lethal dose or LD_{50} of ^{60}Co was established by taking the rate of shoot proliferation and growth development of shoot cultures (SubCycle 1 to 3). After bulk irradiation using the developed LD_{50} , all plantlets were inoculated with abaca bunchy top virus and banana bract mosaic virus using insect transmission and mechanical transmission, respectively.

Out of the 2,296 plants of variety Tinawagan Pula and 974 plants of variety Tangongon, 43 plants or 1.9% and 9 plants or 0.9%, respectively, were negative to abaca bunchy top virus using Enzyme-linked immunoassay (ELISA). For bract mosaic, from the 2,169 plants of variety Tinawagan Pula, and 1,006 plants of variety Tangongon, 57 plant or 2.6% of variety Tinawagan Pula and 14 plants or 1.4% of variety Tangongon, were negative to banana bract mosaic virus using Polymerase Chain Reaction (PCR). The putatively resistant lines of these two varieties from the screenhouse experiment are being micro-propagated for field evaluation.

Keywords: abaca, abaca bunchy top virus, banana bract mosaic virus, gamma irradiation

AS - 50

**EFFECT OF *Cymbopogon citratus* (LEMONGRASS)
AND *Pandanus amaryllifolius* (PANDAN) INFUSION ON
RICE-SPOILAGE ORGANISM *Bacillus cereus***

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The Philippines has a rice-based diet wherein people usually get their carbohydrate requirement from rice and its derivatives. *Bacillus cereus* is one of the most common spoilage organism found in rice, wheat, dairy products, etc. There are many ways to cook rice, among them is to add some species of grasses which may improve flavour and aroma. The objective of this study is to find if these aesthetic additions may have antimicrobial benefit. Leaf infusions of the two plants were screened through Kirby-Bauer disk diffusion method for antimicrobial properties. Different concentrations of the leaf infusion were used on vegetative cells (0.2 g/ml, 0.15 g/ml, 0.1 g/ml, 0.5 g/ml, and 0.25 g/ml) and spores (0.8 g/ml, 0.7 g/ml, 0.6 g/ml, 0.5 g/ml, 0.4 g/ml, 0.3 g/ml, and 0.2 g/ml). A close relative, *B. subtilis* was used for control and clindamycin was used as antimicrobial control. The highest inhibition for vegetative *B. cereus* was found at the highest concentration of lemon grass (1.6 mm) and at 0.1 g/ml of pandan (0.6 mm). While for *B. subtilis*, the highest inhibition was found at the same concentration (4.8 mm for lemon grass and 2 mm for pandan). The effect of lemongrass infusion in its inhibition of growth of *B. cereus* is directly proportional to its concentration. While the effect of pandan is increasing at first it decreases at higher concentrations of the infusion. The experiment has demonstrated that lemongrass has more antimicrobial activity than pandan for both *Bacillus* sp. Among the two, *B. subtilis* is more susceptible to antimicrobials. More research is needed to test isolated, purified compounds from infusion of the two plants to be used as rice additive.

Keywords: *Bacillus cereus*, *Cymbopogon citratus*, *Pandanus amaryllifolius*, rice-spoilage

AS - 51

**LONG-TERM WEED MANAGEMENT, DIVERSITY AND
ABUNDANCE OF BROADLEAF WEEDS IN A BANANA
PLANTATION IN DAVAO CITY, PHILIPPINES**

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Weeds are often considered pests because they reduce crop yield. However, some weeds perform useful ecological functions such as providing a habitat for biocontrol agents, nourishing useful microorganisms in the soil and preventing erosion. Appropriate weed management should therefore aim to maintain a certain level of useful weed population and diversity instead of totally eliminating them. To determine the effects of manual and chemical (paraquat and glyphosate) weed management on the abundance and diversity of broadleaf weed species in a banana plantation, counts, dry weights, seed bank and diversity indices of broadleaf weed species were compared in two identical experiments in 15% and 25% slopes. Bananas were at the fruiting stage and were established 2 to 5 years earlier when the experiment started. Seedling emergence and diversity indices of broadleaf weeds showed an increasing trend in seed banks in both 15% and 25% slope over 3 years. Field counts and biomasses were significantly lower in the chemical plots compared to the manual plots. The sustained dominance of *Ageratum conyzoides* was also observed in the field but chemical treatment was better than manual treatment in reducing its population. Species *Cleome ruidosperma* and *Bidens pilosa*, which were dominant in the first year of sampling, continuously declined. Along with this decline was the increase in *Drymaria cordata* and *Acalypha indica* in the 15% and 25% slopes, respectively. The ecological significance of the shifts in weed composition resulting from manual and chemical weeding is discussed in this study. The chemical treatment was ecologically advantageous compared to manual treatment as it has effectively reduced weed abundance and dominance of noxious weed without concomitantly decreasing weed diversity.

Keywords: *Ageratum conyzoides*, banana plantation, weed diversity, paraquat, glyphosate

AS - 52

**INSECTICIDE USE IMPACTS OF INTEGRATED
PEST MANAGEMENT (IPM) FARMER FIELD SCHOOLS:
EVIDENCE FROM ONION FARMERS IN THE PHILIPPINES**

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This article empirically examines the impact of Farmer Field Schools (FFS) on insecticide use by onion farmers in the Philippines. FFS is an intensive Integrated Pest Management (IPM) information dissemination method that encourages producers to lower their reliance on chemical insecticides for controlling pests and diseases in their farms. These FFS-IPM trainings have been conducted within vegetable-based production systems in the country since 1994. The data used in the study are from the face-to-face farm level survey in 2009 of 200 onion growers in Nueva Ecija. Using instrumental variable (IV) procedures to control for endogeneity and selection problems in the data, we found that FFS trained onion farmers in the Philippines have significantly lower insecticide expenditures (~PhP5,000) than non-FFS trained control farmers. By not controlling for these econometric biases, the FFS training did not show any effect on insecticide use. The insecticide reducing effect of FFS has important environmental and health implications, and provides evidence about the effectiveness of the FFS training method in disseminating important IPM concepts in the country.

Keywords: Farmer Field Schools; Insecticide Use Impact; Instrumental Variables Technique; Integrated Pest Management (IPM); Onion Production

AS - 53

**CLIMATE CHANGE MITIGATION IN CROP
PRODUCTION: DEVELOPING YELLOW CORN
(*Zea mays* L.) VARIETIES FOR SALINITY TOLERANCE**

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Problems due to soil salinity are widely spread throughout different agro-ecological zones. Corn (*Zea mays* L.), as one of the major cereal crops in the world, is adversely affected by this stress. Efforts to develop tolerant varieties are underway to limit the ill effect of salinity on corn production. Greenhouse experiments and field trials were conducted to evaluate the potential of 25 yellow corn populations or open pollinated varieties (OPVs) developed by the Institute of Plant Breeding (IPB) for salinity tolerance. Initial screenings were conducted in the greenhouse using the nutrient solution culture with varying degree of salinity. Treatments were replicated three times and were arranged in randomized complete block design with salinity levels serving as main plot and variety as the sub-plot. Results of agronomic parameters like percent survival root and shoot length, root and shoot biomass, chlorophyll content (SPAD value) and leaf area revealed three varieties with good potential for improving their saline tolerance; these were Phil 1-115, IPB Composite 3 and IPB Composite 5. These OPVs were further evaluated by growing them under actual saline soil. IPB Composite 3 and IPB Composite 5 produced the heaviest biomass and grain yield with the IPB Composite 3 being the better of the two. Thus, IPB Composite 3 had been chosen as the best OPV candidate for yellow corn population improvement for salinity tolerance.

Keywords: climate change, salinity tolerance, corn population improvement, nutrient solution culture

AS - 54

AGRICULTURAL LIMING CONTRIBUTES TO GLOBAL WARMING

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The role of atmospheric CO₂ in global warming is unchallenged. Lime carbonates contribute to atmospheric CO₂ emissions and enhance soil organic carbon (SOC) turnover in limed acid soils. Experimental data on the magnitude of lime-contributed CO₂ are still few although liming is common agricultural practice worldwide. To separate lime-contributed and SOC-originated CO₂-C to CO₂ evolution, we used Ca¹³CO₃ (¹³C 99%) as lime and tracer to an acidic Kuroboku Andisols from Tanashi, Tokyo Prefecture (35°44'N, 139°32'E) and Kunigami Mahji Ultisols of Nakijin, Okinawa Prefecture, Japan (26°38'N, 127°58'E). The lime was applied under two soil water conditions: 70% (FC70) and 30% (FC30) of the field capacity (FC) of the soils incubated at constant temperature (20° C).

After 36 days, ¹³CO₂-C evolution was 74.37 – 79.32% of total CO₂-C emissions from Kuroboku Andisols, and 62.32 – 70.4% in Kunigami Mahji Ultisols. This confirmed significant contribution of carbonates in CO₂ evolution of limed agricultural soils. Liming also increased ¹²CO₂-C evolution from native SOC. Priming effect of lime ranged from 51.97 – 114.95% in Kuroboku Andisols and 10.13 – 35.61% in Kunigami Mahji Ultisols. These are real priming effects since there was no other source of ¹²CO₂-C than SOC. Decrease in soil microbial biomass carbon (SMBC) indicated microbial stress due to liming, and rise in soil pH allowed an increase in microbial populations able to utilize SOC, explaining the extra ¹²CO₂-C evolution in limes soils.

Keywords: agricultural liming; soil organic carbon; priming effect; lime carbonate; soil microbial biomass carbon

AS - 55

EFFECT OF CATTLE FARMING ON POTENTIAL GROUNDWATER RESOURCES IN MASBATE, PHILIPPINES

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Masbate Island receives an annual rainfall of 2,624.51 mm. However, 50% of its rocks have no obtainable groundwater and are infested with bacteria and amoeba. The island's area is 46% pasturelands and difficult areas are found in places where large pasturelands are located. This study is aimed at understanding how cattle-raising industry in the island affects groundwater supply in terms of magnitude of recharge and water quality; and at identifying options for cattle-raising management that would help ensure sustainable groundwater supply. Policy review, stakeholders' analysis, interviews and tests on bulk density, amount of surface runoff and runoff-bacteriology test were conducted. The social, economic, institutional and technical aspects that affect the practices of cattle farmers were measured in terms of its effect on the magnitude and quality of potential groundwater resources. The findings of the study showed that practices of the farmers are affected by: their motive to generate income; their socio-economic status; and the incompetence and insufficiencies of policies. These were manifested by their practices on overgrazing, which resulted to compaction of soil in some of the grazing areas; unwillingness to adopt the use of improved grass, and unreligious reforestation of protected areas under FLGMA (Forest Land under Grazing Management Agreement). Forty-two percent of samples were found to have compacted soils. In their practices, the type of grass for grazing influenced the runoff behavior. Cogon grass showed strong influence in the behavior of runoff in which rainfall greater than 30 mm resulted to more than 8 mm-depth runoff. Total and fecal coliform in the runoff is greater than 8.0 MPN per 100 ml.

Keywords: Masbate, pastureland, runoff, cattle raising, cogon grass

AS - 56

CLIMATE CHANGE MITIGATION THROUGH CONSERVATION OF ANGAT WATERSHED RESERVATION IN LUZON, PHILIPPINES

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The impacts of climate change are becoming more severe. For the past decades, the Philippines have witnessed strong typhoons, prolonged rains and intense drought that caused significant damages to agriculture, infrastructures, human settlements and health. As proposed by the Intergovernmental Panel on Climate Change (IPCC), mitigation strategies such as reforestation and protection of the remaining forest cover can help lessen the impacts of climate change. Forested watersheds such as the Angat Watershed Reservation Dam in Luzon have huge capacity to store and sequester atmospheric carbon. Among the greenhouse gases, carbon dioxide is the most important contributor to global warming. Using the biomass sampling technique developed by ICRAF-ASB and Winrock Foundation, the study estimated the carbon stocks of Angat watershed. On the average, old growth forest has the largest carbon density with 404 ton ha⁻¹. This was followed by second growth forest (387.5 ton ha⁻¹ C), tree plantations of *Swietenia macrophylla* (357 ton ha⁻¹ C) and *Gmelina arborea* (240.7 ton ha⁻¹ C), submarginal forest (151.9 ton ha⁻¹ C), and lastly grassland (65.7 ton ha⁻¹ C). Total carbon stock of the watershed was estimated to around 22 gigaton C, an amount that is significant to help compensate the country's carbon emission level. Overall, the study emphasized the need to protect Angat watershed in order to sustain its twin role of climate change mitigation and sustainable water and energy generation.

Keywords: carbon stock, climate change, dam, watershed

AS - 57

RISK ASSESSMENT OF SALTWATER INTRUSION

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A study was conducted to investigate the current status of saltwater intrusion in the northern coastal aquifers of Ilocos Norte. Specifically, the study aims to determine the following: the degree of possible salt water intrusion; to identify the possible causes of risks associated with salt water intrusion and to come up with mitigation measures suitable in the locality.

The study area was characterized based on its geophysical and hydrological factors. The cropping pattern practiced is predominantly rice-garlic-vegetables. Groundwater resources are being used both for domestic and agricultural purposes.

Groundwater samples were collected from the farmers 21 existing shallow tubewells (STW) in three coastal barangays of Pasuquin, Ilocos Norte. Collection of samples were done using a portable sampling pump wherein the STWs were purged for 10 minutes prior to collection to pump out possible impurities. Groundwater samples collected were placed in 1 liter nalgene bottles, properly labeled and kept in an ice chest. The samples were immediately submitted to the Regional Testing Center of DOST-I, San Fernando, La Union for chloride and calcium analyses.

Results of analyses showed alarming results especially on chlorides content of groundwater samples. Average chloride content of seven STWs per barangay reached 650.0 mg/liter which is above the recommended limit of 250.0 mg/liter (Ayers, 1976) for irrigation water and 5.0 mg/liter for domestic purposes.

Therefore, the chloride content of groundwater samples analyzed posed an alarming threat to the coastal aquifer under study. There is a possible encroachment of saltwater intrusion to the STWs in farmers' field. A recommendation to undertake a mitigation technique to reduce saltwater intrusion using freshwater technology both in a hypothetical and actual coastal aquifer system is deemed necessary. This would serve as source of management strategies to solve if not to halt the saltwater intrusion landwards, thus protecting the coastal aquifer systems.

Keywords: saltwater intrusion, coastal aquifer system, chloride

AS - 58

CARBON SINK POTENTIAL OF THE PHILIPPINE MANGROVE FOREST

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The importance of mangrove for both human and coastal organisms has been well-documented in many literatures. Among which is the capacity to trap atmospheric carbon into its biomass and help mitigate the impacts of climate change such as tidal surge, erosion and salt water intrusion. Notwithstanding its smaller share in the global forest cover, it is one of the most productive and biodiverse ecosystems. On the average, mangrove contains as much as half of the old growth forest biomass, and represents 12 genera of plants. The Philippine mangrove forest currently accounts to 247,362 ha, and is gradually increasing because of the coastal rehabilitation programs being implemented by the government, NGOs and communities. Mangrove trees are very common in almost all coastal areas of the country. All regions, except the Cordillera Autonomous Region (CAR) harbor mangrove forest. Among the regions, MIMAROPA (Region 4B) has the largest share with 57,567 ha, followed by ARMM in Mindanao with 45,786 ha, and Region 8 (Samar and Leyte) with 38,781 ha. To estimate the potential of Philippine mangrove for carbon storage, carbon density estimates observed by the Environmental Forestry Programme of the University of the Philippines Los Baños were used. On the average, the country's mangrove could be storing as much as 28.56 to 35.05 megaton carbon (Mt C). Among the provinces, Palawan (53,678 ha) and Sulu (24,305 ha) have the largest carbon stocks with 6 to 7 Mt and 3 to 3.5 Mt, respectively. Indeed, Philippine mangrove has huge potential for carbon storage hence proper forest management is vital to sustain its ecological roles.

Keywords: Philippine mangroves, carbon sink, climate change, conservation

AS - 59

INCREASING RICE PRODUCTIVITY IN FLASH FLOOD-PRONE AREAS VULNERABLE TO EFFECTS OF CLIMATE CHANGE

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Flash floods of up to 2 weeks can occur at any crop growth stage, sometimes more than once, resulting in severe yield losses in rice. Despite the risk, farmers continue to grow susceptible modern varieties, local landraces with low yield, or leave the field idle and wait for another season. Six mega-varieties introgressed with *SUB1* gene and other lines possessing the *SUB1* gene were disseminated in Southeast Asia; their adoption was facilitated. On-station adaptive yield trials, subjected to normal and flooded conditions, and on-farm researcher and farmer-managed participatory varietal selection (PVS) followed by preference analysis and sensory evaluation were implemented. Following complete flooding for 8 to 13 days, varieties with *SUB1* had 1- 3 t ha⁻¹ yield advantage over normal varieties. Results from PVS showed Swarna-Sub1 (5.2 t ha⁻¹ yield) was most preferred in North Vietnam, while IR64-Sub1 (3.7 t ha⁻¹ yield) was most preferred in Central Vietnam. TDK1-Sub1, developed from the popular variety TDK1, and PSB Rc68 are top choices in Laos and Northeast Thailand. IR64 was the second most popular variety after Ciherang; thus, acceptance of IR64-Sub1 is faster in Indonesia. In the Philippines, IR49830-7-1-2-3 and BR11-Sub1 yielded 4.2 and 3.8 t ha⁻¹, respectively, and were most preferred. Varietal registration and accreditation of IR64-Sub1 (Submarinol) for the Philippines and IR70213-9-CPA-12-UBN-2-1-3-1 (INPARA-3), IR64-Sub1 (INPARA-4) and Swarna-Sub1 (INPARA-5) for Indonesia was made possible, thus commercialization and support from national governments was achieved. Initial success was attained through active partnership among farmers, local officials, extension workers, scientists, and other stakeholders. These Sub1 varieties provide considerable security for farmers in flash flood-prone areas.

Keywords: participatory varietal selection, *SUB1* gene, flash flood-prone areas, submergence tolerant rice

AS - 60

**VAST-Agro: A COMMUNITY-BASED VULNERABILITY AND
ADAPTIVE CAPACITY ASSESSMENT METHODOLOGY
FOR VARIOUS AGROECOSYSTEM**

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Vulnerability and adaptive capacity assessment is a necessary step prior to planning, implementation and prioritization of responses to changing climate. Often results of global and regional assessments are not appropriate for the local level thus requires a local-level assessment for a more focused and realistic adaptation measures, particularly for the agriculture sector, which is not highlighted in any of the available hazard assessment procedures. This paper aims to present a structured approach to vulnerability assessment specific for the Philippine agricultural systems at the local level. Available hazard assessment procedures were reviewed and examined in terms of their purpose, framework, methods, agriculture-related data and applicability to agriculture areas facing climate change. Based on the concept that vulnerability to climate change is the interaction of exposure to climate change-related hazards and their potential impacts as determined by sensitivity and adaptive capacity, a stepwise procedure was designed for understanding the local situation, describing the climate-related hazards, describing vulnerabilities, capacities and local adaptation measures. Climate-related and agriculture indicators were identified to describe exposure of the production systems and the farming communities to hazards, sensitivity of the system and the communities to the said hazards like high risks areas, vulnerable farming systems and groups, preparedness and adaptive capacity of the farming communities including physical, economic and technological adaptation capacities. As a community-led vulnerability assessment, an instrument was devised requiring data collection techniques involving community participation as well as integration of science, technical and local knowledge. A test of the methodology in the upland areas provided outputs including maps of vulnerable communities and agricultural production areas and a vulnerability index that showed areas requiring immediate attention and specific adaptation measures needed.

Keywords: climate change, vulnerability, adaptive capacity, agroecosystem, agricultural system

AS - 61

**UNDERSTANDING THE PATTERNS, DRIVERS AND
IMPACTS OF LAND USE CHANGE IN
STA. ROSA SUB-WATERSHED**

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Sta. Rosa sub-watershed had undergone an abrupt shift in economic-base from agricultural to an industrial economy. In understanding the patterns, drivers and impacts of land-use changes Sta. Rosa subwatershed. Participatory Rural Appraisal (PRA) activities including Focus Group Discussion, Time Line, Community Land-use Mapping, Causal Mapping and SWOT analysis were conducted in upstream, midstream and lakeshore sites.

The upstream community had undergone land use conversion from forested areas in the 1920s, to deforestation in the 1940s, planting of rice in the 1950s, coffee planting in the 1970s, and start of pineapple planting in the 1980s. The main drivers of land use changes are population migration, food security and income generation. Currently, the main problems focus on agriculture and farming. In order to address this problem, the community proposed crop diversification and use of organic fertilizers such as compost.

The midstream and lakeshore communities had undergone a tremendous degree of land conversion from an agricultural-based to an industrial-residential economy. Industrialization and increase in population are the driving factors for the land use change.

Solid wastes from households and liquid wastes from factories are the major problems in both mid-stream and lakeshore communities. Proper solid waste management and strict implementation of policies on solid waste management by the LGU is strongly recommended.

Keywords: PRA, Sta. Rosa subwatershed, land use change, industrialization, waste management

AS - 62

ASEPTIC CULTIVATION OF *Coprinus comatus* IN PULP AND PAPER WASTE

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Coprinus comatus is a wild edible mushroom that normally grows in cellulosic substrates. It is considered as a weed mushroom that competes with *Volvariella volvaceae*. In this study, we developed production technology for aseptic cultivation of this mushroom using paper sludge and corn grit. Two strains of *C. comatus* were rescued from decomposing pile of rice straw and cultured in different combinations of pulp and paper waste and corn grit.

Mycelial growth of *C. comatus* strain 1 was more vigorous than strain 2. *C. comatus* strain 1 grown in 7 parts paper waste + 3 parts corn grit had the shortest incubation period with a mean of 6 days while those cultured in 5 parts paper waste + 5 parts of corn grit produced the heaviest fruiting bodies with a mean of 9.87g and the most number of fruiting bodies with a mean of 23. Moreover, 2 parts paper waste + 8 parts corn grit produced the longest fruiting bodies with a mean of 83.49 mm. In contrast, *C. comatus* strain 2 grown in 8 parts paper waste + 2 parts corn grit had the shortest incubation period with a mean of 9 days, heaviest fruiting bodies (8.58g) and the most number of fruiting bodies (64.33). Finally, those that are grown in 7 parts paper waste + 3 parts corn grit produced the longest fruiting bodies with a mean of 40.77 mm.

Keywords: *Coprinus comatus*, aseptic cultivation, pulp and paper waste, production technology, cellulosic

BIOLOGICAL SCIENCES

BS - 01

**IMMUNOSTIMULATORY EFFECTS OF
Uncaria perrottetii (A. RICH) MERR. (RUBIACEAE)
VINEBARK EXTRACT *IN VIVO***

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The immunostimulatory effects of *Uncaria perrottetii* (A. Rich) Merr. vinebark aqueous extract was evaluated by employing a number of immune response assays *in vivo*. Initially, the optimum concentration was determined *in vitro* to be 50µg/mL. This concentration was then assessed for the immunoprotective effects of the extract against immunosuppressed Balb/C mice.

Thirty-six (36) mice were divided into 3 groups: (1) Phosphate-buffered saline (PBS)-injected mice; (2) *U. perrottetii* extract and Cy-treated mice (*U+Cy*); and (3) cyclophosphamide (*Cy*)-induced immunosuppressed mice. Group 1 was injected intraperitoneally with 0.2mL of 30mg/kg body weight of cyclophosphamide (Endoxan®) at days 1, 4, 7 and 10 of the treatment period. Cyclophosphamide was also administered to group 2 one hour after each administration of the plant extract. 50mL/kg body weight of PBS and *U. perrottetii* extract (2.5 mg/kg body weight) was administered daily.

In all immune assays undertaken, group 3 showed significantly lower response when compared with group 1. Group 2 showed significant improvement in phagocytic activity (27%), proliferation of cells with (29.61%) and without (44.57%) lipopolysaccharide, superoxide production ($P<0.05$), and plasma lysozyme activity ($P<0.05$) compared with the group 3.

The study showed that the extract could potentially reverse the immunosuppressive effects of cyclophosphamide *in vivo*. There is, therefore, a great potential of the plant as a source of bioactive products and metabolites for drug development.

Keywords: *Uncaria perrottetii*, Balb/C mice, immunostimulation, Rubiaceae, murine macrophages

BS - 02

**BACTERIAL PATHOGEN ISOLATED FROM
WHITE SHRIMPS *Pennaeus vannamei* CULTURED
IN ILOCOS NORTE**

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There is a need to have an alert surveillance on the microorganisms afflicting cultured shrimps to be able to curtail the spread of disease that could wipe out shrimp business ventures. This study focused on characterization and identification of a bacterial pathogen isolated from white shrimps cultured in Ilocos Norte.

White shrimps were surface sterilized for one minute prior to dissection. Swabs were obtained aseptically from the head parts after removal of the carapace and were inoculated into Nutrient broth cultured overnight. Colonies were grown in Nutrient Agar and pure cultures were further morphologically and biochemically characterized. The pure cultures were tested for hemolysin activity and the one that turned positive in the hemolysin test was identified using the API System of bacterial identification.

Results show that the isolate is a Gram negative non-fermenting aerobic rod. API identification system show that the isolate is Indole negative, nitrate reductase positive, Methyl red positive, Voges-Proskauer negative, catalase positive, cytochrome oxidase negative, phenyl alanine deaminase positive, Tryptophan test negative, Urea positive, Casein negative starch negative, hydrogen sulfide positive and citrate agar positive. Over all characteristics reveal that the isolate is a *Proteus mirabilis*.

Results call for the need to collaborate with shrimp industry owners to become aware of the possible sources of contamination of grow-out ponds for the protection of their business as well as the consumers.

Keywords: *Proteus*, white shrimp, API, shrimp industry, biochemical characterization

BS - 03

**INDUSTRIALLY IMPORTANT BACTERIAL
ISOLATES FROM SWEET SORGHUM
Sorghum bicolor L MOENCH**

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In an effort to search for industrially important enzyme producing bacteria, specially needed for biofuels production, sweet sorghum was used as the inoculum. Three varieties of sweet sorghum namely SPV 422, NTJ2 and ICSV93046 were used in this study. Sweet sorghum flour were inoculated in Nutrient Broth and incubated overnight. Pure cultures were obtained and grown in Nutrient Agar. Colonies were morphologically and biochemically characterized. They were further screened for production of enzymes needed in the industry. Three isolates are protease producers, one is a lipase producer and one has the ability to hydrolyze starch. All the isolates are Gram positive coccus except the starch hydrolysis positive which is Gram negative coccus. They can tolerate up to a maximum of 36% to 39 sugar concentration%, an indication that they are osmophiles. All the isolates are present in all of the sweet sorghum varieties. They are at present molecularly characterized to further elucidate their taxonomical positions. These are potential isolates for biotechnological production of industrially important enzymes.

Keywords: sweet sorghum, bacteria, industry, enzymes, lipase, sugar hydrolysis, protease, lipase

BS - 04

CHARACTERIZATION OF PIGMENT PRODUCING BACTERIA FOR INDUSTRIAL PURPOSES

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This study focused on the isolation and characterization of pigment producing bacteria from various sources like larvae of insects affecting sweet sorghum, fish paste and cultured shrimps in Ilocos Norte.

Insect larvae affecting sweet sorghum include earworm, army worm and katydid. The larvae were first surface sterilized prior to dissection. Inocula were obtained aseptically from their guts and are cultured in Nutrient broth overnight. Pigmented isolates were screened and grown in pure cultures in Nutrient agar and characterized morphologically and biochemically. Isolates produce yellow pigments. Fish paste was inoculated into Sea Water Complex medium and cultures were grown overnight. Pigmented isolates were plated and screened in Nutrient agar supplemented with 15% NaCl. The isolates from fish paste are slightly yellow. They were tested for salt tolerance and results show that they could tolerate up to 20% salt concentration, an indication that they are pigmented halophiles.

Inocula from the head parts of shrimps *Penaeus vanamae* were obtained and cultured in Nutrient Broth. Pure cultures were grown in Nutrient agar and were screened for pigment producers. The colonies obtained are blue green.

Most of the isolates are Gram positive coccus. Pigment production ranged from the 3rd to the 6th day after inoculation and is affected by the pH of the medium but not by temperature. The blue green, yellow and slightly yellow pigments are released into the medium and therefore extracellularly secreted.

The isolates are currently characterized at the molecular level. They are potential sources of dye in the food, fabric and leather industries.

Keywords: pigment, pigment producing bacteria, industry, isolation, biochemical characterization, Biotechnology

BS - 05

**PROTECTIVE EFFECTS OF FORMALIN- AND HEAT-
KILLED *Aeromonas hydrophila* IN NILE TILAPIA
(*Oreochromis niloticus*) INFECTION**

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Aeromonas hydrophila is an opportunistic bacterial pathogen of a number of aquatic animals that causes hemorrhagic septicemias, erythrodermatitis, fin and tail rot in fish. The pathogen affects *Oreochromis niloticus* (Nile tilapia), an economically important cultured fish in the Philippines. In this study, the protective effects of formalin- or autoclave-killed *A. hydrophila* or bacterin were injected via intraperitoneal on *O. niloticus* then challenged with live *A. hydrophila*. Data on mortality rates, serum lysozyme levels and histopathology of immune related organs, head kidney and spleen, generated responses in the challenged fish. Though fish were not entirely protected from the live form, autoclaved-killed bacteria showed stronger immune responses compared to formalin-killed bacteria.

Keywords: formalin-and autoclave-killed *A. hydrophila*, histopathology, tilapia infection

BS - 06

ESTABLISHING THE LEAF ANATOMY OF *Tamarindus indica* LINN. (TAMARIND) AND ITS IMPLICATION TO HARSH ENVIRONMENTS

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Tamarind (*Tamarindus indica* Linn.) has not received sufficient research attention over the years though it is one of the minor fruit crops in the Philippines, with a great potential for commercialization. It is an important crop because of its varied food and medicinal uses. The young green leaves are used for tasty dishes. Crushed leaves are put on wounds and abscesses. Juice from crushed leaves is taken with porridge to stop vomiting. Several studies are reported on its taxonomy, description and distribution; properties of the species; uses and products; ecological requirements; agronomy and production areas; reproductive biology; genetic improvement; genetic resources; harvest, postharvest and processing; economics of production; marketing and trade; and current situation and needs for research and technology. None so far is reported on the anatomy of the leaves which maybe responsible for the structural responses of tamarind in environments that make it durable, robust, easy to grow and cultivate. Thus, this study aims to establish the anatomy of the leaves and other structures, and therefore contribute and hopefully complete the baseline information on tamarind. Histological techniques such as freehand, sliding, clearing and paraffin techniques on the leaves were done. The leaf anatomy is of the "non-Kranz" type. The upper and lower epidermises is uniseriate, with stomata on both epidermises (amphistomatic). The mesophyll is differentiated into three layers of long slender, compactly arranged palisade mesophyll, and a few spongy mesophyll cells. The multiseriate palisade mesophyll may be one of the reasons why tamarind is very resistant to strong winds, can tolerate violent typhoons and cyclones (von Maydell, 1986; von Carlowitz, 1986), and hurricane resistant (NAS, 1979). Its strong and pliant branches and a deep and extensive root system, which anchors it to the ground (Coronel, 1986) may also account for the overall tolerance to harsh environments.

Keywords: non-Kranz, epidermis, palisade, spongy mesophyll, stomata, amphistomatic

BS - 07

**IDENTIFICATION AND CLONING OF RIBOSOME
INACTIVATING PROTEIN (RIP) GENES IN
JATROPHA PANDURIFOLIA ANDR. AND
JATROPHA PODAGRICA HOOK.**

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Ribosome-inactivating proteins inhibit protein synthesis in eukaryotes by catalytically damaging ribosomes and been proven to have antiviral and antitumour activity because it can truncate the translation of viral coat proteins. The presence of RIP genes in *Jatrophapandurifolia* Andr., *Jatropha podagrica* Hook. was screened using 5 primer sets. *Jatropha curcas* L. was used as the control because it already has a known RIP gene as determined by Lin *et al.* (2003). PCR products obtained were analyzed through BLASTs and ClustaWof MEGA4. Cloning of the genomic DNA PCR products and RT-PCR products were performed. Sequence analysis of the cloned PCR products through BLAST showed 87%-90% homology of *J. pandurifolia*'s RIP gene sequence to *J. curcas* precursor gene, while 87%-89% homology of *J. podagrica*'s RIP gene sequence to *J. curcas*' curcin precursor gene. Nucleotide sequence and deduced amino acid sequence revealed possible ORFs in *J. podagrica* and *J. pandurifolia*'s cloned PCR products. Alignment of the deduced amino acid sequence of the cloned PCR products of *J. podagrica* and *J. pandurifolia* to *J. curcas*' curcin revealed the presence of RIP's conserved regions such as SYFF, ALD and EAA which are putative active sites. Identification of the RIP genes in *J. pandurifolia* and *J. podagrica* will shed light on the medicinal properties of the ribosomal inactivating proteins (RIPs) in these plants. It will serve as a guide for those who might be interested in the isolation and purification of these proteins which have known antitumour and antiviral properties.

Keywords: Cloning, Ribosome Inactivating Proteins, antitumour

BS - 08

**CHARACTERIZATION OF *Moringa oleifera* LAM.
GERMPLASM COLLECTIONS IN THE PHILIPPINES
BY DNA FINGERPRINTING**

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Moringa oleifera Lam. or *Malunggay* is increasing in commercial relevance because of its nutritional, therapeutic and prophylactic properties. However, in the Philippines, there are few studies of *Malunggay* on the genetic level despite the extensive genetic resources. To contribute to the knowledge about *Malunggay*, in this study, genetic variation of *M. oleifera* germplasm collections in the Philippines was analyzed using intersimple sequence repeats (ISSRs) and SRILS as genetic markers. Seventy five accessions of *Malunggay* cuttings and seeds were collected from different locations in the Philippines. From these cuttings and seeds, genomic DNA was extracted using DNAzol and Zymo plant DNA extraction kits. Twelve ISSRs and nine SRILS primers were used as markers. Genomic DNA was subjected to PCR analysis. The PCR products were run on agarose gels. Then the results were analyzed by scoring the presence (1) and absence (0) of the different bands for all the sample. Polymorphic bands were determined as the bands that were present and absent across the samples. Results showed that there are 8 polymorphic bands using the ISSR primers and 15 of polymorphic bands emerged using the SRILS primers. These results indicate that *M. oleifera* in the Philippines is genetically diverse. A preliminary analysis was done by using the PAUP software and phylogenetic tree construction is underway. More accessions are currently being optimized for PCR analysis. Hence, the extent of genetic diversity of the *Malunggay* germplasm collection in the Philippines is yet to be determined statistically.

Keywords: germplasm, *Moringa oleifera*, DNA fingerprinting

BS - 09

THE EFFECTS OF *Aglaia loheri* BLANCO, *Aleurites moluccana* LINN. AND *Ardisia pyramidalis* (CAVS.) PERS. PLANT EXTRACTS ON HEPATIC HISTOLOGY AND LIPID PEROXIDATION ACTIVITY IN CARBON TETRACHLORIDE-TREATED MICE

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Three plant species, *Aglaia loheri*, *Aleurites moluccana*, and *Ardisia pyramidalis* were evaluated for their antioxidant properties by employing lipid peroxidation assays and histological analysis in carbon tetrachloride (CCl_4)-treated mice. Sixty mice were divided into six treatment groups: 1) PBS-injected mice; 2) corn oil injected mice; 3) 30% CCl_4 in corn oil intraperitoneally injected in mice every 72 hrs; 4) *A. loheri* extract + CCl_4 ; 5) *A. moluccana* + CCl_4 ; 6) *A. pyramidalis* + CCl_4 . Each of the plant extract was injected intraperitoneally on a daily basis. After two weeks, liver tissues were dissected out and subjected to lipid peroxidation assays. Liver samples were also processed for histopathological examination. Lipid peroxidation in both control groups was significantly lower than in CCl_4 -treated mice. Malondialdehyde (MDA) levels in *Ardisia*-treated and *Aleurites*-treated mice are higher than the CCl_4 -treated mice but the *Aglaia*-treated mice had lower MDA levels than the CCl_4 -treated mice. However, the difference was not statistically significant. In the histological examination, the extracts from *Ardisia* and *Aleurites* seemed to induce cellular regeneration in CCl_4 -treated mice. Higher degree of vacuolization and nuclear pyknosis, ballooning degeneration and multifocal necrosis were prominent in CCl_4 -treated liver tissues. Based on these results, it is recommended that further studies to confirm the antioxidant capacity of these plant species should employ varying extract dosages and longer treatment periods.

Keywords: antioxidant, histopathology, lipid peroxidation, carbon tetrachloride, malondialdehyde, ethanol plant extracts

BS - 10

**AMPALAYA (*Momordica charantia* L.) LEAF EXTRACT
AS TREATMENT AGAINST NON-ALCOHOLIC
FATTY LIVER DISEASE**

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Non-alcoholic fatty liver disease (NAFLD) is characterized by a myriad of condition including steatosis or increase in triglyceride retention in the liver, liver inflammation, and increase in liver enzyme levels in the blood. Steatosis of the liver is due to the increase in the influx of free fatty acids (FFA) into the liver and the prevention of exportation of excess triglycerides. Increase in FFA is linked to obesity and retention of triglycerides is said to be caused by hyperinsulinemia or increase in insulin levels. Cases of NAFLD is said to be rising in an alarming rate and is said to be one of the leading cause of liver failure. 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). 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. This study was conducted to test the effectiveness of ampalaya or bitter melon (*Momordica charantia* L.) in treating various symptoms of NAFLD using the MSG-mice. Neonatal mice were subcutaneously injected for five consecutive days with MSG (2mg/g bodyweight). After eight weeks, MSG- and control-mice were fed with ampalaya leaf extract (10% and 15% gram over milliliter). At 18 weeks old, all the mice were sacrificed, along with positive and negative control groups, and their Body Mass Index (BMI), glucose levels, and liver / body weight ratio were determined. Liver samples were observed for the presence of inflammation and steatosis. It was determined that the BMI of some of the treated groups were significantly lower than that of untreated MSG-mice, that the weight change of the treated were lower than the controls, and that there is reduced steatosis in the treated groups compared to the control groups. It was concluded that both concentrations of ampalaya extract used were effective in lowering steatosis in MSG and non-MSG mice.

Keywords: fatty liver disease, steatosis, *Momordica charantia*, ampalaya, MSG-mice

BS - 11

**DIVERSITY AND STATUS OF BUTTERFLIES
ACROSS VEGETATION TYPES OF MT. HAMIGUITAN,
DAVAO ORIENTAL, PHILIPPINES**

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An inventory was conducted to determine the diversity and status of butterflies of Mt. Hamiguitan, wildlife Sanctuary, Davao Oriental using quadrat method in five vegetation types namely; agroecosystem (10-400 masl), dipterocarp (500-900 masl), montane (900-1400 masl), mossy (1400-1500 masl) and pygmy (1500-1675 masl). Two 20m x 20m plots were established per vegetation type. These inventory techniques revealed 141 species of butterflies plus one subspecies described and illustrated. Diversity assessment using Shannon-Weiner index showed high level (4.1) in the Montane forest as compared to other vegetation types. Bray-Curtis similarity index shows low species similarity in pygmy, mossy and agro-montane forest (< 40 %). Furthermore, this study revealed 3 possible new species, 44 endemics: 2 eastern Mindanao endemic (very rare), 4 Mt. Hamiguitan endemic (very rare), 16 Mindanao endemic and 22 Philippine endemic. Seven new species were recorded in Mindanao. Mt. Hamiguitan wild life Sanctuary is the home of diverse and endemic butterfly species. The study recommends further monitoring to establish population and species richness trend. It further recommends that policies and ordinances should be formulated by PAMB and LGUs.

Keywords: butterflies species richness trend pygmy vegetation types Mt. Hamiguitan

BS - 12

INVENTORY OF EARTHWORMS IN MT. HILONG-HILONG RANGE, AGUSAN DEL NORTE, PHILIPPINES

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Earthworms play an important role in the ecosystem as keystone species on soil formation. They plough the soil, mix, till and build topsoil as they burrow through the earth. They consume large quantities of soil and fresh or partially decomposed organic matter from the soil surface, depositing it as fecal matter/casts in the lower soil horizons. They loosen and aerate the soil as they tunnel the ground affecting the hydrology cycle. Earthworms in their natural habitats improve soil structure, fertility, and the rate that organic matter gets broken down. Yet, they are less known in the Philippines. Here, inventory of earthworms in the mossy and montane forests of Mt. Hilong-hilong, Diwata Range, Agusan del Norte was conducted for 15 days to provide information on species composition and richness using digging, hand sorting and counting methods. Twenty six species were identified and 6 were undetermined. These were placed in 32 genera. Twenty species were disconcordant in the mossy and seventeen species in the montane forest. Only six species of earthworms were concordant in both vegetations. Species diversity was higher in the mossy forest $H' = 2.788$ compared to montane forest $H' = 2.674$. Similarity of species composition showed low $S_i = 25.33\%$ between the mossy and montane forests which implies that mossy and montane forests are two unique habitats for earthworms in Mt. Hilong-hilong. It is recommended that cast formation and biology of these earthworms be studied as future source of vermicast organic fertilizer production rather than using exotic stocks.

Keywords: inventory, earthworm, Mt. Hilong-hilong, Philippines, species diversity

BS - 13

**ANTIOXIDANT PROPERTY AND HISTOLOGICAL EFFECTS
OF THE ETHANOLIC PLANT EXTRACTS OF *Ficus septica*
BURM, F. and *Uncaria perrottetii* (A. RICH) MERR IN MICE**

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Many antioxidants that confer protection through inhibition of cellular membrane damage have been developed from various plants. In this study, the antioxidant properties of the leaf extract of *Ficus septica*, and the vine bark extract from *Uncaria perrottetii*, were assessed by measuring the malondialdehyde (MDA) levels, as by-product of lipid peroxidation, in the liver of ICR mice. In addition, histological examination was undertaken to determine the hepatoprotective effects of the two plant extracts. Mice were grouped into five cages, as follows: 1) negative control- phosphate buffered saline (PBS); 2) negative control- corn oil only 3) positive control- intraperitoneal injection of 30% carbon tetrachloride (CCl₄) in corn oil (1 ml/kg BW) every 72 hours; 4) treatment with *U. perrottetii* + CCl₄; and 5) treatment with *F. septica* + CCl₄. Both crude extracts were injected at a dosage of 250 mg/kgBW, and were given daily through intraperitoneal injections for two weeks. Results obtained from the lipid peroxidation assay showed that the CCl₄- treated mice had the highest MDA levels. Lower MDA levels were detected in the extract-treated mice and in the negative control mice but these were not statistically significant. However, histological examinations revealed various signs of cellular repair in the hepatic tissues of the extract-treated mice relative to the degenerative and necrotic pathologies in the CCl₄-injected mice. The results show that the extracts conferred hepatoprotection but future validation studies must employ a longer period of treatment and other routes of extract application.

Keywords: antioxidant, histopathology, lipid peroxidation, *Uncaria perrottetii*, *Ficus septica*

BS - 14

**EFFICACY OF FORMULATED ANTI-MOSQUITO
GEL FROM EUCALYPTUS (*Eucalyptus globules*)
AND CARRAGEENAN**

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The *in vitro* and *in situ* biocidal property of Eucalyptus gel formulation against larval mosquitoes was evaluated. The study aimed to (1) determine the effects on the morphology of mosquitoes; and (2) determine the mosquito repellent effect of the gel formulation.

Eight (8) different treatments were prepared for the *in vitro* test namely: T1 (combination of carrageenan and eucalyptus oil); T2 (combination of carrageenan and eucalyptus powder); T3 (pure carrageenan); T4 (pure eucalyptus oil); T5 (pure eucalyptus powder); T6 and T7 (positive control, commercial anti mosquito lotion for kids and adult); and T8 (negative control). Morphological effects of formulated treatments on the larval mosquitoes include the loss of body fluid, antennae and cut hair-like structures. In terms of mortality rate, eucalyptus oil formulation was not significantly different from the positive control, which both achieved 100% mortality. Based on the *in vitro* test, pure eucalyptus oil was observed as the most effective in attaining 100% mortality in just 29.33 minutes after application. The first three (3) formulations that gave the best result were used in the *in situ* evaluation namely T1, T2 and T4.

The *in situ* evaluation revealed that the combination of carrageenan and eucalyptus oil (T1) and commercial anti-mosquito lotion gave the best result in which no mosquito bites were observed by the human samples. Coefficient of Variation (CV) revealed that there are no significant differences between the formulated treatments and positive control on the number of mosquito bites.

The abundance of eucalyptus plant in the country can be tapped for the production of environment-friendly anti-mosquito product.

Keywords: *in vitro*, *in situ*, biocidal property, repellent, anti-mosquito

BS - 15

**COMPARATIVE STUDY ON THE BIOACCUMULATION OF
LEAD (Pb) IN THE TISSUES OF *Arachis pintoi* (PINTO
PEANUT) AND *Imperata cylindrical* (COGON GRASS)
GROWN IN LEAD CONTAMINATED SOIL**

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Plants have the intrinsic capability to take up heavy metals and store and accumulate these in their tissues. These capabilities are selective of plants, of the heavy metal adsorbed and on their interactions with the physico-chemical environment. This is the basis of selection of plants that could be used as potential phytoremediators. The Pb uptake potential in the root and shoot tissues of pinto peanut and cogon grass seedlings was investigated in potted greenhouse conditions and analyzed using Atomic Absorption Spectrophotometry (AAS). Percentage survival of the plants was also evaluated. Results indicated significant differences in Pb accumulation in both the root and shoot tissues of the two plants grown for 2 months in lead contaminated soil. Pinto peanut seedlings accumulated significantly greater amount of lead in their shoot (11.26 ppm) and root (8.74 ppm) than cogon grass seedlings which accumulated a noncomparably lesser amount of 1.47 ppm Pb in their shoot and 0.15 ppm Pb in their root. However both plants showed 100% survival when grown in lead-contaminated soil. The greater bioaccumulation of lead in the tissues of pinto peanut suggests that the plant may be used for the clean up and phytoremediation of Pb-contaminated soils.

Keywords: lead (Pb), bioaccumulation, pinto peanut (*Arachis pintoi*), cogon grass (*Imperata cylindrical*), phytoremediation

BS - 16

**PHYTOCHEMICAL SCREENING AND EVALUATION OF AN
INDIGENOUS PLANT SPECIES, PAPAIT (*Mollugo
oppositifolia*) AS A POTENTIAL ANTI-DIABETIC PLANT**

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The development and exploration of the remaining Philippine indigenous plants as a botanical resource remain a researchable area not only in medicine but also in biodiversity conservation. Papait (*Mollugo oppositifolia*) is very common weed indigenous to the Philippines. The whole plant is eaten as a vegetable by local folks and is claimed to have anti-diabetic effects and is reported lately as exceptionally rich in iron and calcium. The study aimed to determine the phytochemicals present in Papait leaf extract and evaluate its potentials to lower blood glucose level of white mice. The study was laid in Completely Randomized Design (CRD) in 5 treatments: T1 (0.0025 mlPLE/g wt of mice), T2 (0.005 mlPLE/g wt of mice), T3 (0.0075 ml PLE/g wt), T4 (0.01 ml PLE/g wt) and T5 (control-insulin). The extract was orally fed to hyperglycemic mice. Phytochemical screening of the leaf extract showed this to be very rich in phytochemicals including alkaloids, saponins, steroids, fixed oils and proteins. All the treatments exhibited comparable degrees of potency in lowering blood glucose levels in both sexes of white mice. Percentage (%) reduction of BGL as affected by Papait leaf extract in all the mice was comparable to percentage reduction caused by insulin. The results remarkably demonstrated comparable effect of the plant with the anti-diabetic drug insulin. It is concluded that Papait Leaf Extract can be used as a component material for the preparation of anti-diabetic drugs. It likewise confirms claims of folkloric medicine that the Papait plant can lower blood sugar level hence, it can be a very good complement or substitute for the expensive commercially available anti-diabetic drugs.

Keywords: phytochemical chemistry, hypoglycemic effects, papait (*Mollugo oppositifolia*), antidiabetic

BS - 17

**MOLECULAR PHYLOGENY AND A NOVEL SPECIES OF
THE PHILIPPINE ENDEMIC *Antherosteles* (Rubiaceae),
WITH IMPLICATIONS ON ITS CONSERVATION AND
BIOCHEMICAL PROPERTIES**

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Antherosteles Bremek. is an understudied genus of Rubiaceae endemic to the Philippines comprising four species of small to medium-sized trees distributed in Luzon and Visayas. All species of the genus are threatened and categorized by the DENR (2007) under vulnerable status. Since its segregation from *Urophyllum* Wall. on the basis of morphology of limited herbarium materials, *Antherosteles* has not been challenged by any molecular study to test its monophyly and determine its phylogenetic placement within Rubiaceae. To address these gaps, field collection of all *Antherosteles* species was done and sequences of the Internal Transcribed Spacer (ITS) region (nrDNA) were utilized for phylogenetic analysis. Parsimony analysis of the ITS data showed that *Antherosteles* is monophyletic with strong support (BS=100%) and is nested within the tribe Urophyllaeae. The genus is united by hairy corolla lobes and syngenesious stamens. The montane *A. luzoniensis* is found to be sister to the rest of shaded understory *Antherosteles* species. The present study recognizes five *Antherosteles* species including a new species (*A. samarensis* Obico & Alejandro). Three *Antherosteles* species (*A. luzoniensis*, *A. callophylla* and *A. samarensis*) have restricted distributions and are considered rare based on field observation. Hence, a sustainable conservation management is herein urged for the three species of the endemic genus. By its placement under subfamily Rubioideae, *Antherosteles* is a potential source of anthraquinones, an organic compound with many industrial and medicinal applications.

Keywords: *Antherosteles*, conservation, nrDNA, Philippine endemic, Rubiaceae, Urophyllaeae

BS - 18

HISTOCOMPATIBILITY ASSESSMENT IN THE CHICKEN COLONIES CLOSED FOR SEVERAL YEARS

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Despite the numerous calls for the conservation of avian genetic stocks, there is still continued elimination of chicken research populations. The core objective for conservation of farm animal genetic resources is to maintain access to the adaptive genetic potential of collection of valuable research resources. The closed colonies of chicken used in this experiment are well characterized. However, assessment of isogenicity of these closed colonies has not been performed, thus, immunological methods to assess the status of the histocompatibility antigens were employed. The RIR-Y8/NU, BL-E, YL and WL-G chicken closed colonies were assessed by hemagglutination test using anti-red blood cell (RBC) antibodies (HT), skin transplantation test (STT) and formation of isohemagglutinins (FIHs) during STT. The YL individuals all showed the survival of skin grafts with no FIHs in STT and no RBC antigenic variations in HT, indicating high homogeneity at the serological loci. The BL-E as well as WL-G closed colonies were also found to be histocompatible in the STT with no FIHs, although the HT showed heterogeneities at serological locus/loci other than the *B* and *C* blood group loci which have significant effects on histocompatibility. In the RIR-Y8/NU closed colonies, STT showed early skin graft rejection with positive FIHs caused by different *B* locus alleles, suggesting relatively high heterogeneities. The YL, BL-E and WL-G are isogenic lines, however, RIR-Y8/NU needs further selection.

Keywords: chicken closed colony, chicken genetic resource, hemagglutination, isohemagglutinin, skin transplantation

BS - 19

**CLONING AND SEQUENCE ANALYSIS OF PARTIAL cDNAs OF
SELECTED GENES IN NORMAL AND MUTANT 'MAKAPUNO'
ENDOSPERMS OF COCONUT (*Cocos nucifera* L.)**

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Makapuno is a mutant coconut (*Cocos nucifera* L.) with over-proliferating endosperm, occurring in the Philippines and Dutch East Indies. Its fruit is almost full of viscous and delicious endosperm, commercially useful in making ice cream, pie and other delicacies. The science behind the makapuno phenomenon has not been completely understood. To determine the molecular basis of the makapuno phenomenon, we designed primers and cloned genes involved in cytokinin biosynthesis, polyamine synthesis, galactomannan degradation, glycolysis, alcoholic fermentation, fatty acid biosynthesis and cell cycle regulation. The total RNA from normal and makapuno endosperms of coconut were isolated and reversed transcribed. The cDNAs were used as template for PCR. The PCR products were ligated into pGEM[®]-T Easy vector, cloned in *Escherichia coli* JM109 cells and sequenced. A total of thirteen partial cDNA sequences were obtained. Interproscan and BLAST analyses revealed the cDNAs contain conserved domains and are highly homologous (68-98%) to equivalent sequences from other plant species. Pairwise alignment (Blossom 62) of the thirteen partial cDNAs between normal and mutant makapuno coconut revealed absence of nucleotide sequence differences implying no structural differences in the genes of the two coconut genotypes. The makapuno and normal coconut used in this study are of the same Laguna Tall variety.

Keywords: coconut endosperm, endosperm overgrowth, cDNA cloning, makapuno

BS - 20

SELECTION OF A SUITABLE INTERNAL CONTROL GENE FOR RELATIVE RT-PCR-BASED EXPRESSION ANALYSIS IN NORMAL AND MUTANT 'MAKAPUNO' ENDOSPERMS OF COCONUT (*Cocos nucifera* L.)

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Makapuno is an abnormal coconut with over-proliferating endosperm that is softer and fluffy due to galactomannan accumulation. To perform relative RT-PCR for expression analyses of important genes possibly involved in the makapuno phenomenon, an internal control gene was initially determined for normalization purposes. Three genes were studied, namely, glyceraldehyde-3-phosphate dehydrogenase (GAPDH), enolase and actin. GAPDH and enolase were found to have considerably varied expression level in all the samples and are not recommended to be used as internal control genes. The actin gene has a uniform detectable expression in all the samples studied and is recommended for use as reference gene for normal coconut and mutant makapuno solid endosperm samples at stages 5-6, 6-7 and 7-8 months.

Keywords: actin, coconut endosperm, endosperm overgrowth, internal control, makapuno, relative RT-PCR

BS - 21

BIOPHYSIOLOGY OF *Panaeolus* spp. ASSOCIATED WITH DRIED DUNG OF DOMESTICATED RUMINANTS

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Panaeolus is a psychoactive mushroom usually found growing on dried dung of domesticated ruminants such as carabao and horse. In our efforts to look for alternative source of bioactive compounds for drug development, we initiated a study on domestication of this wild mushrooms hallucinogenic activity. The baseline information generated in this research is necessary for the development of production technology towards its sustainability. As a prelude to its domestication, we evaluated the nutritional and physical requirements for efficient mycelial growth of *Panaeolus* sp. and fruiting body performance on different formulated substrates under aseptic condition. Wild strain of *Panaeolus* sp. was obtained from dried carabao dung. The cell lines were aseptically rescued following the standard tissue culture protocol for mushroom.

Among the different media evaluated, results revealed that potato sucrose gulaman (PSG) was the best culture medium as indicated by vigorously thick mycelial density and shortest incubation period with a mean of 9 days. Moreover, potato sucrose gulaman with pH of 6.5 incubated under sealed and alternating light-dark condition favored the mycelial growth of *Panaeolus* sp.

Aseptic cultivation using 90% carabao dung and 10% rice bran recorded thick and fast mycelia growth and shortest incubation period with a mean of 11 days. However, 90% horse dung and 10% rice bran yielded more fruiting bodies with a mean of 0.39g, highest mean height of 33.67 mm and highest biological efficiency with a mean of 1.15%.

Keywords: Psychoactive mushroom, *Panaeolus*, domesticated ruminants, aseptic cultivation

BS - 22

**MORPHO-ANATOMICAL INVESTIGATION ON STIPULES,
COLLETTERS AND LEAVES OF *Rhizophora* spp. IN PAGAPAS
BAY, CALATAGAN, BATANGAS, PHILIPPINES**

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The morphology and anatomy of stipules, colleters and leaves of four identified *Rhizophora* species: *R. apiculata*, *R. mucronata*, *R. stylosa* and putative hybrid *R. x lamarekii* in Pagapas Bay, Calatagan, Batangas, Philippines were investigated. Stipule color and size vary within species. The stipule has mono-layered epidermis covered with thick cuticular wax, distinct aggregated sclereid ideoblasts, well-developed vascular bundle, and multilayered hypodermis. The variations in color, exudates consistency and series number of aggregated colleters were elucidated. Colleters have central axis composed of slender, elongated cells surrounded by palisade-like epidermis. Differences in leaf morpho-anatomy including leaf shape, leaf structure, mucus cells, vascular bundle, stomata apparatus and corkwarts were also observed in the four *Rhizophora* species. In general, *Rhizophora* leaf consists of thick cuticle, single layer epidermis, 6 to 7 layers of hypodermis, funnel-shaped mucus cells, parallel columns of four layers of palisade mesophyll, and varied layers of spongy mesophyll. The presence of druse crystals in stipule and leaves is common. Features of the stomatal apparatus including guard cells lignin thickness, subsidiary cells arrangement and stomatal aperture are considered diagnostic. Guard cells have a pair of inner and outer cuticular ridges. Stomata and corkwarts, which developed from stomata as the leaves mature, are concentrated only in abaxial leaf surface. These morpho-anatomical characteristics of *Rhizophora* species exemplified the structural modifications that enabled them to adapt to the physiologically dry, saline mangrove environment.

Keywords: colleter, leaf anatomy, leaf morphology, *Rhizophora* spp., stipule

BS - 23

FUNCTIONAL STUDIES OF WSSV-SHRIMP HOMOLOGS BY DS-RNA INTERFERENCE IN THE SHRIMP *Marsupenaeus japonicus*

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Global shrimp production tripled over the past decade from 750,000 tonnes in the 1990s to more than three billion tonnes over the past five years, severely affecting ecosystems and livelihoods. White spot syndrome virus (WSSV) is a deadly pathogen for shrimp and a major threat to shrimp farming for the last two decades. Elucidation of the underlying mechanism of shrimp-virus interaction will be of enormous help in the prevention and management of shrimp viral diseases.

Double stranded RNA interference (ds-RNAi) is a powerful tool in elucidating gene function in invertebrates. ds-RNAi allows interference with the expression of a gene in a highly sequence specific manner and thus essential genes can be targeted by design, with little or no risk of undesired off-target effects.

Eight (8) WSSV-shrimp homologs ORFs (MjORF13, MjORF17, MjORF 20, MjORF23, MjORF24, MjORF31, MjORF34, MjORF37) from Kuruma shrimp previously identified to have significant homology with WSSV were studied using dsRNA interference technology.

The eight WSSV-shrimp homologs were successfully amplified, sequenced and dsRNA have been produced. Interestingly, initial results showed that shrimp injected with MjORF31- and MjORF34-dsRNA significantly increased mortality compared to that of the PBS injected group, highlighting their importance in shrimp survival.

Challenge test results with white spot virus syndrome (WSSV) as pathogen showed that shrimp injected with MjORF17-, MjORF20-, MjORF23- and MjORF34-dsRNA have higher survival rate than those of the control. Hence, dsRNAs of these four WSSV-shrimp homologs may have protective effect on shrimp against WSSV infection. It would be interesting to pursue or assess the stability and the possible therapeutic application of dsRNAi in shrimp.

Keywords: shrimp, dsRNA interference, homologs, white spot virus syndrome, shrimp-virus interaction

BS - 24

**COMPUTATIONAL RECONSTRUCTION AND
CHARACTERIZATION OF ANCESTRAL PROTEINS
RELEVANT TO PROKARYOTIC-EUKARYOTIC
TRANSITION 2 BILLION YEARS AGO**

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Anaphase Promoting Complex 11, most probable ancient Ubiquitin ligase is correlated with a former study to have emerged after the Great Oxidation Event. RPN3, most ancient non-ATPase 26S proteasome lid appeared in cyanobacteria and proteobacteria emergence. However, BCS1 in mitochondria inner membrane, found to be the most ancient protein, functions as an ATP-dependent chaperone which led to some rise of multicellular organisms. The AA sequences of these genes were retrieved with Entrez gene in FASTA format and aligned with CLUSTALW via MEGA 4. Using gamma distribution and JTT matrix rates, distance matrices were obtained and used to create a phylogenetic tree. The ancestral sequences were generated in the codeml program of PAML. ProtParam and SWISS-MODEL were used in characterizing the 1^o, 2^o, and 3^o structures of derived ancestral proteins and reference species. Using ProtParam, physico-chemical properties of Ub ligase, mitochondrial chaperones and proteasome were known. Visualization of the 3-dimensional structures of these ancestral proteins was requested from SWISS MODEL and Rasmol. New Likelihood-based Probability Method gave 0.91, 0.86, and 0.73 for all, variable, and parsimony-informative sites, respectively, whereas the corresponding probabilities for the parsimony method were 0.84, 0.76, and 0.51, respectively. The probability that ancestral sequence was correctly reconstructed ranged from 91.3 to 98.7%.

Keywords: ubiquitin proteasomal degradation, mitochondrial chaperones, PAML, ProtParam, SWISS-MODEL

BS - 25

CRUSTACEANS AS BIOINDICATORS OF WATER IN LABAC RIVER OF CAVITE

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The study was conducted to assess the physico-chemical status of water in Labac river in Cavite using crustaceans as bioindicators.

The occurrence of crustaceans was assessed quantitatively in eight sites of the western Labac river and nine sites of the eastern Labac river of Cavite.

The banks of the entire Labac river are highly vegetated. Some river waters are still undisturbed and clear while majority of the river stations have polluted waters.

Labac river is narrow (6.84 m) and very deep (>1.50 m) with a cold water temperature (25.9°C), slow water velocity (26.41 cm/sec), alkaline water (7.25), had sufficient DO (7.72 mg/l.), low level of TDS (0.27°brix), high level of TSS (280 mg/l.) and high level of salinity (2 ppt).

Shrimp population count was positively correlated with width, pH, and TDS and moderately correlated with depth and salinity of river water while crab population is moderately correlated with river water temperature. DO has a very small positive correlation with crab population.

Shrimps favor wide and deep rivers with acidic to alkaline water, and low level of TDS and salinity in water. Crabs prefer shallow, cool and shaded areas and high level of dissolved oxygen in river water.

Shrimps can be bioindicators of pH, total dissolved solids and salinity, while crabs can be bioindicators of temperature and dissolved oxygen in river water.

Keywords: Crabs, Dissolved Oxygen (DO), Labac River, pH, Salinity, Shrimps, Total Dissolved Solids (TDS), Total Suspended Solids (TSS)

BS - 26

**PROCRUSTEAN ANALYSIS OF WING SHAPE DIVERGENCE
AMONG SIBLING SPECIES OF *Neurothemis* DRAGONFLIES**

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Dragonflies under the genus *Neurothemis* are the common red- and brown- winged dragonflies that one sees often in drains, small ditches and ponds. There are more than four confusing *Neurothemis* species that are easily mixed up by their similar color and pattern. These species are difficult to identify in the field. The present study determined wing shape divergence in three species of *Neurothemis* dragonflies collected from Northern Mindanao, Philippines. These include *N. terminata terminata* Ris (29 females, 7 Males), *N. fluctuans* Fabricius (9 females, 4 males), and *N. ramburii ramburii* Kaup & Brauer (6 females, 7 males). A generalized least square fitting analysis was done via Procrustes superimposition of landmarks from the wings. Relative warp analysis showed significant variation among the *Neurothemis* species. The first extracted relative warp showed differences in the shape of the pterostigma and disparity in the distance between the distal end of the radial planate supplement and the distal margin of the wings bounded by the end points of the intercalary vein and the radial branch. This accounted for 26.78-42.28% of the variation in the shapes fore wing. Differences in the shape of the pterostigma were also observed and accounts for 27.98-44.18% of the variation in the shape of the hind wing. Distance matrices were constructed for the four data sets: left and right fore wing; left and right hind wing. Then, comparison was done via correlation analyses of the four matrices of distances among the species. Results showed that the shape of the fore wing contributed more in discriminating among species when compared to the hind wing. The result of the study is discussed in relation to the utility of wing morphology in the taxonomy and discrimination of sibling species of *Neurothemis* dragonflies.

Keywords: *Neurothemis*, procrustes analysis, dragonfly, wings, sibling species

BS - 27

CYTOGENETIC ANALYSIS OF SELECTED NATIVE AND ENDEMIC PHILIPPINE FRESHWATER FISH SPECIES

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Cytogenetic analysis may show variations in chromosome numbers and total DNA content of the nuclei which enables the identification of species origins and relationships. This project plans to establish the chromosome constitution of selected native and endemic fishes.

Ten individuals from each species were collected from Laguna, Quezon and Bicol freshwater rivers and lakes. The selected species were *Glossogobius celebius* Valenciennes (Gobiidae), *Glossogobius giuris* Hamilton (Gobiidae) and *Leiopotherapon plumbeus* Kner (Terapontidae). Metaphase chromosomes were collected from regenerating blastemas of the caudal fin following the modified procedure of Vallejo (1982). The cut caudal fin was first allowed to regenerate for 2-3 days, and then the fishes were transferred to a beaker containing a 0.003% colchicine solution for 4 hours. The regenerated fin was severed from the fish, transferred to distilled water and treated with Carnoy's solution each for 30 minutes. All the smears were stained with either 20% Giemsa or 2% aceto-orcein. The search for 20 C-metaphase cells per species is ongoing using light microscopy. Expected outputs for the first year of the project include the chromosome numbers and karyograms of the selected endemic fishes in order to provide baseline information for biodiversity and evolutionary researches.

Keywords: karyotype, *Glossogobius celebius*, *Glossogobius giuris*, *Leiopotherapon plumbeus*, karyogram

BS - 28

ISOZYME ANALYSIS OF SELECTED NATIVE AND ENDEMIC PHILIPPINE FRESHWATER FISH SPECIES

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In an attempt to establish the genetic relationship and to assess the genetic variation within and in between populations of selected endemic and native Philippine freshwater fishes, isozyme analysis was done using starch gel electrophoresis for four different enzyme systems namely: esterase, alkaline phosphatase, malic enzyme and, α -glycerophosphate dehydrogenase. A total of 285 fish individuals were used that include *Leiopotherapon plumbeus* ("Ayungin"), *Glossogobius celebius* ("Biyang Bato"), *Glossogobius giuris* ("Biyang Bato") and *Ophieleotris aporos* ("Bangayngay"). The crude protein extracts were loaded onto the starch gel and the electrophoretic run followed. After the run was finished, the gel was sliced into four and each slice was soaked in a specific enzyme staining solution. The resolved bands were then scored and the relative mobility (Rf) values were computed for each band. Preliminary results include the banding patterns observed for each population and the temporarily assigned presumptive loci and alleles based on the Rf values. The loci and alleles assigned are still temporary until all the bands are confirmed for their presence and position which is now underway. These loci and alleles will be the basis for the statistical analysis using the POPGENE32 software. However, to have a more effective analysis, four more enzyme systems namely: acid phosphatase, lactate dehydrogenase, phosphogluconic acid, and isositric dehydrogenase will be added.

Keywords: isozyme, starch gel electrophoresis, esterase, alkaline phosphatase, malic enzyme, α -glycerophosphate dehydrogenase, acid phosphatase, lactate dehydrogenase, phosphogluconic acid, isositric dehydrogenase, *Leiopotherapon plumbeus*, *Glossogobius celebius*, *Glossogobius giuris*, and *Ophieleotris aporos*

BS - 29

ISOLATION AND CHARACTERIZATION OF MICROSATELLITES IN SELECTED PHILIPPINE NATIVE AND ENDEMIC GOBIIDAE SPECIES

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Microsatellite markers enable species and parentage identification, assessment of genetic diversity and population genetic structure, determine relationships between populations and species and are widely used in marker-assisted breeding. These highlight the significance of the isolation, characterization and development of microsatellite markers from our own, Philippine endemic and native freshwater fishes. Five Philippine native and endemic Gobiidae species were collected. These include *Glossogobius celebius*, *G. giuris*, *Rhinogobius sp.*, *Gobiopterus lacustris*, and *Mistichthys luzonensis*. A modified protocol for the construction of microsatellite enriched genomic library was used. Genomic DNAs from each species were pooled, digested with *RsaI*, size-selected, purified and ligated to *Mlu I* adaptors. DNA containing microsatellite fragments were captured by biotinylated oligo probes [(TC)₁₀, (CA)₁₀, and (TG)₁₀] and recovered using streptavidin magnetic particles. After PCR, the product was ligated to pGEM-T Easy vector, transformed into JM109 competent cells and plated on Luria-Bertani (LB) agar medium. Recombinant plasmids identified through blue-white screening were sequenced. However, there was low efficiency. To increase efficiency in selecting clones containing microsatellites, more stringent hybridization procedures are now being explored including the hybridization of colonies with non-radioactively labelled repeat oligonucleotides.

Keywords: microsatellites, library construction, *Glossogobius celebius*, *Rhinogobius sp.*, *G. giuris*, *Gobiopterus lacustris*, and *Mistichthys luzonensis*

BS - 30

CYTOTOXICITY OF FIVE ANTI DENGUE PLANTS USING *Artemia salina*

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The quest to prevent and cure dengue is continuous. Various researches show that *Uncaria tomentosa* or cat's claw (Yano, 2009); *Ipomoea batatas* or sweet potato (Villafuerte, 2010); *Euphorbia hirta L.* or tawa-tawa (Cabara, 2011); *Azadirachta indica* or neem tree (Parida, 2002); and *Carica papaya* or melon tree (Ahmad et al., 2011) are all potential anti-dengue plants. These plants have been exposed to efficiently fight the disease. *Artemia salina* toxicity bioassay was used to determine and compare the mortality and LC50 (Lethal Concentration 50) of the roots, stem and leaves of the plants. Treatment concentrations of the plant parts extract were: 10,000 µg/mL, 1,000 µg/mL, 100 µg/mL, 10 µg/mL, 1 µg/mL and 0.1 µg/mL. Regression of Toxicity Line and Graphical Interpolation Method were used in the calculations of LC50.

Results show that 100% mortality of *Artemia salina* was obtained in the 10,000 µg/mL concentrations of each leaf extract in the five anti-dengue plants. Overall mean percentage mortality of the leaf extract concentration in *Ipomoea batatas* (47.76%), had the highest while *Uncaria tomentosa* (36.67%) being the lowest. Roots and stem extracts in all the five anti-dengue plants revealed no significant differences on the mortality of *Artemia salina*. Considering cytotoxicity of the vegetative organs among all the anti-dengue plants. *Carica papaya* (LC50 21.73 µg/mL), *Ipomoea batatas* (LC50 24.48 µg/mL) and *Azadirachta indica* (LC50 41.03 µg/mL) leaf extracts were found to be the most toxic and comparable as to its effect to *Artemia salina*. Toxicity of stem and roots were found comparable with each other among all the plants. Hence, the leaves considered as the most toxic. Leaves of the said plants can be further explored serving as benchmark on the formulation of possible drugs to prevent and treat dengue.

Keywords: cytotoxicity, LC50, Antidengue plants, *Artemia salina*, mortality

BS - 31

**TAXONOMIC AND ECOLOGICAL STUDIES OF VASCULAR
PLANTS AT ENTRANCES OF SELECTED CAVES IN
POLILLO ISLAND, QUEZON, PHILIPPINES**

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Partial results of on-going taxonomic survey and ecological studies of vascular plants found at entrances of caves on Polillo Island, Quezon, Philippines are presented. This is the first study that specifically focuses on cave entrance plants in the Philippines. The limited availability of light in cave environments consequently limits primary productivity therein. Hence, photosynthetic organisms are found mainly at the entrances and to a very limited extent, in the twilight zones of caves. Photographs were taken for documentation and common or familiar plants were identified during field surveys. Samples of uncommon as well as unidentified species were collected, brought and preserved for further study and verification at the Botanical and Forestry Herbaria of the UPLB Museum of Natural History. Species include hoyas, begonias, several aroids, ferns, palms, strangling figs, urticaceous plants, etc. Several are known lithophytes whereas a few are also known as invasive or weedy. The taxonomic list of these plants is very important as baseline information for biodiversity and conservation of Philippine caves.

Keywords: Polillo Island, taxonomic survey, lithophytes, Philippine caves

BS - 32

IN VITRO ROOTING OF *Nepenthes truncata* MACF.

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In vitro grown *Nepenthes truncata* plantlets need a well-developed root system to become hardy enough to withstand changes in the environment during transfer from laboratory to nursery. The effects of rooting media, indole-3-butyric acid (IBA) concentration, method of IBA application and source of plantlets for rooting in vitro grown *N. truncata* plantlets were studied. *N. truncata* plantlets were grown in agar, vermiculite and Silvosa medium (2:1:1 coir: charcoaled rice hull/osmunda fiber). Plantlets grown in vermiculite produced the longest and the most number of roots. The number of roots in vermiculite was also significantly higher than those in agar. Apparently, the Silvosa medium can be used as a substitute for vermiculite, but vermiculite has the advantage of being easier to prepare and more aseptic. Effects of IBA concentrations, 3 mg⁻¹L⁻¹, 6 mg⁻¹L⁻¹ and 9 mg⁻¹L⁻¹ IBA, on *N. truncata* plantlet tips and bases were investigated after a month. Root count, root length and root color ratings of shoots which were taken from the base and were placed in media supplemented with 9 mg⁻¹L⁻¹ IBA were constantly highest. *N. truncata* plantlets grown in vermiculite and supplemented with 9 mg⁻¹L⁻¹ were compared to plantlets with cut-ends dipped for 10 mins in 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 500 and 1000 mg⁻¹L⁻¹ IBA prior to growing in IBA-free vermiculite. After a month, root count in all treatments except in plantlets dipped in 50 mg⁻¹L⁻¹ were found to be significantly higher than those grown in vermiculite supplemented with 9 mg⁻¹L⁻¹ IBA. Dipping was only effective at concentration range: 10 mg⁻¹L⁻¹ to 100 mg⁻¹L⁻¹. *N. truncata* plantlets dipped at 40 mg⁻¹L⁻¹ IBA prior to growing in vermiculite yielded the most number of roots and the highest root length rating.

Keywords: *Nepenthes truncata* Macf., rooting, indole-3-butyric acid, vermiculite, in vitro

BS - 33

COMPARATIVE ANALYSIS OF THE ELEMENTAL COMPOSITION AND FUNGAL DIVERSITY ALONG THE CALANCAN CAUSEWAY OF STA. CRUZ, MARINDUQUE

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The Causeway, a 5-kilometer landmass formed by thirty years (1969 to 1996) of mine tailings waste from the operations of the Marcopper Mining Corporation (Marcopper), now dumped at Calancan bay, Sta. Cruz, Marinduque was subjected to soil elemental analysis and fungal diversity evaluation. The objectives of the study were to determine the level of heavy metal contamination in the site across three specific locations: 1) Along the road path; 2) beach front of Calancan bay and 3) inner landmass recently re-vegetated area. X-Ray Fluorescence (XRF) was used to determine elemental concentrations of heavy metals while fungal diversity was analyzed through dilution plating.

After three to seven days incubation in Potato Dextrose Agar (PDA), fungal colonies were counted and re-isolated on PDA plates. Fungal diversity was noted by determining the occurrence of the fungal isolate in other dilutions and sites. PDA blocks and light microscopy were used to identify the isolates. Iron, potassium, titanium, manganese, copper, vanadium and chromium were the elements which exceeded the benchmark concentration tolerable to soil organisms as recommended by the U.S. Environmental Protection Agency (EPA). *Penicillium spp.*, *Verticillium spp.*, *Aspergillus spp.*, *Acremonium curvulum*, *Trichophyton terrestre*, *Chrysosporium spp.*, *Chrysonilia sitophila* and *Stemphylium spp* were the fungal species isolated from the soil samples. Station 2 (beachfront) had the highest fungal population with 2330 cfu/mL. Station 1 (along road path) had 561 cfu/mL while station 3 (inner land and newly re-vegetated area) had 349 cfu/mL of fungi. Among the elements in the sites, iron and potassium showed negative correlation with the fungal population. Fungal isolates were preserved for further screening trials such as, use as biological control agents and as source of important metabolites.

Keywords: causeway, fungal diversity, heavy metals, x ray fluorescence, marinduque

BS - 34

**TESTING A PRELIMINARY METAGENOMIC APPROACH
TO SCREEN FOR ALKALINE PROTEASE AND XYLANASE-
PRODUCING BACTERIA**

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Metagenomics is an emerging field in biotechnology that allows the genomic analysis of entire communities of microorganisms even before the need for culture of individual bacterial isolates. The objective of this study is to assess the feasibility of metagenomics as a preliminary step in screening for enzyme-producing bacteria. Luria Broth was inoculated with soil samples taken from agricultural, oil-contaminated, forest, and roadside soil as an enrichment step to increase the concentration of DNA template from viable microorganisms. The DNA extract from each sample served as templates for polymerase chain reaction using different primers that target genes for industrially-important enzymes alkaline protease and xylanase. The presence of distinct and intense bands of amplicons in the soil samples were observed, suggesting that bacteria producing such target enzymes could be present in the samples. Sequence analysis revealed that the gene from the different soil samples shows 99% homology with the endo-1,4-beta xylanase gene of two strains of *Bacillus subtilis*, *Bacillus cereus*, *Bacillus pumilus* and *Bacillus amyloliquefaciens*. Furthermore, the gene from the different soil samples also shows 99% homology with the *Bacillus licheniformis* bacillopeptidase gene, an alkaline serine protease. Results reveal that the preliminary metagenomic approach could be useful to provide information as to which samples will be subjected to further conventional screening to isolate enzyme-producing bacteria. Sequence analysis of amplicons could result in the isolation of novel genes exhibiting significant sequence variation from the reported genes.

Keywords: metagenomics, enzymes, alkaline protease, xylanase, PCR

BS - 35

***Aedes aegypti* LIFE CYCLE, TEMPERATURE EFFECTS,
AND DENGUE FEVER-DENGUE HEMORRHAGIC
FEVER INCIDENCE: CLIMATE CHANGE IMPACT**

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Climate change impact on various aspects of human existence includes worsening scenario of highly infectious vector-borne diseases such as dengue fever and dengue hemorrhagic fever. Providing an evidence-based framework for the interaction of mosquito life cycle, temperature and disease outbreaks is vital for predictive model construction and for disease control.

Hospital reports on dengue fever (DF) and dengue hemorrhagic fever (DHF) for the years 2005 to 2009 were obtained from cooperating hospitals in Iligan City, Philippines. Meteorological data (2005 to 2009) were purchased from the PAGASA Region 10 Station. Simulated environments at different temperatures (36°C, 38°C, 42°C, 44°C and 48°C) were constructed for larval development studies.

Results show that average minimum temperature has a direct relationship with number of DF and DHF cases. Further, that the amount of rainfall correlates positively with number of DF and DHF cases more than relative humidity. *A. aegypti* life cycle studies reveal that pupae have higher survival rates at 36°C and 38°C in a four-hour period compared to other temperatures. There was also an apparent shorter life cycle at higher temperatures seen as an adaptive strategy of the mosquito. More significantly, there was an observed deviation from the reported thermal death point of 41°C for 1 hour for *A. aegypti* aquatic stages. Pupae survived at 42°C for 72 hours and at 44°C and 48°C for 2 hours.

Therefore, warmer temperatures and increased rainfall coupled with thermal adaptive strategies significantly provide an efficient synergistic mechanism for virus transmission in the human population.

Keywords: *Aedes aegypti*, dengue fever, dengue hemorrhagic fever, climate change, adaptive strategies

BS - 36

VIABILITY OF IMMOBILIZED LACTIC ACID BACTERIA IN DIFFERENT CULTURE DILUENTS AND VARIOUS COCONUT-BASED FOOD PRODUCTS

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There is considerable interest in providing physical barrier against adverse environmental conditions to protect probiotic bacteria and improve their survival in food products. Immobilized cell technology applied to lactic acid bacteria (LAB) and probiotic cultures offers many advantages over the use of free cells.

This study investigates the use of immobilization technique using sodium alginate to determine the viability of *Bifidobacterium* strain. Cells were immobilized in different concentrations of sodium alginate with bead formation accomplished by dropwise addition of the alginate cell mixture into CaCl_2 . Formed beads were suspended in different solutions that include coconut water, formulated coconut beverage, peptone water (0.1%) and saline solution (0.85%). They were also incorporated in reconstituted skim milk (RSM) and coconut-based food products such as ice cream and yoghurt. Viability of the probiotic strain was monitored with time.

The viability of LAB was maintained in beads, regardless of the concentration of sodium alginate used. The survival of immobilized LAB suspended in saline solution and peptone water was lower compared with the immobilized LAB suspended in coconut water and formulated coconut beverage. After two weeks storage at refrigerated temperature, there was a difference of around 2.5 log per bead in the total LAB count between beads suspended in coconut water and in the other diluents.

With incorporation into various food products, the viability of immobilized LAB was maintained at around 6 log per bead up to three weeks in coconut beverage and up to one week in yoghurt. However, this was not achieved when the beads were incorporated into RSM, a standard culture medium for LAB, and into coconut ice cream with a reduction in population to 4 log per bead after a week of storage. These preliminary results showed the potential of incorporating immobilized LABs in formulated coconut-based products.

Keywords: immobilized cells, lactic acid bacteria, coconut-based food products, *Bifidobacterium*, sodium alginate

BS - 37

**EFFECTS OF MYKOVAM, BioN AND INORGANIC
FERTILIZERS ON GROWTH, YIELD AND NUTRIENT STATUS
OF SWEET SORGHUM [*Sorghum bicolor* (L.) MOENCH]**

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Sorghum is an important crop to dryland farmers and can be utilized for feeds and biofuel. This study was conducted to determine the effects of biofertilizers Mykovam and Bio-N on growth, yield and nutrient uptake of Sweet Sorghum. The efficiency of biofertilizers was also compared with that of chemical fertilizers. Sweet sorghum was applied with biofertilizers Mykovam (containing mycorrhizal fungi) or BioN (containing nitrogen fixing bacteria), with or without half or full rate of the recommended rate of chemical fertilizer (RRC = 60-60-60 NPK). The experiment was conducted at the Demonstration farm of BIOTECH, UP Los Baños following a RCBD with four blocks. Growth was monitored periodically and plant samples were harvested at 102 and 154 days. Fresh and dry biomass, juice from the stalk, brix level and plant N and P status were measured. Results show that Mykovam+BioN promoted the largest root collar diameter. Mykovam alone and BioN+Mykovam promoted the highest fresh and dry weights of leaves, roots and cane, cumulatively, the highest total biomass. Mykovam treated sorghum had the highest total N and P concentrations and consequently, the highest N and P uptake (1,707 g N/plant and 269 g P/plant) and the lowest was obtained from the control plants (999g N/plant and 214 g P/plant). The highest fruit yield was obtained from plants treated with RRC (16.10 g/cane) comparable with BioN+Mykovam+1/2RRC (13.24 g/cane) and the lowest was the control (3.97 g/cane). In terms of brix level at 102 days, RRC gave the highest (9.36) comparable with BioN+Mykovam+1/2RRC treated plants (8.80) and the lowest was (6.20). At 145 days, Mykovam+BioN+1/2RRC treated plants had the highest (14.52) brix and the lowest was the control (13.72). The high nutrient status and brix level due to Mykovam+BioN+1/2RRC suggests that sweet sorghum can be a feasible source of feed and biofuel.

Keywords: biofertilizers, sweet sorghum, Mykovam, BioN, mycorrhizal fungi, nitrogen fixing bacteria

BS - 38

PHOSPHORUS AND MYCORRHIZAL FUNGI AFFECT GROWTH, NUTRIENT AND HEAVY METAL ACCUMULATION IN TRANSGENIC POPLAR

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Heavy metal transgenic poplars had been developed in Korea for the immediate rehabilitation of mine tailing sites. Phosphorus fertilizers are applied to counteract the toxic effects of heavy metals on plant growth and survival in mine tailings. However, the amount of P fertilizer to be applied that conforms with the beneficial effects of mycorrhizal inoculation is not known. This experiment was conducted to determine the growth, nutrient status and translocation of heavy metals in tissue cultured transgenic *Populus alba* x *P. glandulosa* uninoculated or inoculated with a mixture of ectomycorrhizal (ECM) fungi *Pisolithus tinctorius*, *Paxillus involutus* and *Amanita pantherina* during *ex vitro*. Treated plantlets were transplanted in cups filled with 50g autoclaved peat perlite vermiculite (PPV) medium and incubated under growth room conditions. One month later, the seedlings were transferred in pots filled with 150g PPV amended with 0, 8 or 16 mg P (CaH_2PO_4)₂ kg soil⁻¹ and nil or mixture of lead (Pb), zinc (Zn) and arsenic (As). Pb, Zn and As are the top heavy metal contaminants in a closed mine tailing area in Bonghwa, South Korea where rehabilitation activities has been concentrated for the last five years. After four months in a glasshouse, total plant dry weight of non-mycorrhizal plants grown at P8 and P16 was comparable with mycorrhizal plants grown at P0. Heavy metals amendment reduced plant growth and biomass but increased concentrations of all nutrients measured. Except for N, Zn and Pb, mycorrhizal plants had higher P, Ca, Mg, Na, and As than non-mycorrhizal counterpart. P16 increased plant growth and N, P, Mg and Na concentrations but reduced Zn and Pb. Highest Zn, Pb and As were in the fine roots and lowest in the stem of mycorrhizal plants. Highest (34%) mycorrhizal colonization was at P16 and reduced to 22% in the presence of heavy metals.

Keywords: mine tailing sites, *Populus*, ectomycorrhizal fungi, *Pisolithus*, *Paxillus*, *Amanita*

BS - 39

DNA BARCODING OF FRUIT FLIES *Bactrocera occipitalis* (Bezzi) AND *Bactrocera philippinensis* DREW AND HANCOCK (DIPTERA:TEPHRITIDAE) FROM CAVITE AND DAVAO DEL NORTE USING THE 5' REGION OF THE MITOCHONDRIAL CYTOCHROME C OXIDASE I (*coxI*) GENE

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Analysis of the 5' region of the mitochondrial cytochrome oxidase I gene was done to compare the pest fruit flies *Bactrocera occipitalis* (Bezzi) and *Bactrocera philippinensis* Drew and Hancock. Adult fruit flies and larvae-infested dropped mango fruits were collected from selected orchards at Cavite and Davao del Norte. Collected adults were immediately identified while larvae from infested fruits were reared to adulthood then identified. Identification was done thru the visual analysis of six diagnostic morphological characters originally described by White and Hancock (1997) and utilized by Iwahashi (1999) to differentiate between the two species.

Genomic DNA was extracted and mitochondrial *coxI* gene was amplified using custom primers. PCR products were verified thru agarose gel electrophoresis and shipped to Macrogen Inc, South Korea for sequencing. Consensus sequences were derived and analyzed using the sequence analysis softwares Clustal W2 and MEGA 4.

The generated phylogenetic trees showed that there were no significant sequence differences between *B. occipitalis* and *B. philippinensis*. Divergence values were from zero to 0.0018%; values obtained were significantly lower than the set standard of 0.5% to establish species delineation. Analysis of the 5' region of the mitochondrial *coxI* gene did not show species delineation between *B. occipitalis* and *B. philippinensis*. It is recommended that further analysis be done on more samples from other locations in the Philippines.

Keywords: DNA barcoding, cytochrome oxidase I, *Bactrocera occipitalis* (Bezzi), *Bactrocera philippinensis* Drew and Hancock, species delineation

BS - 40

DEVELOPMENT OF PROBIOTIC VEGETABLE JUICE FORTIFIED WITH *Lactobacillus plantarum* BS

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Preference for raw and minimally-processed foods and probiotic products is increasing due to obvious nutritional and non-nutritional health benefits. The country is endowed with local plant and microbial resources that can be developed into functional food products.

Various formulations of indigenous Philippine vegetables/herbs namely *alugbati* (*Bacella rubra*), *saluyot* (*Corchorus olitorius*), *okra* (*Abelmoschus esculentus*), *malunggay* (*Moringa oleifera*) and avocado (*Persea Americana*) leaf extracts, strained, pasteurized, flavored with *calamansi* (*Citrofortunella microcarpa*) or lemon grass (*Andropogon citrates*), and fortified with *Lactobacillus plantarum* BS were subjected to microbial stability and sensory testing. The selected formulation with 2% (w/v) air-dried vegetable/herb in different proportions flavored with *calamansi* and lemon grass were stored at refrigerated temperature for three months. Both flavored vegetable juice maintained a pH range of 4 - 4.5 after 14 days in contrast with the control (without flavor and *Lb. plantarum* BS only) that initially decreased to pH 4.0 at day 10 but began to elevate at day 14. *Calamansi*-flavored vegetable juice maintained a higher lactic acid bacterial count of 10^7 cfu/ml, up to 70 days of storage. In contrast, the lemon grass flavored vegetable juice maintained the lactic acid bacterial count of 10^7 cfu/ml only until day 14 but declined thereafter. However, sensory evaluation revealed that lemon grass-flavored vegetable juice was more preferred than *calamansi* flavored. Its flavor/taste, aroma and general acceptability were also significantly different at $p=0.05$ compared with the control after six days. This result suggests the possibility of developing vegetable/herb beverage fortified with probiotic lactic acid bacteria with enhanced health benefits.

Keywords: probiotic juice, lactic acid bacteria, *Lactobacillus plantarum*, *alugbati*, *saluyot*, *avocado*, *okra*, *malunggay*, *calamansi*, lemon grass

BS - 41

**SYNERGISTIC HYPOGLYCEMIC EFFECT OF
Lactobacillus pentosus 3G3 AND BANABA (*Lagerstroemia
speciosa*) ON DIABETIC-INDUCED SWISS WEBSTER MICE**

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Intake of herbal medicines may lead to the accumulation of toxic and anti-nutritional factors. Studies have shown that microbial action by generally regarded as safe (GRAS) and probiotic bacteria may help degrade these factors into non-insidious forms.

The hypoglycemic effect of *Lactobacillus pentosus* 3G3 pure cells on diabetic-induced male Swiss-Webster mice was tested. A saline suspension of 10^8 - 10^9 CFU/ml pure cells was orally administered to mice previously fed with 20 ml condensed milk and 30 ml melted butter in 50 ml sterile distilled water to induce high blood glucose levels. Results showed that *L. pentosus* 3G3 significantly decreased blood glucose level and body weight after two weeks feeding period.

In a previous study, *Lb. pentosus* 3G3 was found resistant to any antimicrobial effect of *banaba* (*Lagerstroemia speciosa*) leaf extract, reported to contain anti-diabetic compound. In this study, *Lb. pentosus* 3G3 was inoculated in 4% (w/v) *banaba* leaf and 5% (w/v) muscovado decoction, fermented for overnight, cells adjusted to 8.2×10^9 CFU/ml, and administered orally at 30 ml/kg body weight to the mice with elevated blood glucose level induced by injecting hydrochlorothiazide intraperitoneally. Glibenclamide and distilled water were also administered as positive control and negative control, respectively. Single ingestion of the *banaba* decoction, fermented with *Lb. pentosus* 3G3, showed comparable potency in decreasing blood glucose level than the unfermented *banaba* decoction, but not significantly different at $p=0.05$ after 240 min monitoring of blood glucose level.

Prolonged feeding period and monitoring is being done in order to determine the long term effects of *Lb. pentosus* 3G3, mixed with *banaba* leaf decoction, in lowering blood sugar levels on mice and other positive effects of the probiotic lactic acid bacteria, such as minimizing the anti-nutritional effects of *banaba*.

Keywords: diabetes, *Lactobacillus pentosus*, probiotic lactic acid bacteria, *banaba*, *Lagerstroemia speciosa*, hypoglycemic effect

BS - 42

**RANDOM AMPLIFIED POLYMORPHIC DNA –
POLYMERASE CHAIN REACTION (RAPD-PCR) PRIMER
DESIGN FOR THE DETECTION OF *Listeria monocytogenes***

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Listeria monocytogenes is a major foodborne pathogen recognized worldwide by food industries and public safety institutions because of its high fatality rate and various complications such as acute diarrhea, meningoencephalitis, septicaemia and abortion. USFDA imposes “zero tolerance” regulation for *L. monocytogenes* in raw and ready-to-eat foods. The National Meat Inspection Services of the Department of Agriculture is strictly monitoring it in processed meat.

This study reports on the design of primers through hybridization, cloning and sequencing of RAPD-PCR amplification products identified to be specific for *L. monocytogenes* reference strains (Lm2, Lm3 and Lm4) against closely related isolates: *Listeria* spp. and *Enterococcus* strains isolated from different food samples at the Food and Feed Laboratory, BIOTECH, UPLB.

Gene amplification using RAPD primer 066 resulted in a potential specific 1.2 kb marker. Molecular cloning of the isolated RAPD marker for *L. monocytogenes* was done to facilitate sequencing of the amplicon. Twenty-three presumptive positive clones were subjected to plasmid DNA extraction and restriction enzyme analysis to determine the presence of the target insert fragment. Two plasmid clones confirmed the presence of the target insert fragment through hybridization. The plasmid clone (5a1) was sequenced using the universal primers, M13. Multiple sequence alignment analysis of the 950-base marker sequence using BLAST-N revealed 100% homology with *L. monocytogenes*. The primers designed using the *Primer3 Plus* design software had good specificity with acceptable melting temperatures and GC content except that of possible formation of secondary structures.

Keywords: *Listeria monocytogenes*, RAPD-PCR, primer design, foodborne pathogen detection

BS - 43

**CONSTRUCTION OF A PLANT EXPRESSION VECTOR
CONTAINING THE REPLICATION INITIATION PROTEIN
(REP) GENE OF THE ABACA BUNCHY TOP VIRUS (ABTV)**

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The abaca industry in the Philippines produces an average of 68,962 metric tons per year of fiber utilized on many industries generating an income of USD 80.8M on exports alone. However viral diseases like the Abaca bunchy top virus (ABTV) cause damaging effects to the plant. A strategy to control ABTV is through pathogen derived resistance (PDR) wherein a virus component is introduced to the plant and its expression could mediate resistance to the virus. The replication initiation protein (Rep) gene, an ABTV DNA virus component is a possible candidate for PDR. For this study, the Rep gene was isolated and cloned to a plant expression vector. Primers were designed to target the Rep gene and appended with restriction endonuclease sites *Bgl*II and *Bst*EII for subsequent cloning. Amplification using the designed Rep primers and genomic DNA from ABTV infected abaca plants from Leyte yielded an approximately 900bp product. This was further subcloned to pCR2.1® TOPO® vector for sequencing. Sequencing results showed 99% similarity to the Banana bunchy top virus (BBTV) Rep gene. The pCR2.1® TOPO®-Rep construct was digested with *Bgl*II and *Bst*EII as well as the plant expression vector pCAMBIA1302. The ligated pCAMBIA1302-Rep gene construct was transformed in DH5á cells for propagation and screening. Screening using CaMV35S and NosTer pCAMBIA vector specific primers showed an approximately 1100bp product. Further sequencing is necessary to confirm if the Rep gene is inserted to pCAMBIA1302. This construct would be delivered to abaca plant cells for assessment of its expression and at most conferring ABTV resistance to the plant.

Keywords: abaca bunchy top virus (ABTV), pathogen derived resistance (PDR), replication initiation protein (Rep) gene, cloning, pCR2.1® TOPO®, pCAMBIA1302

BS - 44

SEQUENCE ANALYSIS OF THE KAPPA-CASEIN GENE IN WATER BUFFALO (*Bubalus bubalis*)

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The aim of the present study was to determine the sequence of the coding region of the kappa-casein gene of the water buffalo and detect potential exonic polymorphisms that are associated with milk production traits. Twenty-five genomic deoxyribonucleic acid (DNA) samples of unrelated buffalo cows coming from extremes of the population (ten high, five medium and ten low milk producers) were used in the study. Since the buffalo genome has not yet been sequenced, primers used to amplify the coding regions were based on the gene sequence of cattle. Polymerase chain reaction (PCR) amplification yielded products of similar size to that of cattle. Direct sequencing results revealed that the kappa-casein gene sequence of the water buffalo was 96% similar to that of cattle. Two potential polymorphisms were also found in nucleotides 467 and 471 located at the fourth exon. The cytosine 'C' to thymine 'T' change of nucleotide 467 resulted to an amino acid change from threonine (T)<ACC> to isoleucine (I)<ATC> at codon 156. Preliminary association studies revealed that choosing animals with 'CC' and 'CT' genotypes will be advantageous since the milk yield at 305 days (MY305D), fat yield at 305 days (FY305D) and protein yield at 305 days (PY305D) are higher ($P < 0.001$) compared with animals carrying the 'TT' genotypes. The methodology above can be used to determine the coding sequence and potential polymorphisms of other genes not only of the bubaline, but also of other ruminant species whose genome has not yet been sequenced such as the swamp buffalo, sheep, goat, anoa, cape buffalo and deer.

Keywords: water buffalo, milk production, kappa-casein, sequence analysis, polymorphism

BS - 45

**MULTIGENE-LOCUS cpDNA BAYESIAN FRAMEWORKS
IN RESOLVING CONFLICTS WITHIN PHILIPPINE
ENDEMIC *Gardenia* ELLIS (RUBIACEAE): IMPLICATIONS
TO TAXONOMY, BIODIVERSITY AND DRUG
DEVELOPMENT**

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The Philippine *Gardenia* species form a highly heterogeneous assemblage, leading to several taxonomic transfers to other Rubiaceae genera (*Ceriscoides*, *Discospermum*, *Fagerlindia*, *Sulitia*, *Vidalasia* & *Villaria*). In spite of these taxonomic rearrangements, three remaining Philippine endemic *Gardenia* species (*G. lagunensis* Merr., *G. merrillii* Elmer & *G. negrosensis* Merr.) still exhibit disparate features against the current circumscription of the genus and remain unresolved. In order to evaluate their true generic affinities with more certitude, we conducted separate and combined Bayesian Inference (BI) of the *rps16* intron and *trnT-F* region sequences of cpDNA. The majority rule consensus tree of the combined dataset is more congruent with the *rps16* intron tree but with much higher Posterior Probabilities (PP). The four sampled Philippine *Gardenia* species including *G. elata*, appeared in two different groups of the tribe Gardenieae. *Gardenia elata* grouped within the *Gardenia* clade with high support (PP=1.00), while *G. lagunensis*, *G. merrillii* and *G. negrosensis* nested within a clade with *Rothmannia annae* and *R. capensis* with strong support (PP=0.96). These molecular findings are congruent with morphology such as the 3:3 nodal pattern of leaves, absence of dornatia, bilobed stigmas, 2-locular ovaries, globular indehiscent fruits and seeds that are embedded in a pulp forming a single mass. Therefore, we recognized three novel combinations under *Rothmannia* Thunb., which established for the first time the genus to the archipelago. In relation to this taxonomic breakthrough, implications on their conservation status and possible medicinal use are presented.

Keywords: bayesian inference, cpDNA, *Gardenia*, Philippine endemic, *Rothmannia*, *rps16* intron, *trnT-F* region

BS - 46

**ANTIMICROBIAL ACTIVITY OF *PARAMERIA LAEVIGATA*
(A.L. JUSS.) MOLDENKE AND *VOACANGA GLOBOSA*
(BLANCO) MERR. EXTRACTS**

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Ethanol extracts of leaves of *Parameria laevigata* (A.L. Juss) Moldenke and *Voacanga globosa* (Blanco) Merr. were examined for their antibacterial, antifungal, and antiprotozoal properties. *P. laevigata* and *V. globosa* extracts were tested against bacteria, namely, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Bacillus cereus*, *Staphylococcus aureus*, *Micrococcus luteus*; fungus, *Candida albicans*; and protozoa, *Entamoeba histolytica*, *Trichomonas vaginalis*. Potential antimicrobial compounds were obtained through solvent extraction and rotary evaporation. To determine the antibacterial and antifungal properties of the extracts, disc diffusion assay was performed. *V. globosa* extracts revealed antibacterial and antifungal activities, inhibiting the growth of *B. cereus*, *M. luteus*, *P. aeruginosa*, *S. aureus*, *S. typhimurium*, and *C. albicans*. On the other hand, extract of *V. globosa* showed no antibacterial and antifungal activity. Lastly, to determine the antiprotozoal activity of the extracts, growth curve analysis and antiprotozoal assay were performed. The extracts were examined against *Trichomonas vaginalis* and *Entamoeba histolytica*. Results showed that both plant extracts can inhibit parasites. Thus, these plant extracts can possibly be used to produce alternative forms of antimicrobials.

Keywords: *Parameria laevigata*, *Voacanga globosa*; antibacterial, antifungal, antiprotozoal activity

BS - 47

**DETECTION OF WHITE SPOT VIRUS IN *Penaeus monodon*
AND *Metapenaeus dalli* FROM HAGONUY, BULACAN**

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Shrimp aquaculture is an integral source of revenue in developing tropical countries of Southeast Asia such as the Philippines. In the early 1990s, the country ranked 3rd in the shrimp international market, however the industry slid back to the 13th as it is presently plagued with outbreaks of diseases which causes massive decrease of production. Among these diseases, White Spot Virus (WSV) remains one of the most potent and infectious for most known species of cultivated penaeid shrimps. It is in this light that the presence of the White Spot Virus (WSV) in *Penaeus monodon* and *Metapenaeus dalli*, both species were collected in three commercial ponds in Hagonoy, Bulacan. In every sampling site, five shrimps of each species were collected, and from each shrimp tissue samples from gills, hemolymph, heart and hepatopancreas were obtained. DNA were then extracted from each organ and were used in the detection through Polymerase Chain Reaction (PCR) amplification. Elongation factor 1-alpha (EF1- α), primers was used to check for DNA integrity and as an internal control. Only the hemocyte samples yielded positive among all the tissues tested. Hence, hemocyte was utilized in all the 30 samples. Twenty percent (20%) of the sampled tissues of *P. Monodon* shrimps were found to be positive. However, *M. dalli* shrimps from the same sampling sites were all found negative for WSV. These results, coupled with the fact that both species were collected from the same pond, suggest that *M. dalli* is more resistant to WSV compared to *P. monodon*.

Keywords: *Metapenaeus dalli*, *Penaeus monodon*, white spot virus, shrimp polyculture, polymerase chain reaction, virus detection

BS - 48

IMMUNOMODULATORY EFFECTS OF DRIED *Curcuma longa* POWDER ON THE EXPRESSION OF CRUSTIN AND LYSOZYME IN *Macrobrachium rosenbergii dacqueti*

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Turmeric, a derivative of the plant *Curcuma longa*, exhibits several pharmacological properties and its extracts were found to have a high potential to inhibit some pathogenic bacteria of shrimp and chicken. In this study, eighty (80) *Macrobrachium rosenbergii dacqueti* juvenile shrimps were used for the entire experiment. Purchased turmeric was properly identified at the UST Herbarium. The turmeric was dried and pulverized; and its powder was incorporated into commercial feeds. The shrimps were divided into three groups, D0, D1 and D7. D0 were fed with commercial feeds while D1 and D7 were fed with the enhanced shrimp feeds for one (1) and seven (7) days respectively. These were challenged with *Vibrio alginolyticus*. Relevant tissues were dissected from shrimp samples and total RNA was isolated, quantified by UV spectrophotometry and synthesized into cDNAs. RT-PCR was performed using crustin and lysozyme for target genes and EF-1 α as standard control. Quality and quantity of RNA was assessed by measuring the A_{260}/A_{280} ratio and by agarose gel electrophoresis. An increasing intensity of crustin and lysozyme PCR bands relative to the duration of feeding was observed suggesting that shrimps fed with enhanced feeds after bacterial challenge had an induced expression of the mentioned antimicrobial peptides (AMPs). A remarkable increase in the expression of the two AMPs was also observed from D0 to D1 but not from D1 to D7. The results suggest that turmeric powder enhances the expression of these two peptides, but its rate of effectivity is yet to be studied.

Keywords: Shrimp biotechnology, *Curcuma longa*, turmeric, *Macrobrachium rosenbergii dacqueti*, crustin, lysozyme

BS - 49

**UNIQUE NUCLEOTIDE DIFFERENCE OF TWO PUTATIVE
Ty1/COPIA-LIKE LONG TERMINAL REPEAT
RETROTRANSPOSONS OF ABACA (*Musa textilis* Nee)**

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Retrotransposons or transposons through RNA intermediates are ubiquitous mobile genetic elements that can amplify themselves in the eukaryotic genomes. It harbors regulatory signals that are responsible for chromosomal rearrangements, fragmental gene movements, alteration of gene expression and genome evolution. In this study, the putative abaca retrotransposons were cloned, verified, sequenced and characterized. The resulting PCR products were cloned using degenerate primers. Restriction digestion of the purified recombinant plasmid using EcoRI revealed a distinct band (~950 bases). Sequence analysis revealed an 868-base perfect alignment insert. Comparing and aligning the two sequences revealed a nucleotide substitution at 779 from T in Retroclone1 to C in Retroclone2. Using sequence alignment and phylogenetic analysis, the cloned putative retrotransposons of *M. textilis* grouped with Ty1-copia retrotransposon of *M. ABB*, *M. AAB* and *M. acuminata*. High homology to known retrotransposon protein of *Oryza sativa*, putative polyprotein of *Oryza australiensis*, gag-pol of *Zea mays*, integrase core domain of *O. sativa* and reverse transcriptase was noted using Blastx. This result supports the generalized structure of retrotransposon which is characterized with gag, pol and env domains in between the long terminal ends (LTRs). To our knowledge, this is the first report on the cloning and sequence analysis of putative abaca retrotransposon. These results provide insight in understanding the genome composition of the Philippine's indigenous fiber crop — abaca.

Keywords: retrotransposons, long terminal repeats, cloning, single nucleotide polymorphism, musa

BS - 50

A CANDIDATE GENE SEQUENCE FOR DOWNY MILDEW RESISTANCE IN MAIZE

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We report a putative resistance gene ortholog for resistance to downy mildew caused by *Peronosclerospora philippinensis* Weston (Shaw) in Philippine maize. We designed two gene-specific markers based on sequence information of the resistance gene analog, *srga3*. BLAST analysis of the *srga3* amplicon showed 39 hits against the maize rust resistance protein *rp3-1* gene with a maximum score of 81.3 and 78% identity. The gene-specific markers were tested for co-segregation with the *srga3*-quantitative trait loci (QTL) and downy mildew resistance phenotype on BC₁F₁ mapping population consisting of 121 individuals. These will be used in map-based isolation of the downy mildew resistance gene in maize and marker-assisted selection towards the development of downy mildew resistant maize varieties.

Keywords: downy mildew, QTL, resistance gene analog, gene-specific markers, maize

BS - 51

**YIELD EQUATION AND BIOMASS EXPANSION FACTOR
FOR ABOVE GROUND CARBON DENSITY ESTIMATION
OF SMALLHOLDER TREE PLANTATIONS IN
NORTHERN MINDANAO**

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Regression equations for the estimation of tree volume and biomass expansion factor (BEF) in a smallholder *A. mangium* plantation were developed based on direct measurements of trees in Northern Mindanao, Philippines. *A. mangium* is an important smallholder tree plantation species and commodity for wood industry in the region and the country. Sound and effective management of smallholder tree plantation for wood production and carbon sequestration necessitates information on yield. The study was designed to develop reliable yield prediction equation and BEF according to various ages, site qualities and spacing. Fifty temporary sample plots were established in Claveria, Misamis Oriental with a total of 3,910 trees measured. The study had generated two equations: 1) yield prediction equation ($\ln YIELD = -4.250101 + 2.017218 * \ln AGE + 1.079861 * \ln SI + .2352149 * \ln SP$); and, 2) BEF ($BEF = 1.693517 * .9938733^{VB}$). The yield prediction equation can be employed as a basis for efficient management and development of smallholder tree plantations. The tree farmers could make use of yield tables in determining the volume of wood that can be harvested, economic rotation, cut schedule, plantation development schedule and business projection. The yield equation and BEF can also be used to predict above ground biomass carbon density for smallholder *A. mangium* plantation. The equations have been developed for plantations located in Claveria, Misamis Oriental particularly those with ages ranging from 3 to 18 years old, site index ranges from 12 to 25 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 *A. mangium* tree plantation establishment and management.

Keywords: biomass, mangium, yield, BEF, regression, smallholder

BS - 52

TERRESTRIAL ARTHROPODS IN SELECTED CAVES OF POLILLO ISLAND, QUEZON PHILIPPINES

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The first set of results from the series of fieldwork focusing on the taxonomy and ecology of terrestrial arthropods found inside selected caves of Polillo Island, Quezon, Philippines are reported. The results presented and the work involved is largely pioneering as most of the existing data on cave biology have always been limited to bats, swiftlets and other vertebrates. Philippine cave arthropods from Polillo Island constitute new faunal records and probably new species that belong to various classes, orders and families. They include springtails (Collembola), cockroaches (Blattodea), ants and fairy flies (Hymenoptera), parasitic, predatory and saprophytic mites (Acari), carabid beetles and water pennies (Coleoptera), guano moths (Lepidoptera), bat flies and midges (Diptera), earwigs (Dermaptera), millipedes (Diplopoda), centipedes (Chilopoda), bat fleas (Siphonaptera), spiders (Araneae), vinegaroons (Uropygi), scorpions (Scorpionida), pseudoscorpions (Chelonethida), etc. The unique conditions and microhabitats inside cave ecosystems (most importantly the very limited availability of light, high moisture and carbon dioxide, and generally nutrient-poor underground setting) have been selected by some organisms to evolve with strikingly unique adaptations to this kind of extreme environment. The number and nature of groups and species encountered further attest to the great diversity of terrestrial arthropods on Polillo Island and in the entire Philippine archipelago. These sets of data on cave biodiversity also provide bases for protection and conservation of Philippine caves.

Keywords: terrestrial arthropods, microhabitats, cave ecosystems, cave biodiversity

BS - 53

EFFECTS OF AGROCHEMICALS ON ENDOMYCORRHIZAL DYNAMICS FOR A SUSTAINABLE SOIL IN TAMPAKAN MOUNTAIN ECOSYSTEM

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Agrochemicals used in upland farms and nurseries in Quezon mountain range from Tampakan, South Cotabato were identified using Key Informant Interview and investigated to evaluate their effects on the dynamics of endomycorrhizal fungi. Endomycorrhizas are important link in plant nutrition and health. Population of endomycorrhizal fungi was assessed to determine soil productivity and sustainability in the area through wet-sieving decanting technique for isolation, characterization, and examination of endomycorrhizal colonization. About 95% of upland farmers extensively used fertilizers (Complete, Urea), herbicides (Power, Atrazine), fungicides (Ridomil, Daconil), and pesticides (Malathion, Lannate) for agricultural, agroforest and forest crops. Endomycorrhizas identified were *Glomus*, *Gigaspora*, and *Entrophospora*, where *Glomus sp.* mostly dominating disturbed grasslands and agricultural areas. Endomycorrhizal density isolated under Corn that received low to moderate levels of agrochemical application revealed 113-129 spores/100 g dry soil compared to only 17 spores at high level. There was also lower endomycorrhizal colonization where application of agrochemical was higher. Results suggest that heavy agrochemical use have significant effects on dynamics of endomycorrhizas, hence a good soil indicator. It is advisable to regulate the use of agrochemicals to maintain soil productivity without harming beneficial role of endomycorrhizas. Cultural practices and integrated pest management are encouraged to reduce dependency on expensive agrochemicals. Isolation, characterization, testing, and mass production of indigenous endomycorrhizas are further recommended to produce alternative organic fertilizers for upland farmers in Tampakan mountain ecosystem.

Keywords: agrochemicals, endomycorrhizas, soil indicator

BS - 54

**BIOSORPTION OF LEAD, COPPER, CADMIUM,
AND MERCURY BY BROWN SEAWEEDS (*Sargassum* sp.
and *Turbinaria ornata*)**

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Biosorption is a process that uses inexpensive biomass to sequester toxic heavy metals and is particularly useful for the removal of trace levels of contaminants from industrial effluents. Several types of biomass have been tested for heavy metal sorption capacity which includes bacteria, fungi, algae, and aquatic macrophytes. Marine macroalgae are one of the organisms proven to have high heavy metal adsorption capacity due to the functional groups such as carboxyl groups from amino acids and polysaccharides and sulfhydryl groups present in the biomass of the seaweeds. In this study, dried biomass of *T. ornata* and *Sargassum* sp. were tested for its heavy metal adsorption capacity. The maximum adsorption capacity of *Sargassum* sp. and *T. ornata* (q_{max} range=84.09-129.87) exceeded many previously reported uptakes by other types of biomass such as that of granulated activated carbon (q_{max} =5.08mg/g) and *Chlorella vulgaris* (q_{max} =58.8mg/g). *T. ornata* adsorbed higher amounts of copper while *Sargassum* adsorbed significantly higher amounts of cadmium and mercury. Results of the experiments also showed that pH and contact time affected the adsorption of heavy metals from aqueous solutions. Based on the FTIR analysis conducted, the carboxyl and hydroxyl groups were the functional groups responsible for sorption of the heavy metals. *Sargassum* and *Turbinaria* were proven to be effective metal biosorbents.

Keywords: biosorption, brown seaweeds, heavy metals, *Sargassum*, *Turbinaria ornata*

BS - 55

THE IDENTIFICATION OF FERN SPECIES AS METALLOPHYTES AND THEIR IMPLICATIONS TO MINE REHABILITATION

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Ultramafic and hydrothermally altered terrains are geographic areas that are anomalously high in metal concentrations and these are influenced by their underlying extreme geology. Plants that grow under such conditions are called metallophytes and to study them, plant and soil samples were taken in tandem at selected sites. The plants were sent to the Botany Division of the National Museum for identification. The plants and soil samples were processed for AAS analyses.

Hydrothermally altered terrains are relative high in Cu. At Lepanto, Benguet, *Nephrolepis hirsutula*, *Dicranopteris linearis*, *Pteridium aquilinum* and *Pteris* sp were the dominant fern species. Similarly at Philex, Baguio, *Histiopteris incisa*, *Onychium siliculosum*, *Pityrogramma calomelanos*, *Pteris* sp and *Sphenomeris chinensis* were abundant. Cu analysis of the roots yielded high values of about 488.00 ug/g, 371.00 ug/g in the stems and about 23.90 ug/g in the leaves. These ferns accumulated higher amounts of Cu than what the soils contain, In ultramafic terrains, such as Acoje, Zambales and Brooks Point, Palawan, laterites are anomalously high in Fe. *Pteridium aquilinum* and *Sphenomeris retusa* were abundant at Acoje, while at Brookes Point, *Dicranopteris linearis* was dominant. Fe analysis of the roots yielded high values up to about 9,358.24 ug/g, about 1,935.59 in the stem and about 199.10 in the leaves. These ferns thrived well in areas with Fe reaching to about 102,803.75 ug/g in the soil.

Ferns are characteristically good metal accumulators and are able to survive in very toxic soils, thus they could be used for mine rehabilitation. Most of them are pioneering plants, and the propagation of these ferns for phytoremediation and reforestation is worth considering.

Keywords: Ferns, metallophytes, phytoremediation, mine rehabilitation

BS - 56

**TOXICOLOGICAL AND HISTOPATHOLOGICAL
EVALUATIONS OF THE EFFECTS OF SYNTHETIC
HORMONES—17 α -ETHINYLESTRADIOL AND
LEVONORGESTREL—ON TILAPIA (*Oreochromis niloticus*)**

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Due to incomplete removal in most conventional biological sewage treatment plants, human excretions containing synthetic hormones from birth control pills find their way into sewage, agricultural runoff and surface waters. In sufficiently high concentrations, these can affect the physiology and reproductive functions of exposed organisms. Unfortunately, information on their potential effects mostly comes from temperate habitats, thus, limiting their application to tropical environments.

Acute toxicity tests (i.e. 96 hrs) and histopathological analyses of gills and liver tissues were performed to determine the effects of varying concentrations of 17 α -Ethinylestradiol (EE2) and Levonorgestrel on juvenile *Oreochromis niloticus* (i.e. "Tilapia"). Fish mortality increased as toxicant concentration and exposure period increased with Mean 96-hr LC₅₀s \pm S.D. of 0.47 ± 0.062 mg/L for EE2 and 6.03 ± 1.03 mg/L for Levonorgestrel ($p = 0.05$). Histopathological examinations also showed massive cellular damage – e.g. disorganization of lamellae, epithelium hyperplasia and hypertrophy, and blood congestion in gill tissues as well as nuclear hypertrophy, cytoplasmic vacuolation, and cytoplasmic degeneration in the liver – relative to the controls.

The information generated in the study can be used as an aid in establishing proper waste water protocols, in risk and impact assessments of xenoestrogens and in policy formulation for public health and the environment.

Keywords: Toxicity, Histopathology, 17 α -Ethinylestradiol, Levonorgestrel, Tilapia

BS - 57

VARIABILITY IN FOREWING VENATION PATTERNS AND
GENITAL SHAPES AMONG FOUR POPULATIONS OF RICE
BLACK BUGS, *Scotinophara coarctata* (Fabricius) FROM
MINDANAO, PHILIPPINES

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Rice Black Bugs are small, cryptic, and highly invasive pest species attacking all growth stages of the rice plant. This pest is extremely variable in morphology resulting to problems in its taxonomy. The present study reports on variability in wing venation patterns and genital plates among four populations of RBBs comprised of 1,1149 males and 1,164 females from Tacurong, Sultan Kudarat (44M, 45F), Lala, Lanao del Norte (132F, 102M), Sta. Josefa, Agusan del Sur (216M, 216F) and Kabacan, North Cotabato (150F, 150M).

Results showed immense inter-individual variability in venation patterns among the populations. The most important variations are in the type and number of marginal cells on the anterior distad part of the wing. The marginal cells are either closed or open and vary in number from 1-6. Geometric Morphometric analyses revealed considerable differences in the shapes of the genital plates of both sexes (@&: Wilk's Lambda: 0.0005, P: <0.000; B&: Wilk's Lambda: 0.0009, P: <0.000). Results showed differences in the concavity of the anterior and postero-lateral margins of the genital plates. The results of the current study may indicate possible genetic differentiation. Such variability may have direct bearing on the management of the RBB as a pest of rice agroecosystem.

Keywords: *Scotinophara* spp., rice black bug, relative warp analysis, geometric morphometrics, wing venation pattern, genital plates

BS - 58

**PLANT DIVERSITY, STATUS AND CONSERVATION
INITIATIVES IN THREE MOUNTAIN ECOSYSTEMS
IN MINDANAO, PHILIPPINES**

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This research describes the vegetation types, determines the diversity, assesses the conservation status and records the distribution of vascular plants in three mountain ecosystems in Mindanao, Southern Philippines. Representative specimens were pressed, dried, poisoned and mounted as herbarium vouchers. To determine the index of general diversity for trees, 20x20 m sampling plots were established per vegetation type, and in each sampling plot, a 5x5 m sub-plot was laid to determine the species diversity for pteridophytes. Transect walk and sampling plots in 3 mountain ecosystems revealed several vegetation types with Mt. Malindang having 9 types, Mt. Hamiguitan with 5 types and Mt. Kitanglad with 3 types. Species richness was highest in Mt. Malindang (1,164 spp.), followed by Mt. Hamiguitan (878 spp.) and the lowest in Mt. Kitanglad (661 spp.). The same trend was observed when the diversity values of the 3 mountain ecosystems were computed. Regardless of the kind of mountain ecosystem, the montane vegetation had high species richness and diversity values than the dipterocarp and mossy forests. Assessment of conservation status revealed that Mt. Kitanglad had the highest number of threatened species (92 spp.) while the two other mountain ecosystems, Mt. Malindang and Mt. Hamiguitan had 34 and 35 threatened species each, respectively. As to endemism, it showed that Mt. Hamiguitan had high endemism (34 %) than Mt. Kitanglad (21%) and Mt. Malindang (16%). Moreover, the 3 mountain ecosystems showed 64 species as new record in Mindanao and 21 species in the Philippines while 2 species of *Nepenthes* are new to science. Ex-situ conservation initiatives were done to protect the remaining threatened and endemic species of plants and their habitats.

Keywords: species richness, assessment, ex-situ and in-situ conservation, protected areas

BS - 59

SPECIES DIVERSITY OF SEAGRASSES IN CAMOTES ISLANDS, CENTRAL PHILIPPINES

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Seagrasses of Camotes Islands were studied to determine its species diversity. A transect-quadrat method was used where 3 transects were laid in each station taking into account its species in the four municipalities of Camotes Islands which are San Francisco, Poro, Tudela and Pilar.

Results show that there were 11 species of seagrasses found in the four municipalities of Camotes Islands which are *Halophila decipiens*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule pinifolia*, *Halodule uninervis*, *Halophila minor*, *Halophila ovalis*, *Halophila ovata*, *Enhalus acoroides* and *Syringodium isoetifolium*.

Halophila decipiens and *Thalassia hemprichii* are the distinct species of seagrass found in the municipalities of Poro and San Francisco, respectively while there are 9 species that are common in all the municipalities that include: *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule pinifolia*, *Halodule uninervis*, *Halophila minor*, *Halophila ovalis*, *Halophila ovata*, *Enhalus acoroides* and *Syringodium isoetifolium*.

Keywords: Seagrass, Species Diversity, Camotes Islands, Transect-quadrat method

BS - 60

**MOLLUSCAN SPECIES ASSOCIATED WITH
HOLOTHURIAN HABITATS IN CAMOTES ISLANDS,
CENTRAL PHILIPPINES**

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Mollusks inhabiting the holothurian habitats were studied. There were 3 habitats surveyed, the sandy, muddy and grassy flats.

This study used the transect quadrat method where transect was laid in the three habitats :sandy, muddy and grassy flats of Camotes Islands.

It was found out that there were nineteen species of mollusks belonging to the fifteen families namely, Family *Conidae*, *Phasianellidae*, *Strombidae*, *Buccinoidea*, *Cypraeidae*, *Volutidae*, *Cassidae*, *Littorinidae*, *Harpidae*, *Pectinidae*, *Mytilidae*, *Pinnidae*, *Arcidae*, *Octopodidae* and *Aplysiidae*.

Results show that there are six species found in sandy areas; one species in muddy and grassy areas; two in rocky areas.

Results further show that there are three species found in both sandy and grassy areas and six species in both rocky and sandy areas.

Keywords: Molluscan Species, Holothurian habitats, Camotes Islands, Transect-quadrat method

BS - 61

**DETECTION OF DERMATOPHYTES FROM
DIFFERENT BODY SITES OF FARMERS IN
SELECTED BARANGAYS OF AMADEO, CAVITE**

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A total of 600 skin scrapings from hands, arms, legs and feet and 300 nail clippings of toenails and fingernails were collected from 150 farmers of Halang, Banay Banay, Pangil, Tamakan and Dagatan in Amadeo, Cavite. Eighty five of the 150 farmers exhibited symptoms of dermatophytosis. All clinical samples were subjected to direct microscopic examination using potassium hydroxide (KOH) to detect the presence of fungal hyphae. Positive KOH cases were cultured on Sabouraud Dextrose Agar (SDA) with streptomycin to determine the fungi that invaded the tissues.

KOH mount revealed that 79.49% of the skin scrapings and 92.31% of nail clippings from farmers with dermatophytosis were positive for the presence of fungal elements. However, opposite result was obtained on samples from farmers without dermatophytosis. Only 43% and 66.55% from skin scrapings and nail clippings, respectively, were positive in KOH mounts. Not all KOH positive samples were culture positive.

Based on the culture, 333 fungal isolates were obtained. They were commonly found in toenails, feet, legs, hands and fingernails. The least number of isolates were found in the arms. *Trichophyton* was the only dermatophyte while the rest of the fungi were non-dermatophytes belonging to the *Aspergillus*, *Penicillium* and *Fusarium*.

Statistical analysis revealed that there was a significant relationship between the age ($p < 0.05$) and gender ($p < 0.01$) on the occurrence of fungi to farmers with and without dermatophytosis. However, no significant correlation was found with medical history.

Keywords: dermatophytes, dermatophytosis, KOH mounts, *Trichophyton*, hyphae

BS - 62

**DIVERSITY IN OUR MIDST: THE BUTTERFLY NECTAR
FEEDERS OF THE DIVIDIVI TREE, CAESALPINIA
CORIARIA (JACQ) WILD AT UP LOS BAÑOS,
LOS BAÑOS, LAGUNA**

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The Dividivi, *Caesalpinia coriaria* (Jacq) Wild is an exotic plant from South America. This leguminous medium sized tree is usually found in windswept seashores. At a glance it looks like a tamarind tree. It is noted for its horticultural and medicinal value. The lone Dividivi tree between Biological Science and the new College of Arts and Sciences buildings at UP Los Baños exemplifies the diversity of life forms in our midst through the nectaring butterflies on its flowers.

We studied the butterfly nectar feeder of the Dividivi tree from August 2010 – December 2010 in order to contribute to the documentation of diversity inventory at Los Baños. Observations were done at 0800 hours – 0900 hours. Counts were accomplished at least once a month.

We documented the species that visited the flowers based on their flight pattern and morphological appearance. We also use sweep net to examine closely the butterflies and release them later.

A total of 36 species from 6 families were observed. The order of decreasing density of the families of butterflies was: Nymphalidae (10) > Papilionidae (9) > Pieridae (8) > Danaidae (5) > Hespiriidae (2) = Lycaenidae (2).

We plan to continue observing the butterflies of Dividivi tree on a monthly basis to enable us to have a whole year perspective of the diversity of butterfly nectar feeders of this tree.

Keywords: Diversity, Butterfly, Nectar, Feeders, Dividivi

BS - 63

**UNUSUAL POPULATION INCREASE OF WOOLY BEAR
CATERPILLARS, *SPILOSOMA* SP. (ARCTIIDAE:
LEPIDOPTERA) AT LOS BAÑOS AND VICINITY IN 2010**

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The wooly bear caterpillars, *Spilosoma sp.* are usually found in *Ipomea obscura* (L.) Ker-Gaw). In 2010, there was sudden and unusual increase in population of this pest. The caterpillars attacked various crops such as eggplants, corn, okra, patoia, ube, paayap and a number of weeds species. The caterpillars even entered homes and pupated in ceilings, cracks and crevices. It caused anxiety to many people due to the menacing thick hairy appearance.

The prolonged dry spell in 2010 could have triggered the aggregation of adults in remaining green areas and led to subsequent population increase. We compared the 2010 agroneteorology data from that of 2005-2009 at the Central Experiment Station, UP Los Baños. The results showed low rainfall from February (3.0 mm) up to May (9.1 mm) in 2010 as compared to the previous four years. The rainfall also increased in June to July 2010 at 171.2 mm and 762.5 mm respectively. This dry spell followed by two wet months could have led to the population increase of *Spilosoma sp.* This phenomenon is similar to the locust outbreak in Central Luzon in the 90's where dry environment due to ash fall predominated in breeding areas followed by strong rainfalls led to population increase and subsequent migration/infestation in the central plains.

The population increase of wooly bear caterpillar coincided with the population outbreaks of armyworms, *Spodoptera sp.* semi-loopers and other lepidoterous species in various parts of the country.

Keywords: *Spilosoma sp.* Population, Unusual, Increase, Wooly Bear, Caterpillars

BS - 64

SOME BUTTERFLIES OF BORACAY ISLAND

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Boracay Island, Malay, Aklan is one of the well known and busiest tourist destination in the country at present. Owing to the increasing demand for space for commerce and domiciles, the butterflies habitat and range in this island resort are rapidly diminishing. We conducted a rapid survey of the butterflies at Boracay last April 2010 to document the butterfly fauna and contribute in the biodiversity inventory of the locality.

We noted down the species that we observed based on their flight pattern and morphological appearance. In other cases we use sweep net to examine closely the butterflies and release them later after confirming our identification.

A total of thirty two species from seven families were noted. The order of decreasing density of the seven families was: Papilionidae (8) > Nymphalidae (7) > Pieridae (6) > Danaidae (3) > Hesperidae (4) = Lycaenidae (4).

Additional counts particularly in the watershed will be included in the future to be able to record the species that are strictly present in forested areas. We will also invite partners in the locality.

Keywords: Butterflies, Boracay, Tourist, Island, Resort

BS - 65

**ISOLATION AND SCREENING FOR BACTERIA WITH
AMYLOLYTIC, PROTEOLYTIC OR LIPOLYTIC ACTIVITY
FROM PITCHER PLANT (*Nepenthes sp.*)**

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Microorganisms possess many different enzymes. The activities of these enzymes determine the nature of the organism; microbe's physiological properties by its enzymatic activities and ecological relationships. Enzymes are proteins that speed up chemical reactions. The traditional sources of many enzymes are plants and animals. These sources are no longer adequate to meet the growing demands for enzymes. Consequently, manufacturers and scientists are turning to microorganisms as sources.

Several studies have dealt with the isolation of enzyme producing bacteria from different sources. However, no similar studies have been conducted on Pitcher plant (*Nepenthes sp.*) or several plants which are indigenous and endangered plant to the Philippines. Enzymes produced from microbial metabolism can be useful raw materials for industrial and environmental applications.

The study focused on the isolation and screening of bacteria from the phytotelmata or digestive fluid of pitcher plant. Thirty-two bacteria were isolated in which ten were screened for enzymatic activities.

Results showed that four of the five isolates were positive for amylolytic activity as indicated by clear zones on Starch Agar. Nine isolates were lipolytic as indicated by zones of clearing and precipitation on Egg Yolk Agar while ten isolates exhibited proteolytic activity on Skim Milk Agar.

Partial characterization of bacterial isolates screened were gram positive, endospore forming, aerobic to facultatively anaerobic rods which probably belong to the Family Bacillaceae.

Keywords : bacteria, amylolytic, lipolytic, proteolytic, phytotelmata

BS - 66

AN INTERACTIVE IDENTIFICATION KEY: THE PHILIPPINE DERBIDAE PROJECT

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Identification is the process of finding unknown organism to which an organism belongs. There are several methods that are available for aiding this process. The most common is the use of a conventional paper-based identification keys - a tedious and time consuming work. The other one is with the help of a computer-aided identification keys - with more options, support back-tracking, provide pictures of excluded species as well as of those that are still under consideration, and provides drawings or pictures of characters or body parts that is/are being described (Yap and Froese, 2005).

With about 160 genera and 1500 species, Derbidae represents the third larger family of the Fulgoromorpha (FLOW, 2010). F. Muir (1917) was able to comprehensively collect and study them in the Philippines. He identified and described a total of 39 genera and 98 species based on the large collection of Prof. C. F. Baker and his own. Most hemipterist have paid less attention to the derbid fauna of the Philippines, aside from those that are found attacking economically important plants. The high endemism of the derbids was noted by Muir (1917), and clearly showed that many more species remain to be discovered.

Using Xper2 - an open e-tool to manage descriptive data - we present here the first illustrated computer-aided identification key for the known Philippine derbid genera based on diagnostical morphological characters. This computer-aided key would facilitate much faster identification of Philippine derbids in the field and would be helpful to those studying derbids with limited access to foreign literature.

Keywords: Derbidae, computer-aided identification key, interactive identification key, identification

BS - 67

PANDAN (*Pandanus amaryllifolius* Roxb.): A PROMISING ANTIDIABETIC AGENT

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The antidiabetic activity of pandan (*Pandanus amaryllifolius* Roxb) was determined in this study. Pandan is widely grown and is used for many purposes. It is known to have useful properties as antiviral, anti-allergen, antiplatelet, anti-inflammatory and anti-oxidant. Pandan contains volatile compounds, alkaloids (pandamarine, pandamerilactones) and essential oils. In this study, the antidiabetic activity of pandan leaf extract was determined in hyperglycaemic induced guinea pigs (*Cavia porcellus* Gesner K., after introduction of varying concentrations of pandan leaf extract (PALE) at 0.3 ml per 100 grams of body weight. Hyperglycaemia was induced by giving 0.3 ml glucose solution per 100g body weight after base line blood glucose determination was done.

Insulin and distilled water (DW) served as the positive and negative control, respectively. Blood glucose levels (BGL) of test animals were determined prior to hyperglycemia, at the onset of hyperglycemia and also 1, 3 and 5 hours after treatment administration of PALE.

Results showed that the PALE concentrations initiated BGL reduction in hyperglycaemic-induced guinea pigs. Significant hypoglycaemic effect was observed with different PALE concentrations: 100% PALE is as effective as insulin, followed by 30% and 50% PALE. The negative control gave a minimal decrease in BGL.

Hence, *Pandanus amaryllifolius* Roxb. Leaf extract (PALE) was found to be an effective agent in reducing blood glucose level. Economic analysis revealed 97.2% lower expense than what is incurred if insulin injection is administered. Furthermore, the use of PALE is 89.68% to 92.4% lower than the administration of Glucophage alone or Glucophage and Euglucon, respectively.

Keywords: *Pandanus amaryllifolius*, pandan, antidiabetic, hypoglycaemic, BGL

BS - 68

**TAXONOMIC STATUS AND LEAF EPIDERMAL FEATURES
OF *AMOMUM* ROXB. (FAMILY ZINGIBERACEAE)
RECORDED FROM MINDANAO, PHILIPPINES**

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The taxonomic evaluation of some *Amomum* species (Family Zingiberaceae) reported from Mindanao Philippines was conducted using both field and herbarium studies supplemented with leaf epidermal characters.

Botanical field studies were conducted and specimens were identified using taxonomic keys, protologues and by doing herbarium studies at the Philippine National Museum (PNM), College of Agriculture, University of the Philippines, College, Laguna (CAHUP) and Herbarium of the Singapore Botanical Gardens (SING).

Results of the study showed that a number of species originally placed under the genus *Amomum* are currently classified under the genera as *Etilingera* Giseke [*E. dalican* (Elm.) Poulsen, *E. philippinensis* (Ridl.) R. M. Smith] *Geocharis* [*G. fusiformis* (Ridl.) R. M. Sm.] and *Hornstedtia* Retzius [*H. conoidea* Ridl.] Examination of the leaf epidermal features revealed that the both *Amomum* and *Geocharis* have broad subsidiary cells while *Hornstedtia* and *Etilingera* had narrower subsidiary cells. *Amomum* have more stomata located near the veins than halfway between veins. In contrast, the stomata for *Hornstedtia* and *Etilingera* are scattered between the parallel veins of the leaf. The leaf epidermal data support the current placement of the above-listed formerly considered species of *Amomum*. Finally, this study showed that previous taxonomic treatment for the Philippine *Amomum* is quite unsatisfactory.

Keywords: Zingiberaceae, *Amomum*, epidermal features, clearing technique, stomata

BS - 69

**TRANSCRIPT PROFILING OF SELECTED GENES IN
NORMAL AND MUTANT MAKAPUNO ENDOSPERMS OF
COCONUT (*Cocos nucifera* L.) USING RELATIVE RT-PCR**

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Makapuno is an abnormal coconut with characteristic endosperm overgrowth. It has softer, fluffy endosperm compared to the hard, crisp solid endosperm of normal coconut. To gain insights on the molecular basis of the makapuno phenomenon, ten selected genes were cloned, characterized and their expression determined through Relative RT-PCR with actin as internal control gene. The ten genes showed conserved domains and have 75-98% identity to other plant sequences when analyzed with Interproscan and BLAST. Four of the ten genes were found to have lower expression in makapuno including an isopentenyl transferase gene that controls the first rate-limiting step in cytokinin biosynthesis. Three glycolytic genes, cytosolic glyceraldehyde-3-phosphate dehydrogenase, cytosolic pyruvate kinase and enolase were also downregulated in makapuno. On the one hand, three regulatory genes namely, protein kinase CK2 regulatory subunit, polyA binding protein, myb-like transcription factor were upregulated in makapuno. There was also altered expression of pyruvate decarboxylase, α -D-galactosidase, and ketoacyl-acyl carrier protein synthase 1 (KAS1). These data support previously reported differences in cytokinin levels, carbon metabolism and respiratory levels in the normal and makapuno coconut endosperms. These also provided further insights into the elucidation of the molecular mechanisms regulating gene expression in normal and makapuno endosperms of coconut.

Keywords: endosperm overgrowth, gene expression, altered carbon metabolism, relative RT-PCR, coconut

BS - 70

**IN VITRO CULTURE AND ENZYME PRODUCTION OF
PLASMODIAL MYXOMYCETES (SLIME MOLDS) COLLECTED
FROM LUBANG ISLAND, OCCIDENTAL MINDORO**

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Plasmodial myxomycetes or slime molds are often studied for the unique and interesting stages of their life cycle. Recently, these organisms were tapped for the production of anticancer metabolites. However, with their minute sizes, *in vitro* culture offers the possibility for the mass production of their natural products. In our research study, we collected plasmodial myxomycetes from ground leaf litter and twigs cultivated on moist chambers. *In vitro* culture showed spore germination of 13 species: *Craterium atrolucens*, *C. concinnum*, *Diderma effusum*, *Didymium ochroideum*, *D. squamulosum*, *Diachea leucopodia*, *Lamproderma scintillans*, *Oligonema schweinitzii*, *Perichaena microspora*, *Physarum bivalve*, *P. cinereum*, *P. compressum* and *P. melleum*. Ten of these species developed into amoeboflagellates while seven further grew into plasmodia. Both of these are part of the life stages of myxomycetes. The amoeboflagellates of these myxomycetes were then preserved and stored for 3 months. Revival of preserved amoeboflagellates resulted in 82% success rate. Production of extracellular enzymes was also tested from the *in vitro* grown myxomycetes. Plasmodia of *P. compressum* and one plasmodium derived from a hardened sclerotium, a resting stage of myxomycetes, showed *in vitro* the presence of amylase and protease indicating perhaps an alternative mode of nutrition for these myxomycetes in addition to the phagotrophic mode of nutrition known for these organisms. This research study is the first report of *in vitro* culture and enzyme production of plasmodial myxomycetes in the Philippines.

Keywords: slime molds, *in vitro* culture, culture preservation, extracellular enzymes, mode of nutrition

BS - 71

FUNCTIONAL ACTIVITIES OF TWO STRAINS OF *Pleurotus cystidiosus*

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Pleurotus cystidiosus is an edible mushroom widely distributed in subtropical and tropical countries growing on decaying logs and other agricultural wastes. In the Central Luzon, wild strains of this mushroom were collected in upland community of Llanera, Nueva Ecija and Central Luzon State University (CLSU) campus. The Center for Tropical Mushroom Research and Development has developed production technology for the cultivation of this mushroom. Because of its potential in the nutraceutical and pharmaceutical industries, our research team determined the functional activities of the basidiocarp and mycelial hot water extracts of two wild strains of *P. cystidiosus*. Carageenan induced edema and charcoal tracing method were performed to determine the anti-inflammatory and the anti-spasmodic activity, respectively, using Swiss albino mice.

Carageenan induced edema test revealed that the mycelia and basidiocarp extracts of the two strains can reduce inflammation. Basidiocarp extract of CLSU strain recorded the highest percentage of inhibition of inflammation with means of 26.47 % and 66.18 % one and three hours after the application, respectively. On the other hand, charcoal tracing assay for antispasmodic activity showed that the mycelial extract of Llanera strain registered the lowest percent traveled by charcoal in the intestine of mice with a mean of 41.83%.

Keywords: *Pleurotus cystidiosus*, functional activity, anti-spasmodic, anti-inflammatory

BS - 72

**THE OCCURRENCE OF MANGROVE BRACHYURAN
CRABS AND OBSERVATION ON THE FEEDING ECOLOGY
OF SOME TAXA OF THE GRAPSOID FAMILIES GRAPSIDAE
AND SESARMIDAE *sensu* SCHUBART *et al.* (2002) FROM
SELECTED MANGALS OF LUZON, PHILIPPINES**

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Despite the obvious importance of mangrove brachyurans to ecosystem functioning in relation to their roles in retaining a large proportion of mangrove leaf-litter, the most prominent groups belonging to the grapsoid families (Grapsidae and Sesarmidae) are less studied in the Philippines. Occurrence and some observations on the feeding ecology of selected grapsoid sesarmids as to their dependence on mangrove trees as habitats, burrowing behavior and arboreal climbing skills were considered in this study. A total of 6 families, 17 genera and 21 species (9 grapsoid sesarmids and 12 non-grapsoids) of mangrove brachyurans are reported from Pagbilao (Quezon); Manila Bay area (Cavite); and Palnab-Pajo and Agojo Inlet (Catanduanes). Sesarmidae is represented by *Perisesarma*, *Episesarma*, *Selatium* and *Sarmatium*; while Grapsidae is represented by *Hemigrapsus*, *Pseudograpsus* and *Metopograpsus*. Non-grapsoids consist of Varunidae (*Ptychognathus*); Ocypodidae (*Dotilla*, *Ocypode*, *Uca*); Portunidae (*Charybdis*, *Portunus*, *Scylla*, *Thalamita*); and Eriphiidae (*Epixanthus*). The sesarmids (*Selatium elongatum* and *Episesarma versicolor*) are exclusive mangrove tree climbers or EMTC, while *Metopograpsus latifrons* and *Sarmatium germaini* are occasional mangrove tree climbers or OMTC and non-arboreal or non-mangrove tree climbers or NMTC are *Neosarmatium smithi*, *Perisesarma bidens*.

Keywords: Brachyurans, mangroves, Catanduanes, Quezon, Cavite, Grapsidae, Sesarmidae

BS - 73

TAXONOMY OF VEGETABLE OILS BASED ON FATTY ACID COMPOSITION

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A scheme for classifying vegetable oils based on fatty acid composition is proposed. Heatmap and dendrogram were constructed from gas-fatty methyl ester (FAME) chromatograms of vegetable oils obtained from Codex Standards 210-1999 and 33-1981; and from published and experimental data. The vegetable oils analyzed formed 5 major clusters designated as lauric (Cluster 1); linoleic (Cluster 2), high-oleic (Cluster 3); palmitic (Cluster 4) and mid-oleic (Cluster 5). Coconut oil including the virgin coconut oil (VCO) and the refined, bleached and deodorized (RBD-CO) variants are classified under the "Lauric Cluster" along with Babassu and Palm kernel oils. This group is unique as most of its fatty acids are fall under the medium-chain (C6:0 to C12:0) category. This food oil taxonomy can be correlated with the nutritional properties attributed to specific fatty acid, fatty acid group or vegetable oil. More importantly, our simplified chemo-informatic based classification scheme can be adapted to the existing food classification systems, such as the EuroFIR and of the USDA.

Keywords: fatty acid, vegetable oil, coconut oil, chemo-informatics and cluster analysis

BS - 74

**CYTOTOXICITY TEST AND PHYTOCHEMICAL
SCREENING OF CRUDE ETHANOLIC AND HEXANE
EXTRACT OF THE AERIAL PART OF *Hydrocotyle verticillata*
(WHORLED MARSPENNYWORTH)**

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The crude ethanolic extract of the aerial part of *Hydrocotyle verticillata* was subjected to solvent partitioning according to increasing polarity: n-hexane, ethyl acetate (EtOAc), dichloromethane (DCM) and water. Brine shrimp lethality test was conducted to the four partitioned solvent extracts and result showed that n-hexane and EtOAc have significant cytotoxic potentials having LC₅₀ of 50.35 and 76.98 ppm respectively. Hence, n – hexane extract showed to be the most bioactive since it has the lowest LC₅₀ among the four solvent extracts.

The phytochemical screening of ethanolic extract of *H. verticillata* showed the presence of bioactive components like alkaloids, saponins, steroids, flavonoids, tannins and anthraquinones. While the phytochemical test on hexane extract (the most bioactive among the partitioned solvent extract) revealed only the presence of alkaloid and saponin.

Keywords: *Hydrocotyle verticillata*; cytotoxic; phytochemicals; brine shrimp

BS - 75

**SYSTEMS ANALYSIS OF X-CHROMOSOMAL miRNAs
AND THEIR TARGET GENES USING INFORMATICS TOOLS**

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In an attempt to investigate the potential roles of miRNAs in human intelligence, miRNAs located in the X-chromosome were identified by mining the miRBase database. Out of the 77 miRNAs, 10 were chosen for further analysis based on their differential levels in the various functional parts of the brain: cortex (executive functions, long-term/immediate memory and speech), hippocampus (learning and working memory) and the midbrain (visual and auditory systems, and body movement). Target genes of these ten brain-expressed X-chromosomal miRNAs were predicted and compared with the following randomized miRNAs: ten nonbrain-expressed X-chromosomal miRNAs, ten nonbrain-expressed miRNAs that are not found in the X-chromosome and ten brain-expressed miRNAs that are not found in the X-chromosome. For the brain-expressed X-chromosomal miRNAs, a total of 221 target genes were predicted based on their common targets from three public prediction algorithms: MiRanda, TargetScan and MiRTarget2. These target genes were then annotated and compared according to their gene ontologies (GOs). Chemo- and Bioinformatics analyses indicate that the X-chromosome has potential roles in human intelligence as indicated by the statistically significant GO terms associated with learning, memory and brain development by the target genes of the brain-expressed X-chromosomal miRNAs.

Keywords: molecular systems analysis, miRNAs, gene ontology, MiRanda, TargetScan

**CHEMICAL, MATHEMATICAL
AND PHYSICAL SCIENCES**

CMPS - 01

**DISCRIMINATION OF PHILIPPINE COFFEE BEANS USING
AN ELECTRONIC NOSE SYSTEM BASED ON POLYMER-
COATED PIEZOELECTRIC QUARTZ CRYSTAL**

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Electronic nose (EN) generates an electrical signal in the presence of a substance causing aroma. In this study, the feasibility of a fabricated EN based on polymer-coated piezoelectric quartz crystals (PQC) was investigated for the discrimination of the different coffee varieties in the Philippines (i.e. Arabica, Robusta, Excelsa and Liberica). The EN system that was employed was based on PQC coated with six sensing elements of different polarities [polyethylene glycol (PEG), polyvinylchloride (PVC), Silica (PVC/Silica), Cat-Ex (PVC/CatEx)], polymethylacrylate (PVC/PMAA) and Fluorosil (PVC/Fluor). Using the optimized conditions, coffee samples were sealed separately in the suitable vial and the headspace gas was pumped through the EN system using nitrogen gas. The gas phase detection was based on the corresponding change on the frequency of the crystal. Distinct radar plot quality profiles were obtained for each variety. Chemometric analysis of the responses from 48 different coffee samples using the EN was carried out using principal component analysis (PCA) and cluster analysis (CA). PCA and CA were applied to classify and to quantify how coffee samples are close to each other. The developed group of sensors was then able to categorize the different coffee varieties.

Keywords: piezoelectric quartz crystal; electronic nose; chemometric analysis, principal component analysis, cluster analysis

CMPS - 02

**ELECTROCHEMICAL PROPERTIES OF PtRuSn TERNARY
ELECTROCATALYST DISPERSED ON POLY(3,4-
ETHYLENEDIOXYTHIOPHENE) (PEDOT) FOR
FUEL CELL APPLICATION**

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Fuel cells have been considered as an effective alternative energy source due to its efficient energy conversion and low pollutant emissions. Therefore, improvement in alcohol oxidation is important in fuel cell technology and this can be achieved by developing modified platinum as electrocatalyst. Electrocatalytic oxidation of ethanol in acidic medium was studied using PtRuSn-PEDOT-modified polycrystalline and (111)-oriented single crystal electrodes of Au and Pt electrodes. In this study, potential cycling from -400 to 850 mV (vs. Ag/AgCl) was employed in depositing the Pt particles. Spontaneous deposition of Ru at 120 seconds with reduction at a constant potential (50 mV) was observed to be the most effective method in depositing Ru. This method was also used to deposit Sn particles for the preparation of PtRuSn ternary electrocatalyst. It was observed that 1 mM exhibits the most effective concentration towards ethanol oxidation. The developed ternary electrocatalysts had shown higher electrocatalytic activity by 15.00% - 21.22% than the binary catalysts. The same surface modification methods were employed on Au(111) and Pt(111) single crystal electrodes. It was observed that (111) single crystal substrates exhibit higher electrocatalytic activity by 10.69% (for Au(111)) and 72.63% (for Pt(111)) than their polycrystalline counterparts. As revealed by SEM, PEDOT electrochemically grown on the well-defined single crystal electrode surface was more ordered and smoother than on the polycrystalline substrate. This gave a better dispersion of the electrocatalysts on the PEDOT matrix, leading to more catalytic active sites.

Keywords: fuel cells, alcohol oxidation, electrocatalyst, cyclic voltammetry, spontaneous deposition

CMPS - 03

A HYBRID GAS SENSOR ARRAY FOR THE QUALITY ASSESSMENT OF VIRGIN COCONUT OILS

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A hybrid gas sensor system composed of seven chemiresistors based on thin conducting polymer (CHCP) films and nine polymer-coated piezoelectric quartz crystals (PPQC) were developed and utilized for assessing the quality of virgin coconut oil. The sensors were exposed to the headspace of samples of virgin coconut oil (VCO), refined, bleached and deodorized coconut oils (RBD), rancid VCO and flavored VCO. The response of the chemiresistor was measured using a bridge circuit operating in a deflection mode, and the response of the piezoelectric quartz crystals was measured using an instrumentation system involving an oscillator circuit and a frequency counter. The CHCP sensors displayed good reproducibility (rsd= 2.02% to 10.40%; n=6) and reversibility (rsd= 0.033% to 1.98%; n=3). At the same time, PPQC also exhibited good reproducibility (rsd= 3.54% to 6.28%; n=3) and reversibility (rsd=3.83% to 7.95%; n=3). Chemometric analysis of the data through principal component analysis (PCA) enabled a very good discrimination of VCO, RBD, rancid VCO and flavored VCO with a cumulative variance of 81.87%. This hybrid gas sensor system will be very useful in monitoring the quality of VCO products and will detect adulterated and fraudulent VCO products.

Keywords: hybrid sensor array, chemiresistor, piezoelectric quartz crystal, conducting polymers, VCO

CMPS - 04

**FISH FRESHNESS ANALYSIS USING A POLYANILINE/
NYLON COMPOSITE-BASED CHEMIREซิสTOR SENSOR**

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Food safety assurance is an important factor in building confidence to consumers when choosing a particular product. In the fish sector, freshness of fish is placed into a great consideration in order to ensure the health and safety of the consumers, and to maintain the quality of their products. Trimethylamine (TMA), a volatile amine compound responsible for the pungent, fishy, ammonia like aroma in fish, is a typical marker for fish freshness detection. TMA is the toxic gas found after death of a fish. In previous studies, a series of inspections were performed to determine freshness of fish, but methods are ineffective and found to be time consuming.

In this study, a chemiresistor sensor based on polyaniline (PANI)/nylon composite was developed for the headspace analysis of trimethylamine. The polymer composite was prepared by an *in situ* chemical oxidative polymerization of 0.4 M aniline with an equimolar amount of HCl onto a nylon membrane using 0.6 M ammonium peroxydisulfate oxidant. The composite was mounted on a home-made assembly for resistivity measurement based on the four-point probe method. The assembly design allowed the membrane composite to be in contact with the headspace of the measurand system. The measured resistance varied with the TMA concentration, exhibiting a sensitivity of 14.05 mA/- log ppb TMA and linearity (r) of 0.975 at a dynamic concentration range of 10^{-9} to 10^{-6} ppb TMA. It is repeatable showing a COV of 7.8% for the 10^{-6} ppb sample cycled thrice. TMA in fish was detected on the 8th hour of exposure. This type of gas sensor is attractive because it provides a promising low-cost means to monitor TMA at RT.

Keywords: fish freshness, polyaniline/nylon composite, trimethylamine, chemiresistor, gas sensor

CMPS - 05

**ELECTROCHEMICAL SYNTHESIS AND CORROSION
PERFORMANCE OF POLYPYRROLE AND
POLY(PYRROLE-CO-ANILINE) FILMS ON COPPER**

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The cheapest and most commonly used metal to date is copper, which is highly prone to corrosion. However, copper is mostly used in highly corrosive environment, which degrades the metal's durability and costs money to multinational businesses. To protect metals, conducting polymers are one of the most promising materials.

In this study, the electropolymerization of polypyrrole and poly(pyrrole-co-aniline) on copper electrode was done with cyclic voltammetry. A 0.1M pyrrole (Py) in 0.1 M near neutral (pH 7.6) $\text{Na}_2\text{C}_2\text{O}_4$ solution was used and a potential window of -0.5 V to +1.8 V. For the preparation of poly(pyrrole-co-aniline), a 0.1 M monomer solution of 0.5 M pyrrole and 0.5 M aniline were used.

The corrosion protection properties of these polymers were studied using the open circuit potential (OCP) measurement in 3.5% NaCl (aq). PPy had the best corrosion protection properties, followed by poly(pyrrole-co-aniline). PPy showed responses going towards more positive potentials compared to the copolymer and bare copper upon immersion to saline solution, which is due to both the pseudo-layer of copper oxalate complexes formed on the copper surface before polymerization and the polymer coat synthesized on its surface. SEM micrographs showed that polypyrrole exhibited multiple layers synthesized on the surface of copper, which contributed to its efficiency on protecting copper from corrosion.

Keywords: polypyrrole, polyaniline, corrosion, open-circuit potential, voltammetry

CMPS - 06

PREPARATION AND INVESTIGATION OF SPIN SELF ASSEMBLED MULTILAYER FILM OF POLY(3,4 ETHYLENEDIOXYTHIOPHENE):POLY(4 STYRENESULFONATE) AND POLY(ALLYLAMINE HYDROCHLORIDE) AS ORGANIC LIGHT-EMITTING DIODE

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The preparation and characterization of thin-film materials is a dominant area of research. These films have found several applications as thin-film and field effect transistors, touch displays and electroluminescent devices such as organic light-emitting diodes. The organic light-emitting diode (OLED) has received a lot of attention because of its attractive features for display applications. This study aims to chemically prepare poly (3,4-ethylenedioxythiophene):poly (styrenesulfonate) (PEDOT:PSS) and fabricate a polymer multilayer film with poly(allylaminhydrochloride) (PAH) by spin self-assembly method and to investigate the properties of the multilayer film as OLED.

EDOT was polymerized with PSS using FeCl₃ oxidant with several monomer to oxidant molar ratios (1:1, 1:2.5, 1:5, 1:7.5), with the 1:7.5 ratio giving the highest yield of polymer. The optical absorptions of several PEDOT:PSS solutions (0.05, 1, 3 and 5% w/v) showed 3% w/v with the highest and most stable reading with absorption peaks at 325 nm and 750 nm indicative of PSS and 990 nm for the blue-colored PEDOT. The PAH/PEDOT:PSS solution was spin-coated (2500 rpm for 30s) to form a film on glass slide and indium tin oxide substrates (1.0 x 2.5 cm). The film coating with a total of 15 bilayers showed an increasing absorbance as bilayer increases. SEM and AFM micrographs of PEDOT:PSS showed relatively smooth surface. The OLED characteristic of the multilayer film gave a current-voltage curve of a diode even if no light was emitted.

Keywords: OLED, PEDOT, LBL films, spin self-assembly, AFM, SEM

CMPS - 07

FABRICATION AND CHARACTERIZATION OF SPIN-ASSISTED AND DIP-COATED PEDOT:PSS AND POLY(DIALLYLDIMETHYLAMMONIUM CHLORIDE) NANOFILMS FOR ORGANIC LIGHT-EMITTING DIODE

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Organic light emitting diodes (OLED) have extended its domain of applications in the area of flat panel displays due to their potential properties, brightness efficiency, extended lifetime and low production cost. The study aims to prepare and characterize nanofilms of Poly (3,4-ethylenedioxythiophene):Poly (styrenesulfonate) (PEDOT:PSS) and Poly (diallyldimethylammonium chloride) (PDADMAC) for the fabrication of an OLED.

EDOT:PSS was chemically polymerized using $(\text{NH}_4)_2\text{S}_2\text{O}_8$ oxidant and FeCl_3 catalyst. Absorbances of different solutions of synthesized PEDOT:PSS were determined using a UV-visible spectrophotometer. The glass slides and ITO-coated slides (10x20 mm) substrates were degreased and functionalized. In dip-coating, the treated substrate was then initially immersed in 0.01M PDADMAC solution for 15 min, followed by immersion in 3% (w/v) PEDOT:PSS solution. In spin-coating, PDADMAC and PEDOT:PSS were deposited alternately on the substrate with spin speed of 2500 rpm for 30 sec. The cycles for two techniques were repeated until 10 bilayers were achieved.

Each bilayer exhibited absorbance peaks at 370, 560 and 850 nm due the dark blue PEDOT. The SEM micrographs of PEDOT:PSS surfaces revealed globular structures. Atomic force micrographs showed average roughness of 1.000 nm and 14.697 nm, for spin-assisted and dip-coated films, respectively. An OLED was fabricated using PEDOT:PSS/PDADMAC films as the hole transport layer. The current-voltage graph of prepared OLED showed a diode characteristic.

Keywords: OLED, PEDOT, layer-by-layer films, spin-coated, dip-coated

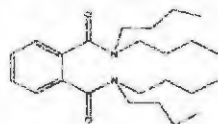
CMPS - 08

**RAPID SYNTHESIS UNDER MILD CONDITIONS OF AN
ACRYLIC DIAMIDE N, N, N', N'
ETRABUTYLPHTHALAMIDE, A POTENTIAL
ANTIMICROBIAL AGENT**

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The amide functional group is a common feature in both small and complex synthetic or natural molecules. It is one of the most significant functional groups of organic molecules in terms of medicinal use. Medicinal Chemistry database showed that approximately 25% of known drugs contain this carboxamide group. The synthesis of acyclic diamide, N, N, N', N' – tetrabutylphthalamide, by the condensation with phthalic anhydride in dioxane of dibutylamine proved to be highly efficient. A product yield of 85% was obtained under mild conditions (6-hour reaction time at 27°C). The product was recrystallized in acetonitrile. The successful synthesis was confirmed through spectroscopic techniques such as infrared, nuclear magnetic resonance and mass spectroscopy. The purified product was tested for antimicrobial activity against *Escherichia coli*, *Staphylococcus aureus*, *Candida albicans* and *Aspergillus niger*. Chloramphenicol and clotrimazole were used as positive controls. The acyclic diamide exhibited antimicrobial activity with an antimicrobial index of 0.1 against *Escherichia coli*, 0.3 against *Staphylococcus aureus* and 0.2 against *Candida albicans*. No inhibition activity against *Aspergillus niger* was observed.



Structure of N, N, N', N' –tetrabutylphthalamide

Keywords: acyclic diamide, medicinal chemistry, condensation reaction, antimicrobial agent, antimicrobial index

CMPS - 09

EFFECT OF PRETREATMENT ON THE STRUCTURE AND CATALYTIC PROPERTIES OF RICE HULL-DERIVED ZEOLITES

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Rice hull was used as raw material for zeolite synthesis. It was pretreated with water and 1 M HCl before ashing at 600 °C in a muffle furnace for 3 hours. Purity of the rice hull ashes was verified by their percent carbon content. Characterization of the zeolites were done using electron dispersive X-ray (EDX), scanning electron microscopy (SEM) and X-ray diffraction (XRD) spectroscopy.

The rice hull pretreated with water had 21:16 (Si:Al) framework ratio while that pretreated with acid had 23:17 (Si:Al) which could mean that the Si-Al framework ratio of the samples could be about 1.3:1. SEM scans at 7500x magnification revealed that zeolites derived from rice hull ash pretreated with water had bigger pore sizes (2 µm) than those of acid-washed (1µm) diameter.

The catalytic properties of the prepared zeolites were determined by spiking a water sample with 69.0 ppm of NO₃⁻ solution (the maximum tolerable limit of nitrate in water), loading it with 0.2 g zeolite per liter of solution and aliquots analyzed after 2, 3 and 4 hours. The zeolite derived from water-pretreated ash removed nitrate in water (99.11%) and is not significantly different from that obtained from acid-pretreated ash (99.26%) after 4 hours. For comparison, commercial-grade zeolite was tested and was found to remove only 98.77% nitrate and is significantly different from the pretreated ones. Hence, pretreatment of the rice hull has an effect on the structure and catalytic properties of rice hull-derived zeolites.

Since water-pretreatment and acid-pretreatment yield zeolites that relatively remove nitrates in water, it is recommended that the former be employed for rice hull pretreatment. Study must be done also to determine the possibility of regenerating the zeolite after its use to remove nitrate.

Keywords: rice hull-derived, pretreatment, zeolites, catalytic, nitrate

CMPS - 10

**SYNTHESIS OF GLYCEROL-CROSSLINKED
POLY(METHYLMETHACRYLATE) MICROPARTICLES
FOR THE CONTROLLED DELIVERY OF
MOSQUITO REPELLENT**

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Crosslinked polymers can act as controlled release device to serve as sustained release source of mosquito repellent for a long period of time. One such polymer is poly(methylmethacrylate)(PMMA). However, being relatively hydrophobic it shows limited swelling in amphiphilic and polar solvents and hence limits its encapsulation and release application. This can be remedied by the use of a more hydrophilic moiety in the polymer network such as glycerol which is highly hydrophilic due to the presence of three hydroxyl (-OH) groups. Hence the research focused on the fabrication of glycerol crosslinked poly(methyl methacrylate) (GXPMMA) nanoparticles that can be used for the controlled release of mosquito repellent DEET(N,N-diethyl-m-toluamide). GXPMMA was synthesized by polymerization and crosslinking MMA with glycerol in one step in the presence of biocatalyst Novozyme 425, initiator benzoyl peroxide in toluene. It was observed that increase in reaction temperature from 50 to 70 °C, and decrease in the amount of toluene resulted in the formation of the product in shorter period of time. GXPMMA showed maximum swelling in amphiphilic solvent acetone. GXPMMA was converted into nanoparticles of size 200 nm by nanoprecipitation technique. DEET was incorporated into nanoparticles by dispersing the particles in acetone containing DEET. It was observed that when the nanoparticles: DEET was in the ratio of 1:0.5, 80% of free DEET got incorporated in 4 h. DEET was released at a controlled rate for 6 h.

Keywords: nanoparticles, glycerol, poly(methyl methacrylate), DEET, mosquito repellent

CMPS - 11

**FABRICATION OF ELECTROCATALYST BASED ON
PEDOT-PSS SUPPORTED Pd NANOPARTICLES FOR
ETHANOLELECTRO-OXIDATION**

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Studies related on the search for an effective yet less expensive catalyst and support material for fuel cells, constitute a step on the development of possible solutions to increase the efficiency of a Direct Ethanol Fuel Cell while lowering its cost. Palladium nanoparticles were synthesized via oleylamine-mediated synthesis and precursor method to achieve a mean particle size of $3.78 \text{ nm} \pm 0.45 \text{ nm}$ and $3.63 \text{ nm} \pm 0.59 \text{ nm}$, respectively as revealed by transmission electron microscopy (TEM). Poly(3,4-ethylenedioxythiophene) doped with poly(styrene sulfonate) (PEDOT-PSS) was prepared by a simple chemical synthesis procedure and was used as a supporting matrix for the Pd nanoparticles (PdNPs). Two different methods to remove the capping agent during the synthesis of metal nanocatalysts were studied, i.e. acetic acid washing and thermal annealing. It was found out that both thermal annealing and acetic acid washing were effective in removing the capping agent, oleylamine. The study was successful in developing an electrode based on PEDOT-PSS supported Pd nanoparticles which gave a current density of 0.90 mA/cm^2 for ethanol oxidation in alkaline medium, which is relatively lower compared to the activity of PdNPs-CNTs (carbon nanotubes)/Na ω n-GCE (glassy carbon electrode) reported in the literature. The prepared electrode showed electrochemical stability even up to 50 oxidation cycles. This study is an effort pointing towards the development and possible commercialization of non-platinum based fuel cell anode dispersed on a conductive polymer matrix.

Keywords: fuel cell, electrocatalyst, Pd nanoparticles, PEDOT-PSS, TEM

CMPS - 12

NANOWIRE FORMATION AND POLYMER
CONFORMATIONS OF ELECTROPOLYMERIZED
POLY(3,4-ETHYLENEDIOXYTHIOPHENE) (PEDOT) ON
IODINE-MODIFIED Au(111) SINGLE CRYSTAL
ELECTRODE AS PROBED BY *in-situ* STM

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In the field of nanotechnology, there is a growing interest in the synthesis of conjugated polymer nanowires because of their promising applications in nanodevices and molecular electronics. In this study, the electrochemical polymerization of 3,4-ethylenedioxythiophene (EDOT) ($E_{ox} = 1.20$ V) on iodine-modified Au(111) single crystal electrode in aqueous 0.10 M HClO₄ was investigated by cyclic voltammetry (CV) and electrochemical scanning tunneling microscopy (EC-STM). The Au(111) single crystal electrode was fabricated using the *Clavilier's* method. The iodine adlayer was prepared by dipping a freshly annealed Au(111) single crystal electrode in a 0.10 M potassium iodide (KI) solution.

Cyclic voltammetric and EC-STM data revealed the iodine adlayer was stable from $E = 0.0 - 1.40$ V vs. Reversible Hydrogen Electrode. This provided a suitable potential range for EDOT electropolymerization at 1.20 V vs. RHE. EC-STM was used to examine the formation of EDOT adlayer on iodine-modified Au(111) electrode. The iodine adatoms on Au(111) surface were prominent at negative potentials but EDOT molecules gradually appeared as bright spots when the potential was shifted more positively. However, the formation of an ordered adlayer of EDOT molecules was not observed. *In-situ* electropolymerization of EDOT was carried out at 1.20 V and showed the formation of single-molecular chains of PEDOT with diameter and lengths of 0.9 nm and 5-7 nm respectively. Extensive STM imaging further revealed PEDOT having bended polymer backbones of 105°, 144° and 180° (i.e. hairpin folding). The growth of PEDOT multi-layers is observed when the potential was held for a longer time.

Keywords: Poly(3,4-ethylenedioxythiophene), nanowire, iodine, Au(111) single crystal electrode, scanning tunneling microscopy

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MICROWAVE-ASSISTED REACTION: A CLEANER AND EFFICIENT METHOD FOR THE SYNTHESIS OF INDAZOLES AND BENZIMIDAZOLES

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The use of microwave radiation for heating reaction mixtures has proved to be a convenient method for the synthesis of indazoles and benzimidazoles as it can carry out the reaction under solvent-free condition, at shorter reaction time and with better product yield.

A domestic microwave oven was used to carry out the reactions. The starting materials were placed in a test tube and mounted in an Erlenmeyer flask. This set-up was placed inside the cavity of the oven and irradiated for several minutes at a particular power. The products were identified by their IR, ¹H nmr and ¹³C nmr spectroscopic data.

A 77% yield of 2-phenyl-2*H*-indazole was obtained by irradiating a mixture of 1.0 mmol *N*-(2-nitrobenzylidene)aniline and 4.0 mmol P(OEt)₃ for 14 min at 200W. 2-(1-Naphthyl)-2*H*-indazole was obtained in 89% yield when *N*-(2-nitrobenzylidene)-1-naphthylamine and P(OEt)₃ was irradiated for 14 min at 200W. Irradiation of *N*-benzylidene-2-nitroaniline and PPh₃ for 5 min at 200W gave 96% 2-phenyl-1*H*-benzimidazole. Other indazoles and benzimidazoles were also synthesized using the microwave-assisted method. The results showed that high yields were obtained at shorter reaction times and without excessive use of organic solvents.

Keywords: microwave-assisted reaction, indazoles, benzimidazoles, imines, synthesis

CMPS - 14

**METHOD VALIDATION FOR THE DETERMINATION OF
IODINE IN URINE BY AMMONIUM PERSULFATE
DIGESTION WITH SPECTROPHOTOMETRIC DETECTION
OF THE SANDELL-KOLTHOFF REACTION**

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Urinary iodine excretion (UIE) has been widely regarded as a biochemical marker for prevention and control of iodine deficiency disorders (IDD). To determine UIE levels, most methods require pretreatment of urine sample before its colorimetric detection based on the Sandell-Kolthoff reaction. In this study, a greener and safer oxidizing agent for the removal of iodide interferences in urine was used and validated. Three levels of pooled urine sample and a sample taken from the interlaboratory comparison used as control were analyzed for UIE using the ammonium persulfate method. Spectrophotometric detection of iodine in urine at 420 nm was performed after the addition of arsenous acid and ceric ammonium sulfate in the digested sample. The calibration curve was linear ranging from 0 – 800 µg/L. The detection limit was 0 µg/L and the quantitation limit was 0.2 µg/L urinary iodine. The method had an intra-assay coefficient of variation (CV) of 26.3% for the low, 4.1% for medium and 2.2% for high UIE level controls. The inter-assay CV resulting from inter-analyst and inter-instrument analyses were 15.7% and 3.8%, respectively. The validated method for urinary iodine determination is fast, safe and economical.

Keywords: urinary iodine, ammonium persulfate, Sandell-Kolthoff, validation, urine

CMPS - 15

**DETERMINATION OF *Trans* FATTY ACID IN
VIRGIN COCONUT OIL AND OTHER FATS AND
OILS BY GAS CHROMATOGRAPHY**

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Trans fatty acid (*tFA*) in fats and oils were identified to be a risk factor for CHD and was made mandatory requirement under the Nutrition Labeling (US NLEA, 2000 and Canada, 2003). The study aims to validate/verify the AOCS Ch2a-94 Gas Chromatography (GC) method of *tFA* analysis for virgin coconut oil (VCO) and other fats and oil.

Precision and accuracy were determined using in-house food reference material (IFRM, Grape seed oil), 2 Food Analysis Proficiency Assessment Scheme Quality Control Test Material (FAPAS QCTM, Vegetable oil and Breakfast Cereal), and inter-laboratory test with foreign laboratory. Linearity, LOD and LOQ were determined by 5 level concentration using 10 different *tFA* standards. Twenty five VCO samples and 5 refined, bleached and deodorized (RBD) oils were studied.

The method was found to be precise and accurate with Horrat value of 1.8 which is within the acceptable criteria (<2) and %recovery of 78.03% (addition method) and 112% (QCTM). Inter-laboratory test showed 0.09% difference in IFRM analysis. The calibration curve was linear (0.9786 – 0.9992) at a concentration range of 0.0044 – 0.38 mg/mL. The LOD was 0.00255 mg/mL and the LOQ was 0.00851 mg/mL. Using the US NLEA guidelines, all VCO samples contained zero *tFA* while the RBD oils contained of up to 2.2g/100g oil *tFA*.

In conclusion, VCO contains zero *tFA* and the AOCS method can be used for *tFA* analysis in VCO and other fats and oils. The method can be recommended for *tFA* analysis of fats and oils from food products.

Keywords: *trans* Fatty acid, Virgin Coconut Oil, method validation, gas chromatography

CMPS - 16

**METHOD VALIDATION OF PLASMA OR SERUM RETINOL
ANALYSIS USING HIGH PERFORMANCE LIQUID
CHROMATOGRAPHY UV/VIS DETECTION**

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Validation of analytical methods is essential in the generation of data for biochemical assessment studies to obtain reliable results that can be satisfactorily interpreted. For this purpose, the validation of plasma or serum retinol using high performance liquid chromatography was performed according to the requirements of ISO 17025 by taking into consideration the different criteria such as linearity, instrument detection limit, limit of quantitation and detection, trueness, repeatability and reproducibility.

The validation was carried out by using 100 μ L of plasma or serum with 100 μ L of retinyl acetate in absolute methanol. It was mixed for 2 seconds and extracted twice with 500 μ L of hexane. The combined extracts were dried up under the stream of nitrogen gas. It was redissolved in 100 μ L of 4:1 methanol-dichloromethane and 50 μ L aliquot was injected to HPLC-UV/Vis.

Results showed that elution time of retinol was at 3.090 ± 0.014 minutes and calibration standards behaved linearly ($R^2 = 0.9994 \pm 0.0001$) over the calibration range of 0.37-6.66 mg of retinol. The accuracy of the method evaluated from the analysis of the certified reference material was 102.89%. The % RSD of repeatability and reproducibility of the method were 3.35 % and 3.76%, respectively. The detection limit was lower than the quantification limit and within the admitted performance range.

The results of the analysis performed to validate the analytical method for the determination of retinol in plasma or serum showed that they were within the performance criteria set for this method and they met the requirements of ISO 17025.

Keywords: plasma or serum retinol, high performance liquid chromatography, method validation

CMPS - 17

ANALYSIS OF ECSTASY IN HUMAN URINE BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

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Ecstasy or n-methyl-3, 4-methylenedioxymethamphetamine (MDMA) is one of the most popular club drugs. This drug was invented to treat obesity but is currently placed under Schedule 1 of controlled substances. It is a psychoactive drug like methamphetamine or shabu.

Ecstasy in urine was analyzed using High Performance Liquid Chromatography (HPLC) with UV detection set at 254 nm. Chromatographic analysis was carried out with a Luna 5 μ C18 reversed phase column and (87:5:5:3) water:methanol:acetonitrile:ammonium buffer as mobile phase at flow rate of 0.5 mL/min. Ephedrine was used as an internal standard. MDMA and ephedrine showed average retention times of ~2.5 min and ~2.8 min respectively. Analysis of 0.50 ppm MDMA had % coefficient of variation (% CV) of 0.57% for the retention time of MDMA and 6.6% for peak area. Inter-day analysis showed % CV of 2.2% for retention time and 3.68% for peak area. Linear response was obtained over the concentration range of 0.10 ppm–1.00 ppm. The limit of detection (LOD) was 0.03 ppm.

Different concentrations of MDMA were spiked in certified drug-free urine and a linear response at the same concentration range after liquid-liquid extraction with ether was also obtained. Gradient elution using (87:5:5:3) water:methanol:acetonitrile:ammonium buffer as mobile phase A and 100 % acetonitrile as mobile phase B was employed to improve separation of MDMA from ephedrine in urine matrix. Different spiked urine samples underwent the same extraction procedure with ether and recoveries ranged from 81–104%.

HPLC analysis of ecstasy could provide an alternative rapid method to detect this drug of abuse in human urine samples.

Keywords: n-methyl-3,4-methylenedioxymethamphetamine (MDMA), ecstasy, urine, HPLC, liquid-liquid extraction

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**CHROMATOGRAPHIC ANALYSIS OF KETAMINE
AND NORKETAMINE IN HUMAN PLASMA
AND URINE SAMPLES**

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In recent years, the illegal use of ketamine in the Philippines has risen and this drug is now included in the list of dangerous drugs under the Comprehensive Dangerous Drugs Act of 2002. Ketamine is a fast acting anesthetic that is mostly administered by veterinarians as an animal sedative. It is also used by anesthesiologists for pediatric and elderly patients as surgical anesthesia. Complications from the use of ketamine include hallucinations and confused states which contributed to the abuse of this drug.

Chromatographic analysis of ketamine and norketamine, its metabolite, was carried out using high performance liquid chromatography (HPLC) with UV detection at 210 nm on a C₁₈ column. The mobile phase used was 30% acetonitrile and 70% phosphate buffer (0.03M, pH 7.2). Flow rate was 0.5 ml/min and oven temperature was set at 37 °C. The retention times of ketamine and norketamine were found to be at ~5.6 min and ~11.3 mins respectively. Reproducible results were obtained with CV (%) of 7.33 % or less. Linear response was obtained over a concentration range of 25 to 500 ppb. LOD for ketamine is 3.6 ppb while LOQ is 4.04 ppb. While for norketamine, LOD and LOQ values were 6.10 and 6.72 ppb respectively.

Ketamine and norketamine standards were spiked in blank urine samples or human plasma sample from volunteers with no ketamine use. Linear response was also obtained over the concentration range of 25 to 500 ppb. Liquid-liquid extraction was utilized for sample preparation. Average percent recovery of ketamine spiked in blank human urine was 85.0% while in spiked human plasma samples, it was 91.0%.

This HPLC method could be utilized for routine analysis of ketamine and norketamine in human urine or plasma samples.

Keywords: high performance liquid chromatography, ketamine, norketamine, human plasma, human urine

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HALOGEN-FREE, IMIDAZOLIUM BASED IONIC LIQUIDS FOR ORGANIC AND INORGANIC SYNTHESIS

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Ionic liquids (IL) are designer solvents exhibiting negligible vapor pressure, high thermal stability, wide liquid range, and excellent ability to dissolve various inorganic and organic compounds. Typical ILs consist of N,N' -dialkylimidazolium cations and a wide variety of halide-based anions but the presence of halides in these ILs raise environmental concerns when the hydrolysis stability of the anion is poor or when a thermal treatment of the IL in use is necessary. In response to this, two series of halogen-free, 1-alkyl-3-methylimidazolium [RMIM] based ILs, [RMIM] Acetate and novel [RMIM] Lauryl Sulfate (LS), have both been prepared through a two step procedure: step (1) involves a reaction between 1-methylimidazole and the appropriate alkylbromide to yield [RMIM]Br and step (2) involves the exchange of the bromide ion in [RMIM]Br with sodium acetate or sodium LS to afford the halogen free ILs. A comparison of optical properties of 1-butyl-3-methylimidazolium [BMIM]LS and [BMIM]Br shows that the interesting excitation wavelength-dependent behavior observed in both ILs is typical of ILs bearing the imidazole moiety. The Diels-Alder reaction provides a means by which heterocyclic rings may be produced from acyclic precursors in a single step and the endoselectivity (endo:exo=91:1) and product yield (89%) obtained for the Diels-Alder reaction between cyclopentadiene and methyl acrylate in 1-hexyl-3-methylimidazolium [HMIM] Acetate is remarkably high. The control of the morphogenesis of gold nanoparticles leads to unique properties that are essential to applications such as catalysis and analytical sensing. [RMIM] LS has been utilized both as a solvent and as a stabilizing agent in the synthesis of anisotropic gold nanostructures and the morphogenesis of these gold nanostructures has been examined. Presence of [BMIM] LS stabilized the formation of Au nanoplates as well as intertwined Au nanoparticles and nanorods.

Keywords: ionic liquid, lauryl sulfate, Diels-Alder, stabilizing agent, morphogenesis

CMPS - 20

**ELEMENTAL AND ISOTOPIC CHARACTERIZATION OF
JAPANESE AND PHILIPPINE POLISHED RICE SAMPLES
USING INSTRUMENTAL NEUTRON ACTIVATION
ANALYSIS AND ISOTOPE RATIO MASS SPECTROMETRY**

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Rice is a staple food for most Asian countries such as the Philippines and Japan and as such its elemental and isotopic content are of interest to the consumers. Its elemental content may reflect the macronutrient reduction during milling or probable toxic elements uptake. Three Japanese and four Philippine polished rice samples in this study mostly came from rice bought from supermarkets. These rice samples were washed, dried and ground to fine powder. Instrumental neutron activation analysis (INAA), a very sensitive non-destructive multi-element analytical technique, was used for the elemental analysis of the samples and isotope-ratio mass spectrometry (IRMS) was used to obtain the isotopic signatures of the samples. Results show that compared with the unpolished rice standard NIES CRM10b, the polished Japanese and Philippine rice sampled show reduced concentrations of elements by as much as 1/3 to 1/10 of Mg, Mn, K and Na. Levels of Ca and Zn are not greatly affected. Arsenic is found in all the Japanese rice tested at an average concentration of 0.103 µg/g and three out of four of the Philippine rice at an average concentration of 0.070 µg/g. Arsenic contamination may have been introduced from the fertilizer used in rice fields. Higher levels of Br are seen in two of the Philippine rice at 14 and 34 µg/g with the most probable source being the pesticide methyl bromide. Isotopic ratio of $\delta^{13}\text{C}$ show signature of a C3 plant with possible narrow distinguishable signature of Japanese rice within -27.5 to -28.5 while Philippine rice within -29 to -30. More rice samples will be analyzed to gain better understanding of isotopic signatures to distinguish inter-varietal and/or geographical differences. Elemental composition of soil samples of rice samples sources will be determined for better understanding of uptake mechanisms.

Keywords: rice, INAA, IRMS, elemental, isotopic

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THE AVERAGE OF THE m th POWER OF L_m NORM OF ZERO-ONE POLYNOMIALS ON THE BOUNDARY OF THE UNIT DISC

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Let $n \geq 0$ be any integer and

$$\Phi_n = \left\{ p(z) = \sum_{i=0}^n a_i z^i : z = e^{i\theta}, a_i = 0,1 \forall 0 \leq i \leq n \right\}$$

$$\Psi_n = \left\{ p(z) = \sum_{i=0}^n a_i z^i : z = e^{i\theta}, a_i = 0,1 \forall 0 \leq i < n, a_n = 1 \right\}$$

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be the collection of zero-one polynomials over \mathbb{C} of degree less than or equal to n and of degree exactly equal to n respectively. We denote

$\|p\|_m$ to be the L_m norm of any polynomial $p(z)$ and $\rho_n(m)$ and

$\omega_n(m)$ be the average of the m th power of L_m norms in Φ_n and Ψ_n

respectively. It is known that the cardinality of Φ_n is 2^{n+1} and the

cardinality of Ψ_n is 2^n hence $\rho_n(m)$ and $\omega_n(m)$ is given by

$$\rho_n(m) = \frac{1}{2^{n+1}} \sum_{p \in \Phi_n} \|p\|_m^m, \quad \omega_n(m) = \frac{1}{2^n} \sum_{p \in \Psi_n} \|p\|_m^m$$

In this paper we derived the exact formula for and for various values of

Keywords: Zero-One Polynomials, norm of polynomial

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**SECURE DOMINATION IN A NETWORK: A
PROTECTION STRATEGY**

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The concept of secure total domination in graphs was investigated further. The study particularly considered a result obtained by Benecke et al. in a recent article. A counter example showed that such result is faulty. A rectification of this result was provided and some quick consequences of the same were stated. Secure total dominating sets in the join of graphs were also studied and some characterizations were generated.

The aforementioned new type of protection strategy in a given network was considered in this study. This strategy which uses a variant of domination in a network is more secure than the ones studied previously. Just like other existing strategies, the objective in this strategy is to evaluate or determine the minimum number of guards needed to protect a graph or network.

The following main results have been generated in this study:

1. Let X be a total dominating set in a connected graph G , $v \in X$, and $u \in V(G) \setminus X$. Then v X -defends u if and only if $\text{epn}(v;X)$ and $\text{ipn}(v;X)$ are contained in $N_G(u)$.
2. If $u \in \text{epn}(v;X)$ for some $v \in X$, then u is not X -defended.
3. Let X be a total dominating set in G . Then X is a secure total dominating set if and only if (i) $\text{epn}(v;X) = \emptyset$ for all $v \in X$, and (ii) for each $u \in V(G) \setminus X$, there exists $v \in X \setminus N(u)$ such that $\text{ipn}(v;X) \subseteq N(u)$.
4. Let G be a connected graph of order $n \geq 2$. Then $\text{st}(G) = 2$ if and only if there exist $x, y \in V(G)$ such that $xy \in E(G)$ and $N(x) = V(G) \setminus \{x\}$ and $N(y) = V(G) \setminus \{y\}$.
5. Let G and H be connected non-complete graphs of orders m and n , respectively. Then $\gamma_{st}(G+H) = 2$ if and only if at least one of the following holds: (i) $\gamma_{st}(G) = 2$ or (ii) $\gamma_{st}(H) = 2$, or (iii) $\Delta(G) = m - 1$ and $\Delta(H) = n - 1$.
6. Let G and H be connected non-complete graphs of orders m and n , respectively, and suppose $\text{st}(G+H) \neq 2$. Then $\text{st}(G+H) = 3$ if and only if at least one of the following holds: (i) $\gamma(G) = 2$, or (ii) $\gamma(H) = 2$, or (iii) $\Delta(G) = m - 1$ or $\Delta(H) = n - 1$ (but not both).

Keywords: X -defended, secure, domination, total domination, join

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**CONVEX DOMINATION IN THE COMPOSITION AND
CARTESIAN PRODUCT OF GRAPHS**

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The convex dominating sets in the composition and cartesian product of two connected graphs were characterized. It was shown that the convex domination number $\gamma_{\text{con}}(G[H])$ of a composition $G[H]$ of two non-complete connected graphs G and H is equal to the clique domination number $\gamma_{\text{cl}}(G)$ of G . The convex domination number

$\gamma_{\text{con}}(G \times H)$ of the cartesian product of two connected graphs was also studied. It was found out that this number is related to the convex domination numbers of the graphs involved.

Some results in an earlier work on convexity were used to characterize the convex dominating sets in the composition and cartesian product of two connected graphs. The concept of cyclic domination number was also defined as this was needed to obtain an expression for the convex domination number of a composition of graphs.

The following results were generated in this study:

1. Let G be a connected graph and K_n the complete graph of order n . A subset $C = \cup\{\{x\} \times T_x\}; x \in S\}$ of $V(G[K_n])$ is convex dominating in $G[K_n]$ if and only if the S is convex dominating in G .
2. Let G be a connected graph and K_n the complete graph of order $n > 1$. Then $\gamma_{\text{con}}(G[K_n]) = \gamma_{\text{con}}(G)$.
3. Let G and H be connected non-complete graphs with $\gamma_{\text{cl}}(G) \geq 2$. Then a subset $C = \cup\{\{x\} \times T_x\}; x \in S\}$ of $V(G[H])$ is convex dominating in $G[H]$ if and only if the S is a clique dominating set in G and T_x is a clique in H for every $x \in S$.
4. Let G and H be connected non-complete graphs with $\gamma_{\text{cl}}(G) \geq 2$. Then $\gamma_{\text{con}}(G[H]) = \gamma_{\text{cl}}(G)$.
5. Let G and H be connected graphs of orders m and n , respectively. Then $\gamma_{\text{con}}(G \times H) = \min\{n \gamma_{\text{con}}(G), m \gamma_{\text{con}}(H)\}$.

Keywords: domination, convex, clique, composition, cartesian product

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VERTEX COVER OF SOME SUPERGRAPHS OF PLANAR GRID

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Let G be the cartesian product of paths $P_m = a_1 a_2 \dots a_m$ and $P_n = b_1 b_2 \dots b_n$. Vertex (a_i, b_j) of G is denoted by c_{ij} . Let H be the supergraph of G formed by adding the edges c_{uv}, c_{st} if $|u - s| = |v - t| = 1$. Vertex set of H has a subset U such that all the edges of H are incident to some elements of U . Such subset is called a vertex cover of H . The vertex covering number of H , denoted by $\alpha(H)$, is the minimum cardinality of a vertex cover of H . Let q and r be the quotient and remainder, respectively, when n is divided by 2. If $n = 1$, then $\alpha(H) = \lceil m/2 \rceil$. If $n > 1$ and $r = 0$, then $\alpha(H) = q \lceil 3m/2 \rceil$. If $n > 1$ and $r = 1$, then $\alpha(H) = q \lceil 3m/2 \rceil + \lceil m/2 \rceil$.

Keywords: planar grid, cartesian product, supergraph, vertex cover, vertex covering number

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ON THE MAXIMUM OF GENERALIZED STIRLING NUMBERS OF THE FIRST KIND

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The generalized Stirling numbers of the first kind $F_{\alpha,\gamma}(n, k)$ were defined by means of the following limit relation

$$F_{\alpha,\gamma}(n, k) = \lim_{\beta \rightarrow 0} \frac{[\Delta_t^k (\beta t + \gamma | \alpha)_n]_{t=0}}{k! \beta^k}$$

where α, γ are real numbers and n, k are nonnegative integers. The limit, when evaluated completely, gives an explicit formula

$$F_{\alpha,\gamma}(n, k) = \sum_{0 \leq j_1 < j_2 < \dots < j_{n-k} \leq n-1} \prod_{q=1}^{n-k} (\gamma - j_q \alpha).$$

In this paper, we determine the index k in which the sequence

$\{F_{\alpha,\gamma}(n, k)\}_{k=0}^n$ assumes its maximum value using the above explicit formula and the Erdos-Stone Theorem.

The following are the major results in this study:

- (1) For real numbers and nonnegative integers n, k , the sequence is strictly log-concave, and, thus, unimodal.
- (2) For real numbers and nonnegative integers n, k , the sequence is asymptotically normal.
- (3) The maximum value of the sequence occurs at the index where

Keywords: Stirling numbers, strictly log-concave, unimodal, asymptotically normal, Erdos-Stone theorem

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ON p, q -DIFFERENCE OPERATOR

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The p, q -difference operator of degree n , denoted by $\Delta_{p,q,h}^n$ is a mapping that assigns to every function f the function defined by the rule

$$\Delta_{p,q,h}^n f(x) = \left[\prod_{k=0}^{n-1} (p^k E_h - q^k) \right] f(x), \quad n \geq 1,$$

When $p = 1$, this will give the known q -difference operator of degree n , and, when $q \rightarrow 1$ and $h = 1$, this will further give the usual difference operator of degree n . It is known that the usual difference operator satisfies the following formulas:

(i)
$$\Delta^n f(x) = \sum_{k=0}^n (-1)^{n-k} \binom{n}{k} f(x+k)$$

(ii) Newton's Interpolation Formula
$$f(x) = \sum_{k=0}^{\infty} \frac{\Delta_k^* f(0)}{k!} (x)_k$$

In this paper, we establish p, q -analogues of these two formulas using the p, q -difference operator of degree n , and apply them to obtain explicit formulas of the p, q -analogues of some Stirling-type numbers. These can also be useful in writing the generating functions of these p, q -analogues in a more compact form.

The following are the major results in this study:

(1) For all integers $n \in \mathbb{N}$, $\Delta_{p,q,h}^n f(x) = \sum_{k=0}^n (-1)^k p^{\binom{n-k}{2}} q^{\binom{k}{2}} \binom{n}{k}_{p,q} f(x+(n-k)h)$

where $\binom{n}{k}_{p,q} = \prod_{i=0}^{k-1} \frac{p^{n-i} - q^{n-i}}{p^i - q^i}$ is called the p, q -binomial coefficient.

(2) A p, q -analogue of Newton's interpolation formula is given by

$$f_{q|p}(x) = a_0 + a_1 p^{x_0+1} \frac{[x-x_0]_{pq}}{P^x} + a_2 p^{2x_0+h+2} \frac{[x-x_0]_{pq} [x-x_1]_{pq}}{P^{2x}} + \dots + a_n p^{nx - \binom{n}{2} h} \frac{[x-x_0]_{pq} [x-x_1]_{pq} \dots [x-x_{n-1}]_{pq}}{P^{nx}}$$

where
$$a_k = \frac{p^{k(h-1)} \Delta_{p^2, q^2, h}^k f_{q|p}(x_0)}{[kh]_{pq} [(k-1)h]_{pq} \dots [h]_{pq}}$$

Keywords: p, q -difference operator, Stirling-type numbers, generating functions, Newton's interpolation formula, p, q -binomial coefficient

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SOME CHARACTERIZATIONS OF THE DIRECT PRODUCT OF GASSMANN TRIPLES

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In a finite group G , two subgroups H_1 and H_2 are Gassmann equivalent if each conjugacy class of G intersects H_1 and H_2 in the same number of elements. The triple (G, H_1, H_2) is then called a Gassmann triple. This definition is equivalent to the well-known Sheng Chen's criterion for Gassmann equivalence. This paper considers this said criterion and a result on transitivity of Gassmann triples as tools in investigating some of the properties a Gassmann triple may satisfy with respect to direct product of Gassmann equivalent subgroups.

If (G, H_1, H_2) is a Gassmann triple, then Sheng Chen's Criterion guarantees the existence of a bijective function $\varphi: H_1 \rightarrow H_2$ such that $\varphi(h)$ is in the conjugacy class of h for all elements h of H_1 . It also shows that (G, H_2, H_1) is a Gassmann triple. With an example of a Gassmann triple in hand, one asks whether the group in consideration contains another Gassmann triple and that the transition of these triples also form a Gassmann triple.

Results of this paper

1. If (G, H, K) and (G, H, L) are Gassmann triples, then (G, K, L) is also a Gassmann triple.
2. If (G, H, K) is a Gassmann triple, then $(G \times G, H \times H, K \times K)$ is a Gassmann triple.
3. If (G, H, K) and (G, H, L) are Gassmann triples, then $(G, H \times K, H \times L)$ is a Gassmann triple.
4. If (G, H, K) and (G, H, L) are Gassmann triples, then $(G \times G, H \times H, K \times L)$ is a Gassmann triple.

The last result is extended into a finite number of factors as follows:

5. Let $(G, H, K_1), (G, H, K_2), \dots, (G, H, K_n)$ be Gassmann triples. Then $(\prod G, H, \prod K)$ is a Gassmann triple.

Keywords: conjugate subgroups, conjugacy class, sheng chen's criterion, gassmann triple, gassmann equivalent subgroups, direct product of subgroups

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THE MINIMAL CLOSED GEODETIC NUMBERS 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 the set of all vertices lying in some u - v geodesic in G . If $S \neq \emptyset \subseteq V(G)$, then $I_G[S] = \bigcap \{ I_G[u, v] : u, v \in S \}$. A set S of vertices in G is called a geodesic cover of G if $I_G[S] = V(G)$. The geodesic number $gn(G)$ of G is the minimum cardinality of a geodesic cover of G . A geodesic cover of smallest cardinality is called a geodesic basis of G . Suppose that in constructing a geodesic cover 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 vertex $v_i \notin I_G[S_{i-1}]$ and let $S_i = \{ v_1, v_2, \dots, v_i \}$. The closed geodesic number $cgn(G)$ and the upper closed geodesic number $ucgn(G)$ of G is the smallest and the largest k , respectively, for which selection of v_k in the given manner makes $I_G[S_k] = V(G)$. A closed geodesic cover S of G is a minimal closed geodesic cover of G if no proper subset of S is a closed geodesic cover of G . The minimal closed geodesic number $mcgn(G)$ is the maximum cardinality of a minimal closed geodesic cover of G . In this paper, it is shown that $ucgn(G) = mcgn(G)$ if and only if G is complete, while $cgn(G)$ and $mcgn(G)$ coincide among extreme geodesic graphs G . Moreover, for complete bipartite graphs $K_{m,n}$, $cgn(K_{m,n}) = mcgn(K_{m,n})$ if and only if $m = n$. More interestingly, for every triple $a, b, c \in \mathbb{Z}^+$, with $2 \leq a < b < c$, a , b , and c are realizable as closed geodesic number, minimal closed geodesic number, and upper closed geodesic number, respectively, of a connected graph. We also determined here the minimal closed geodesic numbers of graphs resulting from the join of graphs.

Keywords: geodesic number, bipartite graph, geodesic cover

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THE QUANTUM PROPAGATOR OF THE HARMONIC OSCILLATOR WITH DAMPING: A WHITE NOISE PATH INTEGRAL APPROACH

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Recently, the infinite dimensional white noise calculus by T. Hida and L. Streit has successfully provided a more mathematically well-defined formulation to the Feynman path integral. It has already been successful in solving quantum problems such as the perturbed harmonic oscillator and systems with exponentially-growing potentials. In this paper, white noise analysis is utilized to solve the quantum propagator, expressed as the Feynman path integral, for the harmonic oscillator with damping described by the Caldirola-Kanai Lagrangian, $L = \frac{1}{2} m \exp(\gamma t) \dot{x}^2 - \frac{1}{2} m \exp(\gamma t) \omega^2 x^2$ for a particle of mass m and angular frequency, ω , which is subjected to a damping of constant γ . In this approach, a parametrization of the paths of the particle in terms of an exponentially decreasing Brownian motion was employed thereby reformulating the Feynman path integral in the context of white noise analysis where the S - and T -transforms in white noise calculus are then used to evaluate the integral. The calculated propagator agrees with known results. The time-dependent wave function for the harmonic oscillator with damping is then extracted via the symmetrization of the calculated propagator which also agrees with known results.

Keywords: white noise analysis, propagator, harmonic oscillator with damping, Caldirola-Kanai Lagrangian, path integral

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SURFACE MODIFIED ZINC OXIDE: A POTENTIAL SMOKE SENSOR AT AMBIENT CONDITION

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Zinc oxide (ZnO), with its satisfactory stability, has been extensively used as a gas sensor for various gases such as hydrocarbons, oxygen, H_2O , etc. ZnO -based gas sensors are usually operated at $>100^\circ C$ temperatures which demand more power consumption compared to sensors that can operate at room temperature. To our knowledge, no reports have been presented on the capability of surface modified bulk ZnO to sense smoke at ambient condition. In this study, the smoke sensing properties of HCl -etched ZnO samples in pellet form is presented.

ZnO powders (99%) were pelletized and annealed at 700 - $1000^\circ C$ with $100^\circ C$ increment. Acidic etching using appropriate amount of hydrochloric acid was performed to increase the surface area of the samples. Morphology, electrical and smoke sensing characteristics of the surface modified ZnO pellets were investigated at room temperature ($\sim 25^\circ C$). Electrical stability of the annealed samples improves as the annealing temperature is increased. All samples have n-type conductivity which is intrinsic for ZnO . Increase in surface area through etching was successfully achieved as seen from their scanning electron microscope (SEM) images. These HCl -etched ZnO pellet samples are then referred to as surface modified samples. The surface modified ZnO pellets are more sensitive to smoke than the as-annealed ZnO pellets. The remarkable increase of sensitivity from ~ 11 to $\sim 2000\%$ is exhibited by the surface modified ZnO pellets annealed at $700^\circ C$. These results indicate that ZnO is a potential material for smoke sensing application at ambient condition.

Keywords: zinc oxide, smoke sensor, annealing, etching, sensitivity

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THE EFFECT OF ADHESION FORCE ON CELL ELASTIC MODULUS

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The ability of cells to deform or resist deformation affects several important factors of cell function. Most studies infer the elastic modulus of a living cell from the simultaneous measurements of forces and deformations exerted on the cell, based on the Hertz model. However, the force-distance curves are affected by indenter-cell adhesion forces, and neglecting this effect may result in systematic errors in the determination of the Young's modulus of elasticity.

For the first time, the Hertz model was extended to include the effect of adhesion in the description of contact stiffness by using the Lennard-Jones potential to model the inter-molecular interaction between the probe surface and a living cell sample. The adhesion force derived from the potential gradient was incorporated to the Hertz relation, from which the value of the elastic modulus of the sample is obtained.

Our results show that during indentation of the intact cell, the adhesion force increases in proportion to the indentation depth. The increase in the slope of the force-indentation curves predicts a higher Young's modulus than the value obtained by the Hertz model neglecting adhesion force by up to 25% for decreasing size of molecules coating the probe. The model predicts the Young's modulus of a cell based on the radius of the probe, and the size and concentration of the molecules coating the surface. Thus, our approach provides precision on cell mechanics measurements without neglecting surface interactions that could be incorrectly neglected.

Keywords: Young's modulus, Hertz model, Lennard-Jones potential, elastic force, force-indentation curve

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HIGH RESOLUTION PROBING OF ELASTIC PROPERTIES OF BIOPOLYMERS AND LIVING CELLS

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Correlation measures based on embedded probe fluctuations, are now widely used for characterizing viscoelastic properties of biological samples. However, novel applications using this robust tool are still lacking, considering that the study of living matter routinely demonstrate new phenomena, not immediately characterized by usual quantitative tools. Therefore, we derived new experimental and theoretical approaches to adapt ways of probing non-linear and non-equilibrium phenomena for biological samples.

Optical tweezer systems, two-beam tandems using dual-wavelength and single-wavelength splitting, were designed for high resolution microrheology in bulk down to single biopolymer or protein, based on the fluctuation spectra of embedded or attached probes. We derived calculations for winding turn probabilities to account for unfolding events in single fibrous biopolymers and globular proteins under tensile stretching based on approximating the ensuing probe fluctuations as originating from a damped harmonic oscillator under oscillatory forcing. Furthermore, for networks of biopolymers and living cells, we designed experiments using force pulses for simulating non-equilibrium phenomena, which naturally incorporates non-linear mechanics. The tools developed in this study will probe elastic properties of single biopolymers and networks, as well as living cells, aimed to gain insights for creating low-cost technologies for industrial and medical applications.

Keywords: biophysics, microrheology, biopolymers, cell mechanics, biomechanics, protein folding, non-equilibrium phenomena

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ELASTIC PROPERTIES OF A BIOPOLYMER

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The mechanical and dynamical properties of a cell are primarily determined by the network of biopolymers in the cytoplasm and the nucleus. Furthermore, these constituent biopolymers play an important role in biological functions, such as in facilitating molecular transport within the intracellular environment, in changing structure for movement, and in providing mechanical support to maintain shape. The cell's physiological behaviour, which collectively contributes to the organism's health, is therefore linked with the interplay of intracellular biopolymers. Since each biopolymer in a cell contributes to cell mechanical properties, understanding the physics behind the adaptive elasticity of individual biopolymers is crucial in gaining biological insights on emergent cellular behaviour. In this study, the elastic properties of a single biopolymer under tensile stress were investigated, deriving an elasticity model that is valid beyond thermal regimes.

This novel elastic model was shown to predict the behaviour of stretched double-stranded deoxyribonucleic acid, single-stranded deoxyribonucleic acid, single-stranded ribonucleic acid, and titin in recent experiments. The model uses the persistence length, which is proportional to the bending rigidity, considering thermal fluctuations, and is validated at minimum bending mode of truncated polynomial expansion. Our newly derived elasticity model fits a broader range of force-extension relations in various types of biopolymers, compared to existing wormlike chain and freely jointed chain models. Therefore, our approach is generically applicable to biopolymers and is applicable to industrial polymers of similar properties.

Keywords: elasticity, biopolymers, cell mechanics, persistence length, bending rigidity, wormlike chain, freely jointed chain, double-stranded, single-stranded, titin, bending mode

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**EFFECTS OF APPLIED VOLTAGE ON THE
MEAN DIAMETER OF ELECTROSPUN POLYANILINE
(PANI)-ELASTOMERIC ADHESIVE FIBERS**

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The effects of applied voltage on the mean diameter of electrospun polyaniline (PANI)-elastomeric adhesive fibers were investigated. Polymeric solutions composed of equal volume of dimethyl sulphoxide-dissolved polyaniline and elastomeric adhesive were prepared. These solutions were drawn into fibers by electrospinning with different applied voltages of 20, 30, 40, 50, and 60 kV. Scanning Electron Microscopy (SEM) images, together with fiber diameter measurements, showed that as the applied voltage was increased, the mean fiber diameter of the electrospun fibers also increased. The increase in mean fiber diameter was attributed to shortened flight time of the jets produced during electrospinning, increased deposition rate and bead formation, which contributed to the increase in fiber diameters.

Keywords: conducting polymer, elastomeric adhesive, electrospinning, polyaniline

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WHITE NOISE PATH INTEGRAL APPROACH ON THE PARTITION FUNCTION OF A SEMI-FLEXIBLE BIOPOLYMER IN A BEND AND TWIST WORM-LIKE CHAIN MODEL

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Understanding the elastic behavior of biopolymers is helpful in understanding biological processes like gene regulation and transcription in cells. Thus, in recent years, statistical mechanics of biopolymers has emerged as a field of rapid theoretical and experimental investigation. This interest has been motivated from experiments which probe the function of elasticity of these biopolymers.

In this paper, we investigate the partition function of a semi-flexible biopolymer theoretically modeled in a Worm-Like Chain (WLC) model which considers its bend and twist degrees of freedom. We note that this partition function can be expressed as $Z = \exp(\beta f) Z_{x_1} Z_{\omega}$, where $\beta = L/s_p$ is the ratio of the biopolymer's contour length L to its bend persistence length s_p , $f = s_p F/k_B T$ is the applied force F in units of $k_B T/s_p$, and Z_{x_1} & Z_{ω} are path integrals of the form

$$Z_{\omega} = \int D\theta \exp\left(-\int_0^L \left[\frac{1}{2} \dot{\theta}^2 - \frac{U}{2} \cos^2 \theta \right] ds\right) \quad (1)$$

where $\beta' = \mu$ and τ is the torque applied to the system. We note that Eq. (1) is similar in form to the quantum mechanical propagator of a harmonic oscillator and we then solve this expression of Z_{ω} using the White Noise Path Integral Approach (WNPIA) pioneered by T. Hida and L. Streit. After which, a final form of the partition function is obtained. Following the works of A. Ghosh, we then derived the mean-extension of the biopolymer from this final form of partition function and plotted it as a function of applied force and torque. As expected, it was found out that for a fixed value of the torque the mean-extension increases as the pulling force is increased whereas it decreases when the torque is increased while the pulling force is kept fixed. Also, it was noted that even at a zero force, there was a nonzero mean-extension of the biopolymer. The results in this paper basically agreed with the works of A. Ghosh.

Keywords: partition function, semi-flexible biopolymer, bend and twist WLC model, WNPIA, mean-extension, quantum mechanical propagator

CMPS - 36

**STRETCHING SINGLE MOLECULAR DNA BY
TEMPERATURE GRADIENT: A WHITE NOISE
FUNCTIONAL APPROACH**

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In this study, we obtained the mechanical properties of double stranded DNA (dsDNA) particularly the partition function and extension under small fluctuations limit stretched by temperature gradient field with Wormlike Chain (WLC) as the favored theoretical model. In this model, the dsDNA is treated as a continuous curve chain. The Hida-Strait integral formulation (White Noise Analysis) is used as a tool in evaluating the partition function of the dsDNA under temperature gradient field because of its versatility and prowess in solving many problems in quantum mechanics as well as in statistical mechanics which includes the system focused in this study. From the partition function, the extension or dsDNA's elastic response through stretching is calculated which turns out to be linearly dependent on the temperature gradient field strength. The result of the calculation shows that temperature gradient can exert force on dsDNA and create internal tension within it which is enough to study and manipulate the biomolecule.

Keywords: partition function, dsDNA, wormlike chain model, temperature gradient, white noise analysis

CMPS - 37

**INITIAL STUDIES OF A MICROWAVE-INDUCED
ATMOSPHERIC PLASMA JET**

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This study investigates the dimensions of plasma using a 6kW microwave-induced atmospheric plasma jet. The forward power studied ranges from 600W to 1800W for different flow rates. In this experiment, a 9.5cm quartz glass was used. In order to measure the length of the plasma, images of the plasma for different settings were observed using a digital camera 127cm away from the setup. The data is presented as plasma length versus absorbed power. It was shown that the plasma length increased as the absorbed power was increased. It was also observed that the ambient air had an influence on the plasma length. The results of this study are relevant for future optimization studies involving the microwave plasma jet.

Keywords: atmospheric plasma, microwave, plasma jet, plasma length, optimization

CMPS - 38

**INFLUENCE OF STACKED Ge ISLANDS ON
THE DARK CURRENT-VOLTAGE CHARACTERISTICS OF
A DIODE FOR SOLAR CELL APPLICATION**

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We report on the dark current-voltage (I - V) characteristics of the diode with embedded stacked Ge islands in the intrinsic layer for solar cell application. Gas-source molecular beam epitaxy was used to grow the stacked Ge islands on a Si substrate. Two-diode model was utilized to analyze the dark I - V characteristics of a solar cell with embedded Ge islands in the intrinsic region. This model describes the relationship between current and voltage of a solar cell with stacked Ge islands in the generation region under dark condition. Furthermore, this model is capable of predicting some physically meaningful parameters for the enhancement of solar cell efficiency. Based on this two-diode model, we found out that the minority carrier diffusion and the recombination current components increase when there is an increase on the number of stacked Ge island layers. Moreover, we believe that the increase in minority carrier diffusion current might be due to an increase on the intrinsic carrier density as the number of stacked Ge island layers increases. Similarly, the increase in the recombination current components might be due to the enormous recombination of carriers in the intrinsic region as the number of stacked layer increases. These results can be used to fabricate a high-efficiency solar cell with embedded stacked Ge islands through efficient separation of electron-hole pairs by the internal electric field and this can contribute to significantly increase the photocurrent without considerable recombination of carriers in the stacked Ge island layers.

Keywords: p-n junction; two-diode model; Ge islands; solar cells

CMPS – 39

ANISOTROPIC SURFACE TEXTURING OF SILICON SUBSTRATE USING ALKALINE SOLUTION FOR SOLAR CELL APPLICATION

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High-efficiency silicon solar cells need a textured front surface to reduce the reflectance of incident light and to improve light trapping using cost-effective method. In this work, we report on the anisotropic surface texturing of Si(100) substrates using alkaline solution, forming pyramidal structures on its front surface. This method provides a straight forward and cost-effective approach. We utilized a mirror-polished single crystalline Si(100) substrate for texturing using alkaline solution. The alkaline mixtures contained sodium hydroxide, isopropyl alcohol and de-ionized water. The concentration of the alkaline solution was held constant while varying the texturing time. The surface morphology of the textured surface is investigated by Scanning Electron Microscopy (SEM) and its reflectance is measured using UV-Vis Spectrometer. Results showed that the sizes and shapes of the resulting pyramids after texturing process are dependent on the texturing time. Furthermore, the pyramid density increases with increasing etching time. Moreover, SEM images revealed that the size and the uniformity of the pyramids affect the reflectance of the incident light as depicted in the UV-Vis spectra of the mirror-polished and textured silicon samples. It was found that reflectance of the incident light could be reduced up to less than 20 percent by optimizing the surface morphology of the textured silicon. It is suggested that having a large and almost uniformly distributed pyramids on the Si surface will drastically reduce the reflectivity. We also present in this study a model that will describe and discuss the effects on the reflectance in relation to the distribution of pyramids in terms of distance and size.

Keywords: solar cells; anisotropic surface texturing; reflectivity; alkaline solution

CMPS - 40

PERFORMANCE EVALUATION OF TAILOR MADE MICROSPHERES AS SENSING LAYER RESPONSIVE TO RESIDUAL CHLORAMPHENICOL IN FOOD MATRICES

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Antibiotics like chloramphenicol are banned in food products of animal origin. Analysis of trace levels of chloramphenicol usually by GC-MS is expensive and could require tedious samples preparation. In this work, chloramphenicol-imprinted microspheres were synthesized via precipitation polymerization at 60°C using chloramphenicol as the template, and methacrylic acid as the monomer. Different crosslinkers like trimethylolpropane trimethacrylate (TRIM), ethylene glycol dimethacrylate and divinylbenzene were tried to produce the polymer. Their binding characteristics were evaluated by Scatchard analysis using UV VIS spectrophotometer. Two classes of binding sites were obtained under the concentration studied. From these polymer microspheres bearing the imprinted sites, the one prepared with TRIM crosslinker showed the highest binding capacity than the non-imprinted polymer and polymers prepared using other crosslinkers. The maximum binding sites were estimated to be about 330 µg/g and 268 µg/g for the molecularly imprinted polymer and the non-imprinted polymer respectively. The adsorption isotherm of the imprinted polymer was fitted to the Freundlich equation and the heterogeneity index was estimated to be about 0.976. Molecular capability of the said polymer as sensing layer to trace amount of chloramphenicol was also confirmed by gravimetric technique using a mass sensor. Results of sensor measurement obtained shows good accuracy and acceptable percent recovery in real samples. Further characterization of the resulting polymers were also performed using BET surface area analyzer, particle size analysis, and microscopic techniques. The study gives merit to the quality of spherical particulates in nano to micro size range. The proposed integration of this polymerization technique and sensor technology can be carried out for very minute analysis of chloramphenicol much quickly with simple sample preparation. **These polymers can also be utilized in sample screening and as effective adsorbent in separation processes.**

Keywords: chloramphenicol, Scatchard analysis, molecularly imprinted microspheres, precipitation polymerization, chemical mass sensor

CMPS - 41

A MONTE CARLO SIMULATION STUDY ON THE INTERACTIONS OF PROTON, ${}^7\text{Li}$ AND ${}^{12}\text{C}$ WITH WATER FOR HADRON THERAPY APPLICATION

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The interactions of ${}^{12}\text{C}$, ${}^7\text{Li}$ and protons were simulated using a tissue reference media (water). The primary focus is to investigate the nuclear fragmentation which is believed to be the cause of the so-called dose-tail located right after the Bragg peak structure, which might affect the healthy neighboring tissue of the tumor.

Using Monte Carlo Method in GEANT4 (GEometry ANd Tracking 4th incarnation) toolkit, a pencil-like beam profile with Gaussian energy distribution is directed towards a box-shaped water target. Mean energies ranging from 100 MeV to 400 MeV for ${}^{12}\text{C}$, 100 MeV to 250 MeV for the ${}^7\text{Li}$, and 50 to 250 MeV for protons were used. Electromagnetic (EM) interactions are described by the standard and low-energy EM models, while the nuclear fragmentation interactions are described by the Hadronic interaction models such as the Binary cascade and Statistical Multifragmentation Models. Information such as Depth dose profile and peak to entrance ratio were extracted from the simulation.

The results show that the peak-to-entrance ratio was lower at higher mean energies for the three projectiles. At 400 MeV the peak-to-entrance ratio was about 3.425 for ${}^{12}\text{C}$. At 250 MeV the peak-to-entrance ratio were 3.615 and 2.514 for protons and ${}^7\text{Li}$, respectively. These peak-to-entrance values are approximately half of the highest known value of ${}^{12}\text{C}$ at 175 MeV. Unlike protons, ${}^{12}\text{C}$ and ${}^7\text{Li}$ produced a larger dose tail with ${}^7\text{Li}$ lower by 37.88% than ${}^{12}\text{C}$ at 170 mm range.

Results suggest that for the three projectiles it is ${}^7\text{Li}$ which are most suitable for therapeutic radiation therapy since it has lower dose tail compared to ${}^{12}\text{C}$ and a more enhanced peak-to-entrance ratio compared to proton.

Keywords: hadron radiation therapy, nuclear fragmentation, dose tail, peak-to-entrance ratio, Bragg peak

CMPS – 42

ANGULAR AND LATERAL RESOLUTION STUDY IN pCT IMAGING INVOLVING BIOLOGICAL TISSUES

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The angular and lateral resolutions were studied for possible application in proton Computed Tomography (pCT) imaging which is a prerequisite procedure for radiation therapy. These quantities provide a measure of the sharpness of the image using proton beams but unlike the conventional x-ray imaging, protons suffer from deflections due to multiple Coulomb scattering (MCS) interactions. In order to improve pCT images, analytical formulas that model the effect of MCS on individual proton trajectories were investigated.

The standard deviation of the angular (σ_u) and lateral (σ_y) distributions were calculated using analytical MCS models reported in two journals: (a) *Phys. Med. Biol.*, 49 (2004), 2899-911 and (b) *Med. Phys.*, 35 (2008), 4849-56. In this study, two methods were performed: the numerical method and the sampling method.

During the simulation, a pencil beam profile of protons is directed to a cubic phantom (20 cm³ for water, soft tissue or muscle tissue and 10 cm³ for compact bone) using the Geant4 toolkit. Fifty thousand protons were bombarded at incident energies 200 MeV and 250 MeV. A 5th order polynomial was then used to parameterize the energy loss function. To test the validity of the analytical models, the angular and lateral distributions were obtained by Monte Carlo sampling of the exit protons. The σ_u and σ_y were extracted and compared with the result of the analytical method.

Results show that for a 200 MeV incident proton, the angular and lateral scattering was around 2 degrees and 3.27 mm, respectively, while for the 250 MeV the values were 1.38 degrees and 2.5 mm, respectively. Also, the inclusion of a logarithmic correction factor to the MCS model improved the analytical σ_u and σ_y values with an error of about 17%. In conclusion, good resolution was observed at higher energies.

Keywords: proton computed tomography, pct, mcs, lateral resolution, angular resolution

**ENGINEERING SCIENCES
AND TECHNOLOGY**

EST - 01

YIELD POTENTIAL OF RAIN TREE FRUIT (*Samanea saman* Merr.) AS FEEDSTOCK FOR BIOFUEL PRODUCTION

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This study was conducted to determine the ethanol yield potential of rain tree fruit and to evaluate its potentials as a feedstock for biofuel production.

Ripe rain tree fruits were fermented using baker's yeast (*Saccharomyces cerevisiae*) with the following treatments with three (3) replications each: Treatment 1 (T_1) - fermentation of the whole fruit pods; Treatment 2 (T_2) - fermentation of the fruit with the seeds removed and Treatment 3 (T_3) - fermentation of the filtered mixture only (solid particles consisting of pulp, bark and seeds were removed). One (1) kg of pounded and blended fruit was used for each replication and was fermented for 10 days in a six-gallon water container.

Result of this study reveals that using the basis that fifty percent (50%) of the measured sugar level is converted into ethanol. T_1 obtained the highest yield potential of 210 ml/kg. Based on the alcohol content analysis of the fermented solution the highest ethanol yield was obtained by T_1 (180 ml/kg), followed by T_2 (177 ml/kg) while T_3 (162 ml/kg) obtained the lowest ethanol yield among the treatments. Moreover, based on the alcohol analysis of the distillate, T_1 (117.03 ml/kg) obtained the highest average ethanol yield followed by T_2 (116.40 ml/kg) while T_3 (90.23 ml/kg) obtained the lowest. Analysis of variance reveals that there is a significant difference among the treatments at 5 percent level of significance.

This study found out that rain tree fruit has a yield potential of 210 ml/kg (210 liters/ton). Comparison of the yield potential of rain tree fruit with other feedstock reveals that the rain tree fruit is a very good feedstock for biofuel production. It is recommended that optimization studies should be conducted in all aspects of fruit processing, from particle size reduction to fermentation and distillation, for optimum bio-ethanol production.

Keywords: rain tree fruit, ethanol yield, biofuel feedstock, biofuel production, fermentation

EST - 02

PROPERTIES AND PERFORMANCE OF MMSU HYDROUS BIOFUEL

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Modified fermentation techniques at ambient temperature and simplified reflux distillation protocols were developed to produce the *MMSU 95 hBE* bioethanol and the *MMSU hBE-20* gasohol fuel blend.

The 95% fuel-grade hydrous ethanol, *MMSU 95 hBE*, was produced from sweet sorghum and sugarcane and was subsequently used to formulate a unique hydrous gasohol blend: the *MMSU hBE-20*. Unlike other hydrous ethanol fuel blends formulated in other countries, our formulation does not need a dispersant, nor a co-solvent and uses the commercially available anhydrous E-10 gasohol blend. The *MMSU hBE 20* was stable at ambient temperature and did not show phase separation even at refrigerated conditions. Preliminary tests of the gasohol, when used in stationary 4-stroke engines, motorcycles and motor vehicles, revealed no discernible problems. The performance of a 6.5 HP engine when fueled with *MMSU hBE-20* was comparable with the commercial E-10. Under different engine load of 4, 6, and 8 kg, the fuel consumption (L/hr), brake horsepower (BHP), brake fuel rate (L/BHP-hr), heat value (Btu/lb), and brake thermal efficiency of the same engine fueled with *MMSU hBE 20* did not vary significantly with the E-10-fed engine. Further tests indicate the *MMSU 95 hBE* can also be used up to E-85, indicating the possibility that it can be suitable for use in modern Flex Fuel Vehicles (FFV) when they become available in the Philippines.

The *MMSU hBE 20* is a promising fuel for gas powered engines and vehicles that is more-economical and environmentally sustainable than blends using anhydrous ethanol. More important, these technologies are scale-adaptable and easily adoptable at the village level to create an enterprise that is economically viable. Current forecast indicate an average production cost of PHP 30 using feedstocks from sugarcane and sweet sorghum which, when compared to the prevailing cost of gasoline, can result in a profit margin of about 67%.

Commercialization of these technologies will open opportunities for village level ethanol production and would be a significant contribution towards the implementation of several Republic Acts: the RA 9637- the Philippine Biofuels Act, RA 9003- Philippines' Ecological Solid Waste Management Act, RA 9513- The Philippines Renewable Energy Act, and the RA 8749- The Philippine Air Act.

Keywords: village-scale ethanol production, *MMSU 95 hBE*, *MMSU hBE-20*, hydrous ethanol, reflux distillation, biofuel

EST - 03

EFFECTS OF ANTIOXIDANTS EXTRACTED FROM LEAVES OF “BANABA” (*Lagerstroemia speciosa*, L.), MANGOSTEEN (*Garcinia mangostana*, L.) AND “TSAANG GUBAT” (*Ehretia microphylla* L.) ON THE OXIDATION STABILITY OF BIODIESEL FROM *Jatropha curcas*, L.

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The stability of biodiesel is relatively inferior to petrodiesel due to its unsaturated fatty acids which may lead to the formation of gums. In the presence of air or oxygen, alcohol and acid may be produced which can reduce the flash point and increase the total acid number, thus causing damage to the engines. The effects of the antioxidant extract from “banaba” (*Lagerstroemia speciosa*, L.), mangosteen (*Garcinia mangostana*, L.) and “tsaang gubat” (*Ehretia microphylla* L.) on the oxidative stability of biodiesel from *Jatropha curcas*, L. were determined based on the induction period (IP) of the samples using the Rancimat method of oil stability index. The data obtained for the “banaba”, mangosteen and “tsaang gubat” extracts had regression coefficients (R^2) of 0.687, 0.804 and 0.886, respectively, indicating a linear positive correlation between the loading rates (mg total polyphenol in the extracts /L biodiesel; ppm) and the IP (hours). To meet the European standard of 6-hour IP, the loading rates (g antioxidants per 100 L biodiesel) were found to be: 983.4, 110.9, 1124.9, and 206.3 for “banaba”, mangosteen, “tsaang gubat” and the commercial antioxidant, respectively. The antioxidant extract from mangosteen leaves had actual loading rate of 260.4 g/100L, with induction period of 17.52 hours, greatly exceeding the American, European and Japanese standards.

Keywords: Antioxidant, “banaba”, mangosteen, “Tsaang Gubat”, biodiesel, *Jatropha curcas*

EST - 04

MICROEMULSIFIED HYBRID FUEL FROM JATROPHA AND COCONUT OILS

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A microemulsified hybrid fuel from *jatropha* and coconut oils was developed through the process of microemulsification. This was done by mixing the oils with surfactant, co-surfactant and water. The resulting product was evaluated in terms of phase behavior and physicochemical properties. Application tests were done in high powered lantern (petromax) for lighting and gas stove for cooking. Results of the study showed that microemulsions of *Jatropha* oil and coconut oil and its blend are thermodynamically stable, have low viscosities and stable against oxidation. Application tests showed that microemulsified *jatropha* oil, microemulsified blend of *jatropha* and coconut and blends with kerosene have better lux range and less fuel consumption than using kerosene in petromax. In gas stove, results showed that blends of microemulsified *jatropha* and coconut oil with kerosene, exhibited less fuel consumption, high thermal and combustion efficiency, reduced CO and CO₂ emission. Results of the analysis of physicochemical properties, smoke emission test and vehicle performance showed its potential as alternative fuel for transport. Application test of microemulsified hybrid fuel in diesel genset showed reduced fuel rate consumption, liter per hour of about 53.0% to 76.5%.

The process of microemulsion is simple with no residual waste product to be disposed or treated. Microemulsion fuels are generally cleaner fuel. Microemulsion fuels provide a method for increasing the use of *jatropha* and coconut oil as fuel. It has the ability to significantly reduce petroleum consumption as well as lower harmful and particulate emissions.

Keywords: Microemulsification; *Jatropha* Oil; Coconut Oil; Hybrid Fuel

EST - 05

**ASSESSMENT OF RENEWABLE ENERGY RESOURCE
POTENTIAL AND APPLICATION FOR DECENTRALIZED
RURAL ELECTRIFICATION USING GEOGRAPHIC
INFORMATION SYSTEM (GIS)**

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One consequence of massive economic development across the globe since the industrial revolution is the depletion of fossil fuel and global climate change. Countries increase its energy demand to sustain their economic growth. However, this relationship between energy demand and economic growth greatly affects our environment. It is already a given fact that fossil fuels will eventually run out, thus the move towards alternative sources of energy which are renewable and at the same time eco-friendly.

This study evaluates solar and biomass energy sources in Bukidnon, a province located at the southern part of Philippines, by means of analyzing the theoretical and the technical potential of these renewable sources of energy using geographic information system (GIS).

Various scenario analyses were also carried out to show the effects of different financial parameters (initial costs, operations and maintenance costs and electricity export rate) to the renewable energy systems financial viability using RETScreen software.

Results showed that Bukidnon has an estimated technical solar energy potential of 55 MW power plant capacities that could be added to the grid and 69 MW of installed capacity power plant can be set-up from the technical potential of agricultural crops.

In conclusion, the study was able to provide a GIS-based support system for the government in the formulation of policies and strategies with regards to finding interested investors that could develop a suitable site for renewable energy system in the province and thus, could help avert future energy crisis and at the same time reduce GHG emissions.

Keywords: Renewable Energy Resources, Solar Energy, Biomass Resource, RETScreen, GIS

EST - 06

**A BI-LEVEL MULTI-PERIOD OPTIMIZATION MODEL FOR
MULTIPLE FEEDSTOCK BIOENERGY SUPPLY CHAINS**

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This paper presents a bi-level optimization model for bioenergy supply chains that integrates a multiple-feedstock, multi-period framework for determining the best trajectories of such systems with time. The resulting model gives a more accurate interpretation of the different scenarios that could face real world energy systems. The upper level decision maker, the government, seeks to maximize the total amount of bioenergy that is produced by setting the appropriate desired range of production; whereas the lower level decision maker, the bioenergy producers, strives to maximize its profit, while subject to the economic and environmental limits imposed by the government. This interaction results in a Stackelberg game which is equivalent to a bi-level programming problem. Inclusion of a multi-period approach allows the growth and development of the different bioenergy sources to be specified for a fixed time horizon from the perspective of multiple decision makers. This approach can pave the way to obtain a rational prediction and allow for the optimization of resources being consumed, which can increase public awareness and assist decision makers in choosing the best path to choose. A numerical case study are used to assess the effects of key system parameters on the growth trajectories of the bioenergy systems and key policy implications of the results are discussed.

Keywords: energy planning; bi-level optimization; sustainability; importation; bioenergy system; Stackelberg game

EST - 07

**LACTIC ACID FERMENTATION FROM *Jatropha curcas* L.
PRESS CAKE AND RAW CASSAVA STARCH
USING *Rhizopus oryzae* NRRL-395**

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The utilization of *Jatropha curcas* L. for biodiesel production, produces significant amount of press cake as by-product. Toxic compounds render the cake unsuitable for animal feed. Thus other uses, such as substrate for fermentation should be explored. Its use for lactic acid production was tried in this study.

Dilute-acid hydrolysis of *Jatropha* press cake substrate was initially optimized, specifically pH conditions and duration of autoclaving. The highest value of reducing sugars recorded was 86.6 g/L, obtained by hydrolyzing the samples at pH 1.0 for 30 minutes. Upon fermentation with *Rhizopus oryzae* NRRL-395, starch-supplemented hydrolyzed *Jatropha* press cake produced 3.67 g/L lactic acid in one day at pH 5.0. On the other hand, unhydrolyzed press cake took four days to ferment, but attained the highest value of 11.93 g/L lactic acid. Hydrolyzed samples could have produced sugars that are not utilizable by *Rhizopus oryzae*.

The use of *Jatropha* press cake as protein supplement for the fermentation of raw cassava starch into lactic acid was feasible. This would probably provide a good alternative to reduce the fermentation costs due to chemical supplements. Further optimization is still needed for it to be suitable for large scale production

Keywords: lactic acid fermentation, *Jatropha curcas*, cassava starch, *Rhizopus oryzae*.

EST - 08

GREENHOUSE GAS EMISSIONS OF TOBACCO FLUE-CURING PROCESS IN THE PHILIPPINES

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The production of flue-cured tobacco is one of the major agricultural production systems in the Philippines specifically in Northwestern Luzon. It is considered high value cash crop that could offset the cost of production of food crops. The production of the crop is energy intensive especially in the flue-curing process which is done in natural convection flue-curing barns made of different materials like concrete and galvanized iron sheets in various configurations with fuelwood as the primary source of energy.

The annual production of flue-cured tobacco for the past five decades is fluctuating between 45,000 to 75,000 tons. The amount of fuelwood to cure this volume of tobacco was determined by statistical models developed and it ranges from 157,500 to 262,500 tons per year. This volume of fuelwood was estimated to be equivalent to trees grown in 6,750 to 7,500 hectares of woodland depending on growth density.

Mathematical models were developed utilizing previous research data in establishing the greenhouse gas emission levels in relation to the different tobacco flue-curing barn configurations. The amount of carbon dioxide (CO₂) and carbon monoxide (CO) emitted were obtained in the mathematical models developed at different conditions. The range of annual CO₂ and CO emission computed using the mathematical model are, 55,460 to 83,460 tons and 4,560 to 6,970 tons.

Keywords: carbon dioxide, carbon monoxide, emissions, energy, flue-curing, fuelwood, greenhouse gases, tobacco

EST - 09

**INVESTIGATION OF ARSENATE UPTAKE BY
HYDROTALCITE AT HYPERALKALINE AND ELEVATED
TEMPERATURE CONDITIONS**

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Hydrotalcite is known to retain large amounts of anionic species due to its positive charge characteristics. Hence, investigating its role for the retention of long-lived dissolved anionic nuclides during an intrusion scenario in radioactive disposal facilities is necessary.

This study examined the Mg-Al type hydrotalcite ($Mg_6Al_2(CO_3)(OH)_{16} \cdot 4(H_2O)$) (Mg/Al ratio = 2) as possible sorbent of anionic nuclide using arsenate as an analogue. The sorption experiments were carried out at alkaline pH condition (pH 11) and elevated temperature of 75°C. to simulate the intrusion scenario at radioactive waste repositories. Arsenate sorption was conducted during and after hydrotalcite formation.

The results showed that hydrotalcite was able to remove more than 90 and 70% of arsenate during and after mineral formation, respectively even in the presence of competing anions. The co-precipitated arsenic was more resistant to release and showed a significant irreversible fraction of sorbed arsenate of more than 30%, which could be attributed to the inner-sphere complexation with the Mg or Al in the octahedral sheets by displacing their coordinated hydroxyl group and stronger interlayer fixation.

Overall, the immobilization of arsenate by hydrotalcite could possibly ensure the long-term immobilization anionic nuclides. Hence, controlling the pore water chemistry of cement to ensure the significant precipitation of hydrotalcite during hydration must be considered in cementitious systems used in geological waste repositories.

Keywords: Hydrotalcite, arsenate, sorption, radioactive waste repositories, cementitious systems

EST - 10

EFFECT OF FUNCTIONAL IRON OXIDE NANOCRYSTALS ON THE ARSENIC LEVEL IN DRINKING WATER

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Arsenic is a semi-metal element in the periodic table and a naturally occurring element in the earth's crust. It enters drinking water supplies from natural deposits in the earth or from the agricultural and industrial practices. It has created serious contamination of the environment, causing many mass poisonings throughout the world. This study was designed to prepare functional iron oxide nanocrystals (a nanomagnet) and be used in the treatment of water contaminated with arsenic.

The synthesis of functional iron oxide nanocrystals was divided into three parts: soap making process, extraction of oleic acid from soap with commercial vinegar, and preparation of magnetite or functional iron oxide nanocrystals from rust and fatty acids.

The functional iron oxide nanocrystals (0.5 g per liter of water) was placed in water contaminated with arsenic and stirred for 5 minutes. The formation of bubbles on the surface of nanocrystals was observed. The water samples before and after treatment was brought to the Natural Science Research Institute for the analysis of arsenic using THGA Graphite Furnace Atomic Absorption Spectroscopic method.

Results of the analysis showed that the functional iron oxide nanocrystals was able to remove 85.89% of arsenic. The removal of arsenic is through nanomagnetism. Further studies on the effect of different amounts of iron oxide nanocrystals and concentration of arsenic in water must be conducted.

Keywords: nanocrystal, arsenic, rust, oleic acid, nanomagnet

EST - 11

**GOOGLE EARTH: A TOOL FOR ELICITING SPATIAL
INFORMATION ABOUT FOREST DEGRADATION
FROM LOCAL PEOPLE**

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As a component of REDD or REDD+ (Reduced Emissions from Deforestation and Forest Degradation), detection and measurement of forest degradation has been widely reported in literature as technically difficult. This is because forest degradation is not easily detected and measured using satellite imageries, a situation that requires increased use of field data and information from local people. Hence, all available technology must be used including Google Earth that provides virtual landscape of localities on earth.

A high resolution Google Earth imagery was used to delineate watershed boundary; map streams, roads, trails, houses and other ground features; stratify forest vegetation according to carbon stock; and as input for interpreting Landsat ETM+ data. More importantly, the three dimensional virtual landscape enhanced collection of information about historical change in extent and composition of forest vegetation, proximate drivers of forest degradation, and risk of degradation based on historical trend. Using the virtual landscape as visual aid, key informant interview and workshop were conducted to elicit information. It was observed that, using an effective visual aid, local people can easily grasp such technical concepts as percent canopy cover, relationship between tree diameter and tree crown, appearance of canopy in the imagery according to species composition and tree density, and carbon stock decline as indicator of forest degradation. The information elicited from local people when combined with GIS ancillary data, Landsat ETM+ data, and field data resulted in reliable estimate of forest degradation in Maasin Watershed in Nueva Vizcaya.

Keywords: Google Earth imagery, forest degradation, REDD, local knowledge, participatory GIS

EST - 12

**FERMENTATION KINETICS OF GELATIN-IMMOBILIZED
Lactobacillus plantarum BS USING SKIM MILK AS SUBSTRATE**

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Probiotics should at least have 10^7 CFU/ml count for more effective health benefits. However, a common problem with probiotic products is cell viability especially at ambient conditions. Cell entrapment or immobilization may promote viability.

A local lactic acid bacteria isolate, *Lactobacillus plantarum* BS, showed good probiotic properties in previous studies. Entrapment in gelatin was thought to enhance cell viability and create a different form of probiotic drink. The growth kinetics of gelatin-immobilized *L. plantarum* was investigated using 8, 10, and 12% (w/v) skim milk as substrates. Batch fermentation was done at 37°C and agitation speed of 100 rpm. Total sugar consumption, biomass production, titratable acidity, pH and viability of immobilized cells during storage were determined. Maximum growth of *Lb. plantarum* BS was observed at its logarithmic phase, which was 6.5×10^7 CFU/ml, 6.0×10^7 CFU/ml and 6.1×10^7 CFU/ml for 8, 10 and 12% (w/v) skim milk concentrations, respectively. Its stationary phase was observed after 6 h of fermentation. Highest rate of substrate consumption and biomass production were observed at 8% (w/v) skim milk concentration, suggesting substrate inhibition at higher concentrations.

Results also showed that through time, the pH of the substrate dropped while the total titratable acidity increased, suggesting an increase in the lactic acid production. The viability of the microbial cells during storage was also investigated and results showed that the viability of gelatin-immobilized cells was higher than that of the free cells during storage at refrigerated conditions. The growth of gelatin-immobilized *L. plantarum* was best described by the Moser Model yielding a μ_{max} value of 0.3556 hr^{-1} and K_s value equal to $3.2E+7 \text{ }\mu\text{g/mL}$.

Keywords: *Lactobacillus plantarum*, viability, probiotics, lactic acid bacteria, skim milk, kinetic study

HEALTH SCIENCES

HS - 01

**ISOLATION AND IDENTIFICATION OF CONSTITUENTS
FROM THE ANTITUBERCULAR DCM FRACTION FROM
THE LEAF EXTRACT *Premna odorata* BLANCO**

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In recent years, the resurgence of multi- and extensively-drug resistant strains has prompted the need to develop safe drugs as quickly and efficiently as possible. In a previous study, the dichloromethane sub-extract (PoMD) obtained from the leaf extract of the Philippine medicinal plant *Premna odorata* Blanco was found to be active against *Mycobacterium tuberculosis* H₃₇Rv, exhibiting 99% inhibition at 128 µg/mL and 64 µg/mL concentrations. This study aims to purify the dichloromethane sub-extract and identify the constituents present therein. The PoMD extract was subjected to vacuum liquid chromatography (VLC) with gradient elution using hexane/dichloromethane and dichloromethane/methanol. Thin layer chromatographic monitoring resulted in 20 pooled fractions which were bioassayed using Microplate Alamar Blue Assay (MABA). The fractions PoMD.4,5,7,8,9 and 15 were found to be active, having a minimum inhibitory concentration (MIC) of 53.87, 119.71, 117.12, 113.12, 82.80 and 108.91 µg/mL, respectively. The high yielding PoMD.8 was further subjected to VLC as above and gave 7 pooled fractions. PoMD.8.2 and PoMD.8.4 were further purified by column chromatography with isocratic elution using hexane to obtain PoMD.8.2.1 and PoMD.8.4.1 as white flakes. Both isolates were characterized by spectroscopic methods and were found to be a mixture of β-sitosterol and stigmasterol. Purification of the other fractions is ongoing.

Keywords: *Premna odorata* Blanco, *Mycobacterium tuberculosis* H₃₇Rv, Tuberculosis, Philippine Medicinal Plant, Steroids

HS - 02

GENETIC POLYMORPHISM OF CYP2D6*10 GENE AMONG FILIPINOS

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Cytochrome P450 (CYP2D6) is one of the major drug metabolizing enzymes involved in the biotransformation of many clinically important medications including opioid analgesics. CYP2D6 enzyme activity varies considerably within a population. Particularly, CYP2D6*10 allele is more common among Orientals than among Caucasians. A recent study among Chinese individuals showed that the allele frequency of CYP2D6*10 (C188T) was about 37-70%. Phenotypic expressions include individuals with ultrarapid, extensive, intermediate, and poor metabolizer status. It has been shown that the various phenotypes have profound effects on the efficacy of drugs as well as its adverse reactions.

In this study, we determined the allele and genotype frequencies of CYP2D6*10 among Filipinos using PCR-RFLP and sequence analysis. Blood samples were obtained from healthy study participants and patients with chronic pain, with diagnosed cancer pathology stages 1 to 4.

The calculated allele frequencies in Hardy Weinberg equilibrium were 0.49 and 0.51 for the CYP2D6*10 dominant and recessive alleles, respectively. Out of the seventy seven samples, 18 (23%) were identified as homozygous for the wild type, 40 (52%) were identified as heterozygous, and 19 (25%) were identified as homozygous for the mutant allele. Our results showed that majority of the Filipinos were heterozygous for the intermediate allele (52%).

PCR-RFLP and sequence analysis provides a useful tool for CYP2D6*10 genotyping. The allele frequency of CYP2D6*10 was comparable with other Asian populations. Individuals heterozygous for the intermediate allele were found to be the predominant genotype among Filipinos.

Keywords: allele frequency, CYP2D6*10, PCR-RFLP, polymorphism, sequencing

HS - 03

**SINGLE NUCLEOTIDE POLYMORPHISM GENOTYPING
OF ANTITHROMBOTIC THERAPY RESISTANCE
MARKERS USING HIGH RESOLUTION MELT ANALYSIS**

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High resolution melt (HRM) analysis is a powerful technique for detecting DNA sequence variations such as mutations, polymorphisms and epigenetic differences. Single Nucleotide Polymorphisms (SNPs) in the CYP3A4 and CYP2C19 genes coding for Cytochrome P450 enzymes involved in the metabolism of nearly all drugs have been reported to be associated with resistance to clopidogrel, an antiplatelet aggregation drug. Moreover, SNPs in the P2Y₁₂ gene coding for the target receptor of the active metabolite of clopidogrel have been determined to be associated with high platelet reactivity, thus possibly lowering response to clopidogrel as well. In this study, we employed HRM analysis as a diagnostic test to detect these SNPs. Primers were designed to amplify short regions containing the CYP3A4*1G (G>A), CYP2C19*2 (G>A), P2Y12 G36T (T>G) and P2Y12 C18T (C>T) SNPs. Blood samples were blotted on Whatman FTA® Elute membrane, from which DNA was extracted. Eleven samples from volunteers were used for screening the three representative genotypes, which we termed homozygous mutant, heterozygous, and homozygous wild-type. Melting temperatures and melting curves generated after fluorescence normalization, temperature adjustment, and difference analysis of the samples revealed distinct genotypes. Larger amplicons were generated by PCR for samples representative of the genotypes and sent for sequencing. Sequencing confirmed the heterozygous genotype for all SNPs, and one homozygous genotype for CYP3A4*G (mutant), P2Y12 G36T (mutant), and P2Y12 C18T (wild-type). We are awaiting the completion of sequencing for the remaining homozygous genotypes. Current results nonetheless suggest a reliable protocol for detecting the heterozygote genotype of CYP3A4*1G, CYP2C19*2, P2Y12 G36T, and P2Y12 C18T using HRM analysis.

Keywords: polymerase chain reaction, high resolution melting analysis, single nucleotide polymorphism, genotyping, clopidogrel, cytochrome P450, P2Y₁₂ platelet receptor

HS - 04

**A PRELIMINARY STUDY ON THE EFFECT OF RED GRAPE
EXTRACT (*Vitis vinifera*) ON THE INHIBITION OF
ANGIOGENESIS ON A NINE-DAY OLD CHICK EMBRYO**

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Cancer and tumor growth is the second leading cause of mortality worldwide and currently the third leading cause of death in the Philippines. Angiogenesis, or new blood vessel formation, is one of the major pathogenesis common in cancer formation and metastasis.

Studies have shown that phytonutrients found in a variety of fruits and vegetables offer many ways to offset cancer. One phytonutrient, called Resveratrol (3,5,4-trihydroxystilbene) found in red grapes, is believed to impede and prevent angiogenesis in tumor cells. Hence, the aim of this study is to determine the effect of red grape juice extract on the angiogenesis, utilizing nine days-old chicken embryos.

The experimental study employed a static group comparison where embryo egg assay was done on 50 nine-day old live embryonated chicken eggs, utilizing a modified procedure of yolk sac inoculation. Several preparations of the test agent was prepared using fresh red grapes as well as commercial grape extract and controlled amounts were administered in vitro to the each subgroup of the experimental group. The control group received same amounts of isotonic saline solution while blanks received none. All eggs were then incubated at 36-38°C and were examined after five days for any observable change.

Results showed that all three subgroups given with the test agent demonstrated angiogenesis inhibition. However, only the subgroup given with concentrated grape pulp extract showed statistically significant results at 95% confidence level. It is then concluded that red grape extracts demonstrated inhibition of angiogenesis on nine-day old chick embryos, but further studies are needed to demonstrate the said effect quantitatively, and to determine if this is specifically due to the phytonutrient resveratrol and/or other extrinsic/intrinsic factors.

Keywords: cancer, tumor, tumor cells, angiogenesis, phytonutrient, resveratrol, red grapes, embryo egg assay

HS - 05

**CHITOSAN POLY(ACRYLIC ACID) SEMI-IPN
PATCH FOR DRUG ENCAPSULATION AND RELEASE**

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In recent years, the formulation of transdermal delivery patches using biopolymers has been given extensive attention. Chitosan, a derivative of chitin, has the ability to form strong films, hence forms a prime component of wound dressing patch. The research reports the fabrication of semi-interpenetrating network (semi-IPN) hydrogel patch from chitosan(Ch) and polyacrylic acid(PAA). PAA is a biocompatible, biodegradable, and bioadhesive and can absorb a large amount of water. Semi-IPN composed of PAA with Ch and Glycidyl Trimethyl Ammonium Chloride (Quat 188) modified Ch was synthesized by polymerizing AA and crosslinking it with N,N'methylene bisacrylamide in the presence of unmodified and modified Ch in deionized water at 70°C using potassium persulfate as the initiator. Ch was modified to improve its antimicrobial property. The strength of the semi-IPNs improved with increase of the crosslink density, molecular weight of Ch and Ch to PAA ratio and by Quat 188 modification. Unmodified Ch semi-IPN swelled 400% in pH 7 and 325% in pH5.5 buffer in 2h. In 2h Quat 188 modified Ch semi-IPN swelled 1200% and 1000% in pH 5.5 and 7 buffer respectively. Two drugs AgNO₃ and mafenide acetate(MFC) were encapsulated in the semi-IPNs. The semi-IPNs could incorporate 100% of free AgNO₃ in 10 minutes from its aqueous solution but showed negligible release. In case of MFC, pH dependent encapsulation and release was observed. Modified Ch semi-IPN encapsulated 95% MFC from its solution in 2h and release 56% MFC in 10h at pH 5.5 whereas unmodified chitosan semi-IPN encapsulated 86% MFC from its solution in 6h and release 35% MFC in 10h at pH 7.

Keywords: chitosan, poly(acrylic acid), semi-ipn, AgNO₃, mafenide acetate

HS - 6

**PREVALENCE OF ADIPONECTIN GENE POLYMORPHISMS
AMONG FILIPINO PATIENTS WITH CORONARY ARTERY
DISEASE EXAMINED AT ST. LUKE'S MEDICAL CENTER**

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The adiponectin gene located on chromosome 3q27 has been previously identified as a susceptibility locus for metabolic disorders and coronary artery disease (CAD). More than ten polymorphisms in the gene have been found and two of these, the rs2241766 (SNP45T>G) at exon 2 and in intron 2, rs1501299 (SNP276G>T), have been related to low circulating adiponectin levels that has been associated with obesity, insulin resistance, and CAD. The allelic distribution of the SNP45 and SNP276 polymorphisms was studied in Filipino patients with CAD using polymerase chain reaction-restriction fragment length polymorphism method. The observed allelic distribution was 0.71 and 0.29 for the T and G alleles respectively in 1,012 patients genotyped for the SNP45 polymorphism and was in accordance with the Hardy-Weinberg law using χ^2 test. Genotypic frequencies were 0.503, 0.41, and 0.10 for the TT, TG, and GG genotypes respectively. In comparison, the allelic distribution of the G and T alleles were 0.57 and 0.43 respectively in 754 patients genotyped for the SNP276 polymorphism. Genotypic frequencies of 0.32, 0.49 and 0.19 for the GG, TG and TT genotypes respectively, were obtained. Linkage between the two polymorphisms was determined. The association of these polymorphisms as a risk factor for the development of CAD and Type 2 diabetes is currently being determined.

Keywords: SNP, PCR-RFLP, cardiovascular genomics, coronary artery disease, type 2 diabetes

HS - 07

HOUSEHOLD DAILY NITRITE CONSUMPTION LEVELS FROM SOME COMMONLY CONSUMED PROCESSED MEATS IN SELECTED SITES/AREAS IN THE PHILIPPINES

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Ten nitrate-and nitrite-treated meat products rank among the top 20 processed meats consumed by Filipinos (6th National Nutrition Survey, 2003). Nitrate and nitrites when ingested in high concentrations have been implicated as factors in the etiology of methemoglobinemia, intestinal/ colon cancer, and type II diabetes. The study determined the contents of nitrites and the potential nitrite intakes/exposure risks in ten commonly consumed processed meats collected from selected sites in nine study areas. Popular branded, canned and plastic-packaged processed meats (i.e. hotdog, corned beef, luncheon meat, Vienna sausage, and beef loaf) were purchased in SM Supermarket - Las Piñas. Commonly consumed cured meat products (i.e. *tocino*, *longganisa*, *tapa*, *chorizo*) were also purchased in selected markets of some major processed meat-consuming cities (i.e. Las Piñas, Muntinlupa, Baguio, Bacolod, and Butuan), and provinces (i.e. Bulacan, Iloilo, Southern Leyte, and Davao del Sur). Nitrite contents of the collected meat samples were compared against the BFAD-DOH Guidelines on Food Additives (2006). Nitrite contents of most test samples within the same sampling area were found to be highly variable but still within the BFAD maximum levels. Nitrite intakes from all the processed meat consumed in each study site/area were then computed using the low and high concentration range, and compared against the JECFA-WHO/FAO (2002), Acceptable Daily Intake (ADI) of 0.07 mg nitrite per kg body weight equivalent to 4.13 mg for a 59 kg adult Filipino male. Results indicated that household nitrite intakes from processed meats in selected sites pose potential exposure risks in the cities of Las Piñas (4.84-38.46 mg/capita) and Muntinlupa (6.53-7.59 mg/capita), and in the provinces of Bulacan (6.53-7.59 mg/capita) and Southern Leyte (7.13 mg/capita).

Keywords: processed meats, nitrite, household intakes, ADI, potential exposure risk

HS - 8

**TELENURSING THRU SMS: ITS EFFECT ON
KNOWLEDGE AND ADHERENCE TO PROPER
DIET AND PHYSICAL ACTIVITY**

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This study aims to develop and implement a telenursing intervention program to increase the knowledge and adherence to proper diet and physical activity for the prevention of weight-related diseases such as Hypertension, Type II *Diabetes mellitus*, and cardiovascular diseases among overweight college students aged 18-25 years old. 24 college students undergone the DeFit It! Program. They have a body mass index (BMI) between 25.00-25.99 kg/m². Subjects in the experimental group were subjected to telenursing by receiving 4 daily short messaging service (SMS) for 21 days regarding health education on proper diet and physical activity, and reminders to follow the DeFIT it! Program. There is a significant increase in the knowledge of telenursing users before and after the study. The mean post test score of the telenursing and nontelenursing users group is 15 and 16 respectively. There is no significant difference on the physical activity and diet adherence scores of telenursing users when compared to nontelenursing users. There is a significant decrease in the BMI of the nontelenursing users group which may be attributed to their low diet adherence scores since they ate in less than the recommended amount of diet.

Keywords: Telehealth, telenursing, diet, overweight, adherence, knowledge

HS - 09

ORAL MICROBIAL DIVERSITY ANALYSIS OF CARIES-FREE AND CARIES-ACTIVE HEALTHY FILIPINO ADULTS THROUGH THE 16S rRNA GENE

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The oral cavity is inhabited by hundreds of bacterial species that play vital roles in maintaining oral health or in shifting to a diseased state like dental caries which is one of the most common oral problems that affect 92.4% of Filipinos. Due to the limitations that are posted by microbial identification through culture-dependent techniques, molecular techniques are currently being used to better understand the bacterial etiology of dental caries. This study aimed to assess the oral microbial diversity of caries-free and caries-active Filipino adults through the 16S ribosomal ribonucleic acid gene (16S rDNA).

Saliva, supragingival plaque samples from 6 caries-free and 6 caries-active adults together with carious teeth samples from the caries-active patients were used. Bacterial DNA from the samples were amplified using polymerase chain reaction. Diversity of the samples were assessed using denaturing gradient gel electrophoresis and the microorganisms were identified through sequencing of the 16S rDNA. Identified bacteria from saliva and plaque samples were compared between these groups as well as with carious teeth samples.

Based on the gathered data, the caries-free group exhibited a more diverse microflora compared with their caries-active counterpart. Several bacteria were found to be common to both groups comprising the resident microflora. *Neisseria subflava* and *Capnocytophaga* species were some of the identified potentially cariogenic bacteria since they were seen only among the caries-active adults. The partial clone library of the 16S rDNA included various species of *Leptotrichia*, *Streptococcus* and *Neisseria*.

This study showed the oral microbial diversity profile of caries-free and caries-active Filipino adults using culture-independent techniques. The saliva and plaque samples of the caries-free group exhibited greater biodiversity compared with the caries-active group. This result suggests that part of the microflora may be inhibited or absent in a caries-active state.

Keywords: dental caries, 16S rDNA, caries-free, caries-active

HS – 10

**ANTIBACTERIAL ACTIVITIES AND DIVERSITY
OF MARINE FUNGI ASSOCIATED WITH
SEAGRASSES COLLECTED FROM LUBANG ISLAND,
OCCIDENTAL MINDORO**

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Marine fungi are commonly tapped for the production of novel secondary metabolites. However, in the Philippines, very few studies explore marine fungi associated with seagrasses in spite of the numerous species of seagrasses found in the country. Our research study assessed the diversity and antibacterial activities of marine fungi (MF) associated with decaying and healthy seagrass leaves collected from Lubang Island, Occidental Mindoro. A total of 61 MF strains belonging to 15 morphospecies were isolated from surface-sterilized leaf explants inoculated on Potato Carrot Agar supplemented with 33 g/L marine salts and antibiotics. Morphocultural and molecular characterization identified the MF isolates as belonging to the genera *Aspergillus*, *Fusarium*, *Cladosporium* and *Penicillium*. Assessment of species diversity showed highest value in the host seagrass *Thalassia hemprichii*, though, highest species richness was noted in *Cymodocea rotundata*. Cluster analysis resulted in the grouping of MF based on their host seagrass. Then, 15 MF morphospecies were grown on PDA for the production of secondary metabolites. The crude culture extracts were tested for their antibacterial activities using paper disc diffusion assay. Our result showed that only one isolate, *Penicillium* sp. 1, exhibited inhibitory activities against extended spectrum beta-lactamase (ESBL)-producing and non-ESBL strains of *E. coli* and *K. pneumoniae* while five MF strains exhibited inhibitory activities against *S. aureus*. The antibacterial activities though were considered as weak. Five MF were then grown on five different media and their crude culture extracts tested against ESBL(+) strains of *K. pneumoniae* and *E. coli* using the microtiter plate assay. Results showed that two morphospecies of *Penicillium* grown on four media exhibited the lowest MIC and MBC values between 7.14 to 71.43 mg/mL. Interestingly, cultivation of MF isolates on a different culture medium resulted in the production of bioactive secondary metabolites as observed in one morphospecies of seagrass-associated *Penicillium*.

Keywords: marine fungi, fungal diversity, fungal natural products, secondary metabolites, antibacterial activities

HS – 11

HYDROGEOCHEMISTRY AND GROSS ALPHA-BETA ACTIVITIES OF AKLAN'S WATERCOURSES

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Neutron activation analysis (NAA) and gross alpha-beta measurement by Liquid Scintillation Spectrometry (LSC), were used to mark out regions with impending elevated concentrations of minerals/pollutants in the offshoot streams of the Aklan River. Five tributaries were selected as sampling points: Tinigao, Numancia, Badyangan, Mobo and Bakhaw Norte. Streambed sediments were collected from Tinigao, Numancia, Badyangan, and Mobo sites, and were analyzed for elemental composition using neutron activation analysis (NAA); surface water from all of the five sites were analyzed for bicarbonate ions by titrimetry; pH and conductivity by selective electrodes; and radioactivity by Wallac 1414 Liquid Scintillation Counting. None of the watercourses exceeded the regulatory limits set by the Philippine National Standards for Drinking Water for conductivity, pH and bicarbonate parameters for surface waters. As far as radioactivity is concerned, each of the Tinigao, Numancia, Badyangan, Mobo and Bakhaw Norte water sample displayed total alpha activity of less than the detection limit, LLD, (LLD= 0.03 Bq/L) which was way below the drinking water regulatory limit of 0.1 Bq/L for alpha emitters; all the samples exhibited beta activities of less than LLD (LLD= 0.3 Bq/L), which were also way below the drinking water regulatory limit of 1.0 Bq/L for beta emitters. The determination of major riverbed components (Cl, Ti, Ca, Mg, V, Si, Al, Na, K, Mn) was accomplished using neutron activation analysis. All the measured parameters were put together to be able come up with a more accurate reconstruction of the ecological processes occurring across the whole watershed system.

Keywords: neutron activation analysis, NAA, gross alpha-beta, Liquid Scintillation Spectrometry (LSC), Aklan River

HS – 12

STABILITY OF BIOACTIVE COMPOUNDS AND SHELF LIFE OF RESVERATROL-ENHANCED PEANUTS

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Phenolic compounds including resveratrol, have antioxidant properties that delay aging and reduce the risk of cancer, cardiovascular and Alzheimer's diseases. Previously, we showed that combined ultrasound (US)-UV processes enhanced resveratrol in peanuts better than US or UV alone, to levels 2.8 times greater than that in red wine, the major food source. This study aims to determine shelf life of roasted resveratrol-enhanced peanuts (REP) and to investigate the stability of *trans*-resveratrol (RES), total phenolics (TP) and trolox equivalent antioxidant capacity (TEAC) during storage.

Raw peanuts were washed, sanitized, imbibed, sliced, processed using optimum US-UV by exposing to US (70 mW/cm² power density for 10 min) followed by 50 min exposure at 40 cm distance from UV light (254 nm), incubated for 36 h at 25°C, dried, roasted, and packaged in polyethylene bags. Untreated samples were prepared as controls. Packages were stored at 30, 35 and 40°C and at ambient, about 25°C. At pre-determined intervals, a total of six sampling times/temperature, samples were withdrawn from storage, and analyzed for RES, TP, TEAC, hexanal, descriptive sensory properties and consumer acceptance.

Lipid oxidation, critical to REP's shelf life, was due processing and storage effects. Initially, REP had higher hexanal and oxidized/off-flavors intensities but lower roasted peanutty flavor and overall acceptance (OA) than controls. During storage, oxidized/off-flavors increased as roasted peanutty flavor and OA decreased. REP's shelf life was 52 days at 25°C. Lipid oxidation in REP followed first-order reaction with 0.02/day rate constant at 25°C, Q₁₀ of 2.2, and activation energy of 300 cal/mol. At the end of shelf life, *trans*-resveratrol, TP, and TEAC were reduced by 13, 8, and 27% to 3.29 µg/g, 1.76 mg GAE/g, and 6.06 µMTE/g, respectively, suggesting that *trans*-resveratrol and TP but not TEAC were stable in REP based on d⁰ 80% retained required during shelf life.

Keywords: bioactive compounds, peanuts, resveratrol, antioxidant capacity, ultrasound, UV, shelf life, Q₁₀

HS – 13

CALAMANSI WASTES FOR THE PRODUCTION OF USP GRADE PECTIN AS SOURCE OF DIETARY FIBER

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Enormous amount of wastes are being generated by calamansi juice processors in the country. These wastes pose health and environment hazard in the environment, thus its utilization into high value products is the main objective of this project.

Pharmaceutical grade pectin was produced from the wastes of *Citrus microcarpa* Bungé (calamansi) obtained from calamansi juice processing plants. Percentage yield was 10-14% (dry weight basis) by alcoholic precipitation method. The physico-chemical properties of produced pectin were analyzed and compared with standard specifications of the United States Pharmacopeia for pharmaceutical grade pectin. Techno-economic assessment of producing USP grade pectin was undertaken.

ITDI produced pectin was off-white to beige in color, odorless and had a slightly acidulous taste. It had a methoxyl content of 8.6% to 10.20% and galacturonic acid content of 77.6% to 82.2%. Degree of esterification ranged between 73.0% and 83.2%. Moisture content was determined at 10.0%. The soluble dietary fiber content was 70.6% using the enzymatic/gravimetric method. The arsenic content and the lead content were 0.15 ug/g and 0.8 ug/g, respectively, using the ashing-acid digestion and atomic absorption spectrophotometry.

The produced pectin was utilized as a source of dietary fiber where it is helpful in maintaining good digestive balance. It is advocated for those suffering from ulcer and for regulating blood pressure.

The total project cost of producing 23 kgs./month of USP grade pectin is P735,235.00. Unit cost of production per kilogram is P3,557.75, with a proposed selling price of P15,500.00 only.

Keywords: Pectin, dietary fiber, *Citrus microcarpa*

HS - 14

**CYTOTOXIC CARDENOLIDE AND STEROLS
FROM *Calotropis gigantea***

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The dichloromethane extract from the leaves of *Calotropis gigantea* Linn. was strongly cytotoxic against non-small cell lung carcinoma (A549), colon carcinoma (HCT 116) and hepatocellular carcinoma (Hep G 2) and non toxic to non cancer Chinese hamster ovary cells (AA8). The extract afforded uscharin (**1**), 3,5,8-trihydroxy-24-methylcholest-6,22-diene (**2**), a mixture of (24R)-3-hydroxy-24-ethylcholest-5-en-7-one (**3a**) and (24S)-6-hydroxy-24-ethylcholest-4,22-dien-3-one (**3b**), and another mixture of (24R)-24-ethylcholest-4-en-3-one (**4a**) and (24S)-24-ethylcholest-4,22-dien-3-one (**4b**). Compound **1** exhibited extreme toxicity to A549, HCT 116 and Hep G 2 with IC₅₀ of 0.003 µg/mL, 0.013 µg/mL, and 0.018 µg/mL, respectively, while sample **3** exhibited IC₅₀ of 1.35 µg/mL, 4.46 µg/mL, and 3.83 µg/mL, respectively.

Keywords: *Calotropis gigantea* Linn., Asclepiadaceae, uscharin, cytotoxic, MTT

SOCIAL SCIENCES

SS - 01

AGRICULTURAL OUTPUT AND THE STATES OF POVERTY IN THE PHILIPPINES: EVIDENCE FROM SELF-RATED POVERTY DATA

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The high poverty incidence in the country is a major development concern that needs to be addressed by our policy makers. Official poverty data shows that headcount poverty increased to 26.5% of the total population in 2009 from 26.4% in 2006. The number of poor Filipinos reached 23 million in 2009. Since poverty incidence has dynamic patterns, studies using official poverty data encounter difficulty because of limited number of data points. This study builds econometric models in analyzing the movement of poverty in the country using the quarterly self-rated poverty series of the Social Weather Stations. The first model uses a Markov Switching model to determine the states of poverty. The model assumes two states: *extremely high* and *high* poverty states. An average of 61% of the population considered themselves as poor when the country is in the state of *extremely high poverty*. In times of high poverty, an average of 49.5% of the population considered themselves as poor. The result shows that once the country is in the state of *extremely high poverty*, it stays there for an average of 24 quarters, or six years, before moving out. The paper then used the Logistic Regression model to show what determines the states of poverty. Three variables are considered as important determinants: agricultural output, government spending and underemployment rate. A one-percentage point increase in agricultural output reduces the probability of being in the *extremely high state* of poverty by about 46 percentage points, all things being the same. The study shows that poverty incidence in the country is dynamic and frequent monitoring through self-rated poverty surveys, perhaps at the provincial level, is important in order to assess the effectiveness of the government programs in reducing poverty. The self-rated poverty surveys can complement the official statistics on poverty incidence.

Keywords: Markov Switching, Logistic Regression, Self-Rated Poverty

SS - 02

DETERMINANTS OF POVERTY IN ELDERLY-HEADED HOUSEHOLDS IN THE PHILIPPINES

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This paper looks at the impact of population dynamics on poverty in elderly-headed households in the Philippines using data from the Family Income and Expenditure Survey (FIES) from 2000 to 2006. The population of the elderly, or those 60 years and above, has increased from 3.2 million in 1990 to 4.6 million in 2000. This group is growing at a rate of 3.6% per annum and estimated to reach 7 million in 2010. Data from the FIES shows that the percentage of the elderly who are poor is increasing since 2003. Moreover, the percentage of elderly-headed household belonging to the poorest 10% of all households has been on the rise since 1997. An econometric model based on the logistic regression shows that the presence of a young dependent (aged 14 years old or below) increases the probability that the elderly-headed household will become poor by about 9 percentage points, controlling for other factors such as income of the household, education, age and gender of the household head, income transfer from abroad and regional-specific characteristics. The results of the econometric model suggest that the high proportion of young dependents create negative effects on the welfare of the elderly-headed household by increasing the probability of that household being poor. From the point of view of policy, addressing the alarming poverty incidence in the country must include measures that will manage the country's burgeoning population and bring down the fertility rate to a level that is conducive to higher income growth.

Keywords: elderly, population dynamics, poverty, logistic regression, young dependents

SS - 03

**RISK COMMUNICATION BEHAVIOR TOWARDS
ENVIRONMENTAL RISKS AMONG UPLAND FARMERS IN
THE DAMPALIT WATERSHED, LOS BANOS,
LAGUNA, PHILIPPINES**

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This research looked into the perception of environmental risks in relation to risk communication (riskcom), explored the upland farmers' perception of environmental risks, and determined their riskcom behaviors as inputs to decisions and actions to adapt to such risks. Riskcom behavior towards environmental risks were measured by their ability to use communication sources, its truthfulness and credibility, and use of obtained information.

A one-shot interview schedule was administered to randomly selected upland farmers with farms located in the Dampalit watershed. Data were triangulated by focus group discussion, interviews, and secondary documents. Descriptive statistics and Pearson's correlation were used in data analyses.

Results found significant relationships between age and mass media as well as educational attainment in relation to mass media and interpersonal communication sources; annual income, educational attainment, and topography in relation to trust and credibility; and age and educational attainment in relation to utilization of information. The study also revealed that upland farmers rely on a *batingaw* or large bell as an effective early warning device in danger zone areas.

This study concludes that riskcom behavior was influenced by familiarity and dread as environmental risk factors. Familiarity made them to prefer mass media. Dread predisposed them to refer to interpersonal sources.

Keywords: risk communication, risk perception, communication behaviour, environmental communication

SS - 04

**FARMERS' ATTITUDES AND KNOWLEDGE LEVEL ON
ORGANIC FARMING IN REGION 1 AND CORDILLERA
ADMINISTRATIVE REGION (CAR)**

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This study mainly focused on the assessment of attitudes and level of knowledge of farmers towards organic farming (OF) and the contributory factors that are assumed to affect these. Two groups of respondents were interviewed: a) NOF or farmers who have not tried OF; and 2) TOF or farmers who have tried OF, either partially or discontinued. T-test was used to analyze the significant difference of NOF and TOF as to attitudes and knowledge. Pearson correlation was used to determine which of the socio-demographic characteristics significantly affect the attitudes and knowledge respondents towards OF.

Results showed that most of the farmers in both regions are aware of OF. However, there are TOF in Region 1 who are unaware. They are practicing organic techniques but unaware that such is organic in nature. Statistics showed that NOF and TOF respondents are significantly different with their attitudes on some attributes of OF. Both groups in two regions are uncertain of the negative and agreeable of the positive attributes of OF but TOF respondents are more optimistic.

Socio-demographics have no affect on the attitudes of both NOF and TOF. Notable demographic factors that have influences on technical knowledge and some aspect of OF are religion, educational attainment, ethnicity, number of years in farming, annual income and farm size.

Notable reasons for non-adoption/discontinuance of OF are economics impact during conversion period like low yield, slow effect, laborious, no sustained government support and low technical knowledge on OF. These can be some possible entry points for promotional activities on organic farming in the country.

Keywords: organic, attitudes, knowledge, composting, conversion

SS - 04

**FARMERS' ATTITUDES AND KNOWLEDGE LEVEL ON
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Keywords: organic, attitudes, knowledge, composting, conversion

SS - 05

**ADOPTION OF A TOOL TO MEASURE THE EXTENT OF
PRESENCE OF SOCIAL CONSTRUCTIVISM IN HIGH
SCHOOL AND COLLEGE PHYSICS CLASSROOMS**

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The move towards constructivism in classrooms has been widely initiated although not explicitly named as constructivism. In the early 1990's, DepEd together with DOST initiated programs to foster new approaches in teaching sciences and mathematics. Lately, with the rapid expansion of the capacity of computer, the ICT integration is becoming a widespread phenomenon and many other pedagogical innovations that are inherently or implicitly associated with ICT integration come into clearer focus. All these are manifestations of the immense scope of social constructivist perspectives in the learning process. However, measurement of the presence of the social constructivism is not being given due importance unlike in the neighboring countries. In this study, the Social Constructivist Learning Environment Survey (SCLES) made by Australian educators is being attempted for full adoption in physics classrooms both in high school and college. With the involvement of 1000 college students in MSU-IIT and 1,194 senior students throughout Mindanao, the reliability of SCLES was established. In the original study, the cronbach alpha in 5 different dimensions of SCLES ranged from 0.54.- 0.81 while the present study ranged from 0.55 – 0.72. The present study, however, showed an overall cronbach alpha of 0.82 which was not established in the original study. The study further revealed that at its initial result, the SCLES can be a good measuring tool in investigating the extent of social constructivism in physics classrooms.

Keywords: social constructivist, pedagogical innovations, reliability, ICT integration, physics classrooms

SS - 06

**YEAR LEVEL FLUCTUATIONS OF MISCONCEPTIONS
ON THE DIFFERENT DIMENSIONS OF FORCE
AMONG PHYSICS MAJORS**

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This study is an attempt to unravel the cognitive structure regarding the concept of force, among physics majors, as it is decomposed into its nine sub-dimensions. The scope of the sample covers both BS and BSEd students represented by year level. The study utilized the Force Concept Inventory (FCI) in which available studies in Philippine set-up involved only, in most cases, its usage as a construct to correlate with other cognitive or affective constructs. The respondents were determined by stratified random sampling and were given the FCI after their classes. By dissecting every dimensions of force, the study yielded very interesting results that are deemed important for curriculum developers; *i*) that misconceptions does diminish with increasing year level in terms of gross count with the third year having the least average misconception over the fourth year, *(ii)* that there is an interesting though inconsistent fluctuations, in the third year and first year based on average percent of misconceptions, *(iii)* that there is indeed an incoherent structure of knowledge about force based on the inconsistent concentration of misconceptions among the respondents. One big implication of the study is the need to investigate in depth the different dimensions of force by covering bigger demographics in order that a conclusive status can be established

Keywords: force; force concept inventory; curriculum developers; misconceptions; incoherent structure.

SS - 07

EFFECT OF WEB-ENHANCED LEARNING ACTIVITIES ON THE ENGLISH ACHIEVEMENT OF FRESHMEN AT NUEVA VIZCAYA GENERAL COMPREHENSIVE HIGH SCHOOL

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The study established the effects of Web-Enhanced Learning Activities (WELA) on the achievement in English of freshmen students of the Nueva Vizcaya General Comprehensive High School (NVGCHS).

The research combined the quantitative approach using quasi-experimental design, with the qualitative approach involving immersion learning among 66 students from two first year classes, 34 under the experimental group and 32 under the control group. Observation, participation in the classroom interaction, and interview were employed. The study covered the third grading period of School Year 2007-2008.

The achievement level of respondents was evaluated based on pretest and posttest with a validated teacher-made test. Data were analyzed using mean, frequency distribution, percentage, and t-test.

While the students gained knowledge in both approaches, those under the WELA obtained higher achievement level in the posttest, significantly outperforming the students in the control group. Moreover, based on data from interview and classroom observation, the following positive behaviors were noted among the students under the WELA: (a) increased interaction among the students, between the students and learning materials, and between the students and the teacher; (b) decreased cases of absenteeism; (c) independent learning; (d) enhanced and structured learning styles; and (e) more defined focus in learning.

Administrators should encourage their teachers to be involved in updating their teaching and learning methods and strategies. Teachers should be more open to new techniques and styles; and join trainings, seminars, and workshops on web-enhanced learning and ICT integration.

Keywords: Web-Enhanced Learning Activities (WELA); ICT integration

SS - 08

THE TEACHER ON THE INTERNET: SELF-EFFICACY BELIEFS, USAGE AND ATTITUDES

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This study examined the relationship between and among teachers' self-efficacy beliefs, usage, and attitude towards the Internet with their personal characteristics such as age, number of years in teaching, computer literacy level, and trainings attended.

A descriptive method of research was used in finding answers to the problems of this study while random sampling method was applied to select the 124 teacher participants from nine campuses of the Isabela State University. This study used a four-part questionnaire and a five-point Likert-type scale in gathering and in interpreting the data. The first part was used to collect the teachers' personal characteristics. The second part measured the teachers' Internet self-efficacy. The third part gathered data on the Internet usage of the teachers, and the fourth part measured their attitude towards the Internet. Negatively stated attitude questions were scored in reverse order.

Teacher participants were given one week to complete the questionnaire before the researcher personally retrieved them. The responses were tallied and presented using frequency distribution, weighted mean and percentage distribution. The Pearson Product Moment correlation was used to determine the significant relationships and correlations between and among the variables.

It has been found that: 1) the older the age and the longer a teacher had been in the teaching profession, the less comfortable he or she was in using the Internet; 2) a high computer literacy level and in-service trainings influenced the teachers' frequency of Internet use, high self-efficacy, and positive attitude towards the Internet; 3) teachers frequency of Internet use increased their self-efficacy and attitude, while a highly positive attitude motivated teachers to frequently use the Internet and increased their self-efficacy; and 4) the more problems the teachers encountered the lesser their usage, the lower their self-efficacy, and the more negative their attitudes were.

Keywords: internet, internet self-efficacy beliefs, internet usage, internet attitude, computer literacy

SS - 09

**TOWARD UNDERSTANDING CORRUPTION:
CONCEPTS AND PERSPECTIVES OF RURAL COMMUNITY
LEADERS**

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This paper investigates how community leaders think about corruption in Philippine society particularly corruption in government through simple interpretative phenomenological analysis (IPA). Eight rural community leaders (4 Barangay captains and 4 Sanggunian Kabataan chairpersons) participated in this study. Using in-depth interview, questions were focused on the “what” and why corruption persists in Philippine society. Interview texts were classified and interpreted following the basic steps used in IPA. Following bottom up approach, abstractions of meaning were done at two levels; text coding and thematic coding. Analysis reveals that corruption involves four basic interdependent concepts namely; a) stealing government funds; b) abused of power; c) conspiracy of those who holds power, and; d) socio-cultural. In other words, rural community leaders think that corruption is an act of conspiracy of those who holds power to steal government funds. Furthermore, community leaders thought that corruption has socio-cultural roots making it more difficult to solve. Participants also thought that political power gives opportunity for corruption to thrive in government and that corruption will perpetuate if those who are in power are “united” in carrying out corrupt practices. Solution in battling corruption, as indicated by the participants, still rest largely on government leaders. Conceptual and practical implications are discussed.

Keywords: community leaders, corruption, interpretative analysis, conspiracy, sociocultural

SS – 10

SIGNS OF THE TIMES: THE VIABILITY OF NURSING HOMES AS A COMPLEMENT TO ELDERLY CARE

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In the Filipino family, certain changes have been evident – one of which is the transition from home care to nursing home care for the elderlies. However, though already practiced by some, the placement of the elderly to nursing homes is still not socially acceptable to many Filipinos.

This study aimed to identify Filipinos current outlook in placing elderlies in nursing homes, and to determine the trends and factors affecting the respondents' answers after using the Changing WInD Tool.

Twenty respondents were chosen through purposive sampling. The following criteria were set: (1) Is in the working age (2) middle to upper class citizens (3) have their own nuclear family and (4) has a living elderly relative. An intervention tool named "Changing WInD (Willingness by Information Dissemination) Tool" was used in interviewing the respondents. The interview was done before "WInD" and after "WInD."

The findings showed that 14/20 respondents were reluctant or has negative reaction in admitting an elderly relative and 16/20 answered no to having themselves placed in a nursing home. However, after the administration of the "Changing WInD Tool", there was a marked change in the answers of the 20 respondents. All these changes were due to the presentation of the tool which proves that information dissemination was enough to elicit a change from within the respondents. Further, three factors that changed the respondents' decision were identified and these were awareness of the following: Aging Filipino population, Availability Nursing Homes in the Philippines and Quality nursing Homes.

Our Filipino culture has long standing roots as to how we should take care of our elderly. Nursing homes are not a means to abandon our elderly, but a place of safety and security; they are not alternative to geriatric care, but a complement to ensuring proper care is rendered to the elderly.

Keywords: elderly, home care, nursing care, care for elderly, aging population

SS – II

DEVELOPMENT OF AN INTERACTIVE INSTRUCTION SYSTEM FOR SCIENCE AND HEALTH VI

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The objective of this study is to develop an interactive instructional system which is a computer-assisted instruction, as an instructional tool in teaching “Climate of a Place”. This is in response to the low performance of the grade six (VI) pupils in the 2007-2008 National Achievement Test in Science.

In carrying this objective, the researcher utilized the quasi-experimental design utilizing a pre-test and posttest design. The grade six (VI) pupils of Northeast-II Central School in Dalipuga, Iligan City were chosen as the respondents of the study and various reactions and effects towards the use of the instruction system were consolidated. The Developed Interactive Instruction System was evaluated by experts and inservice teachers using a set of rubrics. Revisions on the computer-assisted instructional tool were done based on the experts’ and inservice teachers’ suggestions.

The result of this study showed that the developed interactive instruction system could be used as a good instructional tool to improve the pupils’ performance in teaching “Climate of a Place”. Results in the try-out indicate that the performance of the pupils were significantly higher after using the instruction system. Pupils’ comments on the instruction system were all positive and indicate the same reaction, which is they all liked the methods used and they learned better from the lesson.

Keywords: Development, interactive, computer-assisted instruction, instruction system, evaluation, performance

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