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ABSTRACTS OF PAPERS

presented during the

39th Annual Scientific Meeting

Attaining Sustainable Development Goals

PHILIPPINE FISHERIES and other AQUATIC RESOURCES 20/20

12-13 July 2017

Published by the National Academy of Science and Technology, Philippines

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39th ANNUAL SCIENTIFIC MEETING

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AGRICULTURAL SCIENCES

AS-01

DEVELOPMENT OF LOOP MEDIATED ISOTHERMAL AMPLIFICATION (LAMP) fOR THE DETECTION OF CAPRINE ARTHRITIS ENCEPHALITIS VIRUS (CAEV)

Daryl G. Dela Cruz, Joram J. Gautane, Michelle M. Balbin*, and Claro N. Mingala

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Belonging to the family of Retroviridae, Caprine Arthritis Encephalitis virus (CAEV) is a multi-organ disease of goats which is characterized by long incubation period and persistent infection. The presence of this virus in the herd may cause great loss in animal production. Detection of this virus can be done through serological tests such as enzyme-linked immune sorbent assay (ELISA) and recently, molecular tests such as polymerase chain reaction (PCR). However these techniques are laborious and require expensive equipment that may not be present in some laboratories thus, may not be suitable in resource-limited areas or in field settings. We developed a simple dry format loop-mediated isothermal amplification (LAMP) assay to detect CAEV. The dried format LAMP can detect CAEV in clinical samples through amplification of the CAEV proviral DNA at an isothermal temperature of 60C for 15 minutes to 1 hour in a heat block or water bath. The dry format LAMP is stable at room temperature, 4 C and -20 C hence, this permits conduct or use of the technique even in resource-limited areas. This simple and rapid test is also sensitive and specific and offers a lower cost molecular-based test for the detection of CAEV.

Keywords: Dry Format, CAEV, proviral DNA, LAMP

AS - 02

DEVELOPMENTAL COMPETENCE OF EMBRYOS PRODUCED IN VITRO FROM HIGH AND LOW-FERTILE BULLS CLASSIFIED BY FOURIER HARMONIC ANALYSIS

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Fourier Harmonic Analysis or FHA is a computer-based analysis found effective in predicting bull fertility through in vitro fertilization assay assessed by male and female pronuclear formation. To assess the viability of fertilization and prove the in vitro embryo production potentials of bulls classified as High-fertile by FHA, in vitro matured water buffalo oocytes were in vitro fertilized with frozen-thawed semen from High- and Low-Fertile bulls classified by FHA. The in vitro fertilized eggs were further cultured in vitro for embryo development and cleavage, blastocysts development and hatching rates were determined on Day-2 and Day-7 of in vitro culture with Day-0 as the day of in vitro fertilization, respectively. Results showed significantly higher ($P<0.01$) cleavage (73.5±0.8 vs. 60.1±2.7), blastocysts development (27.4±0.7 vs. 18.5±1.6) and hatching rates (38.3±1.2 vs. 28.7±2.7) from using High-Fertile than in Low-Fertile bulls. The results demonstrate that High-Fertile bulls classified by FHA produced more embryos in vitro than the bulls that were classified as Low-Fertile. The result suggests that FHA is a potential tool in predicting bull fertility in buffalo species. Efficiency assessment by artificial insemination is warranted.

Keywords: bull fertility, DNA defects, FHA, spermatozoa, water buffalo

AS - 03

EFFICIENCY OF FOURIER HARMONIC ANALYSIS IN CLASSIFYING BULLS ACCORDING TO FERTILITY: IN VITRO FERTILIZATION ASSAY

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High- and Low-fertile bulls were classified by Fourier Harmonic Analysis or FHA. FHA is a mathematical tool developed to analyze the sperm DNA defects using the harmonic amplitudes derived from its head-shape. Efficiency of FHA in classifying water buffalo bulls was assessed. Thirty one bulls were classified by FHA and 5 each of the 12 High-fertile and 10 Low-fertile bulls were randomly selected and their semen was used for in vitro fertilization assay using in vitro matured water buffalo oocytes retrieved from slaughter-house derived ovaries. A total of 2067 oocytes were matured in vitro for 22 hours of which 1403 oocytes surrounded by expanded cumulus cells were selected and randomly divided into two groups and subjected to in vitro fertilization using frozen-thawed semen from High- and Low-fertile bulls. Results showed significantly higher (83.5±0.1 vs. 70.1±2.7, $P<0.01$) male and female pronuclear formation in High- than in Low-Fertile bulls. The results suggest that FHA is efficient in classifying water buffalo bulls according to fertility.

Keywords: bull fertility, DNA defects, FHA, spermatozoa, water buffalo

AS - 04

LOCAL PRODUCTION OF BUFFALO FETAL CALF SERUM AND ITS EFFICIENCY IN THE PRODUCTION OF CATTLE EMBRYOS IN VITRO

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Fetal Calf Serum or FCS is a good source of micronutrients that supports cell cultures with applications not only in the field of clinical diagnostics but also in research. It is imported thus costly with considerable handling requirements. With the incidence of slaughtering pregnant cows at local abattoirs, utilization of the fetuses in the production of local FCS for embryo in vitro production was examined. Fetal blood was collected direct from the fetal heart and processed to produce serum. Resultant serum was used as supplement in the in vitro culture medium for cattle in vitro embryo production. Medium supplemented with commercially purchased FCS was used as control. Of the 371 oocytes randomly divided into Locally-produced and Imported FCS-supplemented in vitro cultures, no significant difference were observed both on the cleavage and blastocysts development rates after in vitro maturation and fertilization demonstrating potential production of FCS locally and use of healthy fetuses recovered from abattoir for FCS production.

Keywords: Fetal Serum, oocytes, embryos, in vitro, water buffalo

AS - 05

ASSESSMENT OF MILKFISH FRY FISHERY RESOURCES IN MARUYOGON, PUERTO PRINCESA, PALAWAN

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Milkfish, or *bangus*, is one of the most commercially important fish in the Philippines. Nonetheless, drastic declines in wild milkfish fry abundance has been reported since the 1970s. Due to the lack of long-term data, reports regarding the matter were considered inconclusive. Stocks of wild milkfish fry and existing milkfish fry collection grounds were evaluated through rapid survey and GIS mapping. Results show an unfailing perception of declining wild milkfish fry supply from 3M in 2015 to only 2.4M in 2016. Along with this, the richness of fry bycatch, or fry that were unintentionally caught with bangus fry, were also discerned. Canonical Correlation Analysis reveals that the most influential environmental parameters in fry composition in the sampling site were Sea Surface Temperatures (SST) and Dissolved Oxygen (DO). Since SST was found to influence fry composition, the recent El Niño phenomenon, which intensified last June 2016, was taken into account. Morphological and molecular analyses of the samples were done to determine the seasonal species richness of fry in the sampling site. Results show that fry species richness for the peak season of June 2016 was thrice as less in June 2015. Annual sampling will be continued to confirm if the decrease in species richness and the decline in abundance of *bangus* fry was highly influenced by the recent El Niño event, and if further challenges regarding fry stock assessment shall be expected.

Keywords: Species composition, El Niño, stock assessment

AS - 06

FISH SIZE EFFECT ON FISH AND PLANT GROWTH AND WATER QUALITY IN A NILE TILAPIA (*Oreochromis niloticus*) – CABBAGE (*Brassica oleraceae* var. *capitata* L. f. *alba*) RAFT-AQUAPONICS SYSTEM

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Many economically important vegetables and flowering plants can be grown in aquaponic systems. The production of aquaponically grown plants are dependent on the availability of nutrients, converted from insoluble fish metabolites into useful plant nutrients.

This research evaluated the effect of fish size on fish and plant growth and water quality in a Nile tilapia– cabbage raft aquaponics system .The experiment was a completely randomized design with three fish size treatments, each with two replicates: Treatment 1 – small (avg. 9.32g ± 0.25); Treatment 2 – medium (avg. 16.52g ± 2.14); Treatment 3 –large (avg. 41.76g ± 1.62). Total weight for Treatment 1, 2 and 3 were: 83.9 ± 2.26g, 82.6 ± 0.57g and 83.52 ± 4.27g, respectively.

Fish weight gain of small fish was increased by 34 and 55% as compared to medium and large fish, respectively. Treatment 1 showed the highest SGR, lowest FCR, and highest PER. On the other hand, plant growth and water quality (TAN, NO_{2-}, NO_{3-}, PO_4^{3-}, pH, and D.O) were not statistically significant.

In retrospect, one can conclude that using larger fishes for aquaponics may lead to production inefficiencies. Therefore, it is recommended that fishes be harvested at times similar to that of conventional aquaculture.

Keywords: Aquaponics; Fish size; *Oreochromis niloticus*; *Brassica oleraceae* var.; Floating raft

AS - 07

GENETICS AND COASTAL ECOLOGY: UNDERSTANDING MILKFISH FRY FISHERIES IN RESPONSE TO THE EL NIÑO PHENOMENON THROUGH DNA BARCODING

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By-catch is one of the most serious problems affecting fisheries management today. Proper identification of by-catch through DNA barcoding is needed to assess the level of threat these species may be facing due to prolonged negligence. In this study, a Canonical Correlation Analysis for 2015 and 2016 was generated to determine the relationship of fry species richness and environmental parameters in Barangay Maruyogon, Puerto Princesa, Palawan. The target species was milkfish fry while its by-catch were also identified through DNA barcoding. Results show that sea surface temperature and dissolved oxygen level are the most influential parameters affecting fry occurrence. During the last quarter of 2015 until the second half of 2016, the Philippines has experienced a strong El Niño event, causing a significant increase in sea surface temperature. During the fry peak season in June, a decrease in species richness was recorded from 14 species in 2015 to only 4 species in 2016. In 2015, commercially important species such as shrimp (Penaeidae, Palaemonidae, Sergestidae, Euphausiidae), mojarra (Gerreidae), and terapon (Terapontidae) were collected, but were completely absent in 2016. Rather, the latter year was dominated by non-commercially important species such as *Ambassis* spp., (Ambassidae) and garfish (Zenarchopteridae). Annual sampling will be continued to confirm if the decrease in species richness was actually due to the recent El Niño event, or if further challenges regarding fry stock assessment should be expected.

Keywords: DNA barcoding, El Niño, species richness

AS - 08

PERFORMANCE OF NILE TILAPIA *Oreochromis Niloticus* FED DIET CONTAINING DISTILLERS DRIED GRAINS WITH SOLUBLES AND FOLLOWING AMMONIA CHALLENGE

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Distillers dried grains with soluble (DDGS), a corn co-product obtained after fermentation of corn for ethanol production, are the dried residue that remains after the fermentation of corn. It has moderately high protein content, relatively low phosphorus content, and low cost as compared to FM.

The study evaluated the growth, hematology, glucose and resistance to ammonia of Nile tilapia fed diet containing different concentrations of DDGS before and after ammonia stress.

The fish were fed diet containing 10% (D10), 20% (D10), 40% (D40) or the commercial diet (C) for six weeks. Weight sampling was conducted every 2 weeks. Blood was collected before and after 24 hours of ammonia challenge to determine the hematological parameters and blood glucose level.

Percentage weight gain, protein efficiency ratio, specific growth rate and feed conversion ratio of all treatment had no significant difference. Among the hematological parameters, significant difference was observed on hemoglobin (HGB), red blood cell (RBC), and hematocrit (HCT). HGB of D10 fish was the highest after ammonia stress challenge while RBC of fish fed treated diet were significantly higher than the C. White blood cell (WBC) and platelet (PLT) showed no significant difference among all treatments. However, glucose of D10 fish was the lowest among all treatments.

Overall, supplementation of DDGS up to 40% is comparable to commercial feed in terms of growth of tilapia. In addition, D10 stabilizes hematological response (HGB, RBC, and HCT) and glucose level and improve survival of *O. niloticus* under ammonia stress condition.

Keywords: ammonia, DDGS, hematology, glucose, niloticus

AS - 09

FIRST RECORD OF *EOCTENES* KIRKALDY IN SOUTHERN LUZON, (HEMIPTERA: POLYCTENIDAE), WITH KEY TO THE CIMICOIDEA ECTOPARASITIC ON BATS IN THE PHILIPPINES

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Polyctenidae Westwood, also known as bat bugs, is a haematophagous group of hemipterans exclusively ectoparasitic on bats and is closely related to Cimicidae Latreille (bed bugs). Worldwide, it is represented of 2 subfamilies, 5 genera, and 32 species. These bugs are dorsoventrally flattened with conspicuous ctenidia on, apterous, anophthalmus, possess well-developed legs, and reproduce via adenotrophic viviparity. They are rare compared to other insect taxa ectoparasitic on bats as evinced by a relatively small number of museum collections and described taxa. Polyctenid bugs in the Philippines is only represented by two species from the genus *Eoctenes* Kirkaldy: *E. spasmae* (Waterhouse) and *E. intermedius* (Speiser). The first Philippine record for the genus is reported in 1961 from Northern Luzon. This paper presents the first record of *Eoctenes* in Southern Luzon, with key to the Cimicoidea ectoparasitic on bats in the Philippines.

Keywords: Cimicoidea, *Eoctenes*, new record, Polyctenidae, Southern Luzon

AS - 10

MULTIGENE PHYLOGENETIC RELATIONSHIPS AMONG PHILIPPINE ISOLATES OF *Fusarium* SPP. CAUSING SUGARANE POKKAH BOENG

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Pokkah boeng disease of sugarcane has been increasingly noted in different locally grown cultivars throughout the Philippines due to the continuous use of susceptible varieties and varying environmental conditions favorable for the spread and the multiplication of the pathogen. Reported studies have established that pokkah boeng is mainly caused by *Fusarium* moniliforme, but in the Philippines, it was found out that various species can also cause the disease (*Fusarium proliferatum, Fusarium verticilloides, Fusarium subglutinans*, among others). Due to the genetic diversity of *Fusarium* spp. causing pokkah boeng, the correlation between symptomatology and the causative organisms involved would be a viable area of study, which in turn would have an impact on the control measures. Therefore, molecular tools are needed for investigating pathogen diversity and taxonomy. Seventy fungal isolates collected from pokkah boeng infected sugarcane in Luzon, Visayas and Mindanao were confirmed as *Fusarium* spp. using the molecular primer, ITS-Fu-f/r/ From these, 21, 11, 5, and 2 were detected as *F. moniliforme, F. proliferatum, F. verticilloides and F. subglutinans*, respectively, through species-specific primers. A total of 31 isolates were unidentified inferring the inherent genetic diversity underlying the disease. All of the 70 *Fusarium* spp. isolates were subjected to amplification of the elongation factor (EF) gene, tubulin (TUB) gene and the ITS region of the rDNA. Sequence divergence in the coding regions were observed among the isolates indicating that same species grouped together. Moreover, the unidentified *Fusarium* spp. were clustered closer with *F. moniliforme* group suggesting the role of *F. moniliforme* as the primary pathogen causing pokkah boeng. Studies involving control measures against specific *Fusarium* spp. can be further conducted to determine the best method of controlling the disease in the long run.

Keywords: Multigene, phylogenetic relationship, pokkah boeng, *Fusarium*

AS - 11

NEW AND RE- EMERGING PHYTOPLASMA DISEASES: POTENTIAL THREAT TO CROP PRODUCTION IN THE PHILIPPINES

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Phytoplasma is a wall-less phytopathogenic bacteria which are transmitted by insects and via infected seedlings, capable of causing numerous diseases and devastating yield losses in economically important crops. Owing to its being unculturable, phytoplasma diseases are difficult to identify and have not been fully recognized or studied in the early years. Disease identification has just relied on symptoms and microscopic examinations which were not always sensitive to detect bacterium in low titer plants. The most recently detected phytoplasma disease is the cassava witches broom (CWB) that plagued the cassava production in the Eastern Visayas and some areas of Mindanao. Infected cassava plants were stunted and showed excessive proliferation of branches. The CBW was efficiently detected using the polymerase chain reaction (PCR) and the nested PCR techniques. Universal primers that amplified the 16S rDNA, and part of 23S rDNA were synthesized and used in this test. With PCR, other phytoplasma diseases including the re- emerging ampalaya little leaf, and newly detected patola little leaf, malunggay little leaf and the "die back" of papaya have also been detected and identified. Today, more diseases exhibiting the typical symptoms suspected of phytoplasma infection are being observed and yet to be identified. The discovery of these new phytoplasma hosts, increases diversity of the potential reservoir of these diseases and poses considerable risk in the disease epidemiology. Hence, early detection of the disease is needed for a sound and practical management approach.

Keywords: Phytoplasma, cassava witches broom, PCR

AS - 12

Steinernema longicaudum, AN ENTOMOPATHOGENIC NEMATODE SPECIES COLLECTED IN PUMMELO ORCHARDS, DAVAO REGION

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Davao Region is the largest pummelo-producing area in the country. Like other tropical fruits pummelo is infested with several insect pests which consequently leads to the use of synthetic chemicals since it is the easiest to apply, most efficient, and cheapest among the control available. The increasing public awareness to the importance of food safety and the initiative of the Philippine government through the Republic Act 10068 known as Organic Act of 2010, calls for an alternative control measures which are environment-friendly and pose lower risks to human and animals. One of the potential alternative control measures is the use of soil-dwelling Entomopathogenic Nematodes (EPNs). To establish the presence and identify the species of EPNs present in the region, soil collections were done in 10 pummelo orchards in Davao Region. EPNs were extracted from the soil using the insect-baiting technique. Dead larvae were retrieved from the soil and transferred to a white trap to collect the infective juveniles (IJs) of the nematodes. Out of 10, only two sampling areas where EPNs were extracted. Isolates were subjected to molecular identification using 28s and ITS rDNA sequence data. Both isolates were identified as *Steinernema longicaudum*.

Keywords: entomopathogenic nematodes; pummelo; *Steinernema longicaudum*

AS - 13

VALIDATION OF LOOP-MEDIATED ISOTHERMAL AMPLIFICATION TECHNOLOGY (LAMP) USING ELISA FOR THE DETECTION OF FUMONISIN IN EAR-ROT INFECTED CORN CAUSED BY *Fusarium verticillioides*

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Fusarium verticillioides is a fungal species causing *Fusarium* ear rot that affects both pre-harvest and postharvest corn. *F. verticillioides* produces a family of mycotoxins, the fumonisins, that have been reported to cause fatal diseases in animals and humans. This study aimed to compare and validate the color detection of fumonisin gene by LAMP technology with ELISA that measures the fumonisin produced from the expressed gene.

Fumonisin-producing isolate of *F. verticillioides* was cultured and inoculated at varied concentration on healthy kernels. Different severity of Fusarium ear-rot (FER) infection was observed using different amounts of inoculum. Kernel samples with different levels of FER infection were used in a fumonisin-ELISA kit to quantify fumonisin production. The DNA from same samples were also extracted and used in an optimized LAMP reaction for fumonisin gene amplification. Prior to amplification by LAMP, hydroxynapthol blue was added to facilitate visual detection. Optimized isothermal condition was at 65° for 60 mins.

Severity of FER infection was correlated with the level of fumonisin. Amplified DNA from samples with high fumonisin level, as measured by ELISA, showed sky blue color reaction to LAMP wherein relatively darker blue indicated moderate infection/ fumonisin production and dark violet for absence of fumonisin. From these results, the LAMP portable molecular detection kit was verified, and is recommended as faster, easier and more cost effective compared to PCR-based and serological assays for fumonisin detection in the field and in postharvest facilities.

Keywords: LAMP, fumonisin, *Fusarium* ear rot, corn

AS - 14

PREDATORY LADYBIRD BEETLES ASSOCIATED WITH LANZONES MUSSEL SCALE, *Unaspis mabilis* LIT & BARBECHO (HEMIPTERA: DIASPIDIDAE)

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Nine ladybird beetle species found associated with lanzones mussel scales (*Unaspis mabilis* Lit & Barbecho) were collected and identified. The beetles were verified to be *Acarinus philippinensis Kapur, Chilocorus circumdatus (Gyllenhal), C. nigrita* (Fabr.), *Scymnus (Neopullus) hoffmani* Weise, *Nephus phosphorus Lewis, Microweiseinae* sp., *Pseudoscymnus sp., Scymnus (Pullus)* sp., and *Telsimia nitida Chapin*. Among these, only four are currently being reared by DA-BPI, RCPC and PCA. Hence, the other potentially more effective predators' remains to be studied and further evaluated.

Keywords: scale insects, *Unaspis mabilis, coccinellids, Acarinus philippinensis, Chilocorus circumdatus, Chilocorus nigrita, Microweiseinae, Pseudoscymnus, Scymnus (Pullus) hoffmani, Telsimia nitida. Nephus phosphorus*

AS - 15

PLANT- BASED PESTICIDES FOR THE MANAGEMENT OF SELECTED PEST FOR ORGANIC VEGETABLE PRODUCTION IN THE ILOCOS

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With the increasing concern for environmental safety and human health, development of alternative control methods for crop production such as the use of biopesticides against major pests of vegetable crops is a necessity. Such crop insect pests were tomato fruitworm, *Helicoverpa armigera* Hubn., thrips (*Thrips tabaci*), mites (*Aceria tulipae*) and Epilachna beetle (*Epilachna vigintioctpucntata)* and aphids (*Aphis.cracivora*) while on diseases were *Alternaria solani* causing early blight on tomato, *Alternaria porri*, causing purple blotch and *Cercospora duddiae* causing cercospora leaf spot on garlic, respectively. Plants with known pesticidal properties were collected and re-evaluated as biopesticides.

Pesticidal effect on target pests was noted from plants such as *Cleome viscosa, Argemone mexicana, Euphorbia hirta, Tabernaemontana pandacaqui. Cucurma longa, Origanum vulgare. Piper betle, Lantana camara, Allium sativum, Aloe barbadensis Azadirachta indica* leaves and garlic waste. Insect growth inhibitory effect was observed such as reduced number of larval and pupal days, as well as, premature mortality of treated larvae. Using the formulated products, the effectiveness was comparable with chemical pesticides under field conditions; lower disease intensity and higher marketable yield were noted compared to farmers practice. Cost and return analysis also showed that the different products is comparable with chemical pesticides. Microbial antagonists isolated from goat manure tea and bat dung were identified and proved effective in vitro against *A. solani* in tomato and *A. porri* and *C. duddiae* in garlic. Shelf life of the products showed potency after one year of storage. Results mentioned proved that the formulated biopesticides were very essential for organic vegetable production in the Ilocos.

Keywords: plant extracts, pesticidal property, toxicity, product formulation, pest

AS - 16

ASSESSMENT OF THE EFFECTIVENESS OF ORGANIC-BASED AMENDMENTS AGAINST DISEASES OF SWEET PEPPER

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Organic amendments such as animal manures and composts are used in agricultural systems to recycle nutrients and improve the soil conditions for the growth of the plants. The application of organic fertilizers provides a slow release of nutrients as microorganisms break the soil materials into organic forms. A study arranged in Randomized Complete Block Design with three replications was conducted to evaluate the diseases and determine the yield advantage of sweet pepper applied with organic-based amendments. The following treatments were used: T1- (Control -No inorganic fertilizers), T2- Inorganic fertilizer (60-40-150), T3- Vermicompost at 2 tons/ha,T4- Chicken dung at 2 tons/ha and T5- Vermicompos at 1 ton /ha + chicken dung at 1 ton/ha.

There were two diseases assessed, namely; anthracnose leaf spot which was caused by *Colletotrichum capsici* and Tomato Yellow Leaf Curl Virus (TYLCV), a virus infection. The percent severity of anthracnose leaf spot was very low throughout the duration of the study and was initially observed at 45 days after transplanting (DAT). However, significant differences were observed among the treatments. At 60 and 75 DAT, T1(Control-No inorganic fertilizers) showed the highest percent severity of 5.08 and 7.30, respectively. Plant height was significantly affected by the application of the different treatments. Tallest plants were observed on T4 (Chicken dung at 2tons/ha) while the shortest plants were exhibited on T1(Control-No inorganic fertilizers). In terms of yield, application of chicken dung at the rate of 2 tons/ha (T4) had an advantage of 142% while the combination of chicken dung at 1ton/ha and vermicompost at 1 ton/ha (T5) had 56.52%.

The findings suggest that the application of chicken dung and its combination with vermicompost produced higher yield and low disease severity which may encourage farmers to consider organic farming.

Keywords: severity, organic amendments, compost, yield advantage

AS - 17

INFLUENCE OF SOIL AMENDMENTS AND BIOSPARK TRICHODERMA ON THE CONTROL OF *Sclerotium rolfsii* SACC. ON PEANUT

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Sclerotium rolfsii Sacc., is a fungal organism causing stem and root rot, damping off and wilting on peanut and incurring yield losses on the crop. A complementary approach for managing *S. rolfsii* is through biological control. Hence, a study using Completely Randomized Design was laid out with eight treatments and three replications to evaluate the influence of soil amendments and Biospark Trichoderma on the control of *S. rolfsii* as well as to evaluate the agronomic and yield performance of peanut. The treatments were: Control (T_1), Banguard Fungicide (T_2), Malunggay + Biospark (T_3), Madre de Cacao + Biospark (T_4), Malunggay + Madre de Cacao + Biospark (T_5), Malunggay alone (T_6), Madre de Cacao alone (T_7) and Inorganic Fertilizer: 16 - 20 - 0 and 0 - 0 - 60 (T_8).

On disease incidence, Sclerotium wilt was observed to have the highest mean of 60.00% in plants applied with Madre de Cacao alone (T_7). On the contrary, the disease was not observed in treatments T_2 (Fungicide), T_3 (Malunggay + Biospark), T_5 (Malunggay + Madre de Cacao + Biospark) and T_6 (Malunggay alone). It is evident that the application of Malunggay alone or in combination with Biospark and Madre de Cacao showed no incidence of Sclerotium wilt.

On yield parameters, significant differences were observed on pod yield, weight of seeds and adjusted grain yield. However, adjusted grain yield on plants applied with Fungicide Banguard (T_2) obtained the highest mean of 12.97 kg/ha but had comparable means with Malunggay alone (T_6) and Malunggay + Madre de Cacao + Biospark (T_5) with 11.78 kg/ha and 11.52 kg/ha, respectively. The lowest was noted in Madre de cacao alone (T_7) with a mean of 5.58 kg/ha.

Keywords: *S. rolfsii*, *in vitro*, Biospark Trichoderma, soil amendments

AS - 18

SPATIAL DISTRIBUTION OF LANZONES MUSSEL SCALE, *Unaspis mabilis* LIT & BARBECHO (HEMIPTERA: DIASPIDIDAE) IN CALABARZON, LUZON, PHILIPPINES

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A study was conducted to determine the spatial distribution of lanzones mussel scales, Unaspis mabilis Lit & Barbecho in Cavite, Laguna, Batangas, Rizal and Quezon provinces (CALABARZON). Results revealed that lanzones mussel scales are cosmopolitan in the CALABARZON area, predominantly in the lanzones producing areas in Laguna. However, the highest infestation rate was observed in Batangas province. The lanzones mussel scales are sporadically recurring every year at different levels of infestation depending on a number of environmental factors such as season, rainfall, presence of natural enemies, cropping system, etc. Nevertheless, the pest population and levels of infestation decreases on the onset of rainy season after leaf shedding and this was validated regionwide.

Keywords: spatial distribution, mussel scale, Unaspis mabilis, CALABARZON

AS - 19

YIELD OF ILOCOS WHITE GARLIC IN RESPONSE TO AIR TEMPERATURE AND PURPLE BLOTCH DAMAGE IN ILOCOS NORTE, PHILIPPINES

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Garlic is a cash crop with a quick return on investment and this is a good source of income for the Ilocano farmers. Bulb formation is one of the most sensitive phenological stages of garlic. It was observed that when exposed to high temperature before bulb initiation and during the growth and development of bulb, bulb production is low. On the other hand, purple blotch (*Alternaria porri* L.) has been identified as an important yield limiting disease in garlic (*Allium sativum* L.). The study was conducted to determine the relationship between air temperature and degree of purple blotch damage on the yield of garlic in Ilocos Norte, Philippines. Garlic yield produced from the experiments conducted at the Mariano Marcos State University, City of Batac, Ilocos Norte from 2008–2016 garlic season and the average production data from the province of Ilocos Norte (2006–2016) were considered in the analysis. The yield was correlated with the air temperature gathered from the MMSU-PAGASA Agrometeorological Station (18° 3' N latitude, 120° 32' E longitude at an elevation of 17 m AMSL) in the City of Batac, Ilocos Norte and in Laoag City Synoptic Station (18° 11' N latitude, 120° 32' E longitude at an elevation of 5 m AMSL). Likewise, the yield was correlated with the degree of purple blotch damage to the plants.

Results showed that air temperature and purple blotch damage were negatively correlated and significantly affected the size and weight of the bulb. These indicate that the lower the mean air temperature i.e. <25°C and the slighter the purple blotch infection or damage during the bolting stage of the plants, the bigger and heavier bulbs it produced ensuing higher yield of garlic.

Keywords: purple blotch, Ilocos white garlic, temperature for garlic, garlic yield

AS - 20

IMPROVEMENT OF PHILIPPINE 'CARABAO' MANGO BY PAIRING AND CLIPPING METHOD OF HYBRIDIZATION WITH MARKER-ASSISTED SELECTION

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'Carabao' mango (*Mangifera indica* L.) is one of the most important commodities in the Philippines. It is the country's only export variety, is one of the best varieties in the world. The export potential of this variety is hampered by its short shelf life, susceptibility to pests and diseases and preference of European and Asian countries in mangoes with red-blushed skin. This study was undertaken to produce improved mango varieties with thicker peel and red blush color of skin and resistance to insect pests and diseases through conventional breeding by pairing and clipping method of hybridization with marker-assisted selection method. Potential mango trees were sprayed with calcium nitrate ($CaNO_3$) to induce flowering of mango tree. Thirty (30) trees were sprayed with a mixture of 5% $CaNO_3$, Dithane and Tween 20 using a power sprayer. Flowers/panicles of 'Carabao' mango strains and selections were used mainly as female parents while 'Carabao' mangoes and other mango varieties with the desired characteristics like thick peel, red blush and/or resistance to anthracnose and fruit fly were used as male parents. Thirty-four (34) F1 seedlings were produced from 710 crosses, 132 of which were reciprocal crosses. The first batch, comprising of 17 F1 seedlings, underwent hybridity testing using Min-221 and Min-253 simple sequence repeats (SSR) markers. Four were identified as hybrids and currently being maintained and evaluated at the Fruits Breeding Nursery IPB, UPLB. The improvement or development of hybrids will boost the Philippine mango export industry and consumer acceptability.

Keywords: 'Carabao' mango, conventional breeding, hybrids, red blush

AS - 21

ENDEMIC ORCHIDS OF MT. KIAMO, BUKIDNON

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This study aimed to inventory the endemic orchid species of Mt. Kiamo, Bukidnon and classify its local status. Data gathering were done on the montane forest and an exhaustive sampling (alpha taxonomy) was done from base to peak of the mountain. Assessment of the endemicity was based on Cootes (2011) and Fernando et al. (2008) while local status was based on Panal et al. (2015). The study recorded 21 endemic orchid species belonging to 12 genera. Among the 12 genera, Bulbophyllum, Ceratostylis, Dendrobium and Mycarathes were the most speciose with 3 species each, followed by Dendrochilum with two species, and the rest were represented only by a single species. Locally, most of the observed species are rare, out of 21 species 15 (71.43%) are rare, 2 (9.52%) species are common and only 4 (19.05%) species are abundant. This result provides an insight for conservation of the orchid flora on this mountain and to the other remaining forested mountains in Bukidnon. It is further recommended to have survey at different seasons of the year, increase sampling effort to catch any as-of-now unidentified species. It is also highly recommended that the results of this study be made known to the community and concerned stakeholders to design strategies to conserve, preserve, protect and manage Mt. Kiamo forest resources particularly the orchids.

Keywords: endemic, orchid, Mt. Kiamo, Bukidnon

AS - 22

DArT MARKER-BASED GENETIC DIVERSITY ANALYSIS OF SELECTED SUGARCANE VARIETIES

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Sugarcane is an economically important crop grown for sugar and bioethanol. Commercial varieties are hybrids of the noble cane *Saccharum officinarum* and its wild relative *S. spontaneum*. Sugarcane breeding in the Philippines is focused on the development of new varieties with higher sucrose content and resistance to major fungal diseases. Evaluation of parents for crossing depends on the knowledge of the genetic diversity of available sugarcane germplasm. In this study, the forty-eight sugarcane varieties selected by breeders from Philippine Sugar Research Institute (PHILSURIN) and Sugar Regulatory Administration (SRA) were analysed thru genotyping-by-sequencing using Diversity Arrays Technology (DArT). Varieties were selected based on their sucrose content and resistance to downy mildew and smut diseases. Single Nucleotide Polymorphisms (SNPs) and Silico-DArT (presence/absence) dominant markers were developed using DArT-Seq. DArT-Seq employs genome complexity reduction method using methylation-sensitive restriction enzymes and Next-Generation Sequencing (NGS). Two dendrograms were constructed based on the SNP and Silico-DArT marker scoring data. Both dendrograms showed nine low-sucrose varieties grouping separately from commercial hybrids developed in the Philippines. High-throughput genotyping by DArT-Seq can be used in the genetic diversity analysis of available germplasm for breeding of more superior sugarcane varieties.

Keywords: sugarcane, single nucleotide polymorphisms, silico-DArT, Diversity Arrays Technology, genotyping-by-sequencing

AS - 23

HYBRIDITY TESTING OF EGGPLANT (*Solanum melongena* L.) F_1 PROGENIES DERIVED FROM PARENTALS WITH VARYING RESPONSE TO MOISTURE STRESS USING SSR MARKERS

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In a breeding program aimed at producing eggplant hybrids, it is essential to confirm that the F1 progenies are indeed products of the cross made between the two selected parents especially since eggplants are self-pollinating. This study focused on the hybridity testing of F_1 progenies derived from drought tolerant eggplant accession PHL 2778 and drought susceptible PHL 1602 in our effort to improve drought tolerance in eggplant. SSR markers were utilized in the determination of true F_1 hybrids. Genomic DNA was extracted from leaf samples; DNA quantity and quality were checked by agarose gel electrophoresis. DNA of the parental lines was amplified in PCR using SSR primers to facilitate polymorphism survey. PCR products were separated using non-denaturing polyacrylamide gel electrophoresis. SSR markers were considered polymorphic when each of the parents is represented by a distinct allele. These bands from both parents must be present in the progenies in order to be considered as true hybrids. Two hundred fifty SSR markers representing the 12 chromosomes of eggplant were screened, resulting in the selection of 7 markers that were able to discriminate between PHL 1602 and PHL 2789. These markers were used in hybridity testing of 35 F_1 progenies.

Of the 35 progenies tested, 37% were confirmed to be true hybrids, with % hybridity ranging from 71.43 to 100% attributed to the difference of results among markers. The seven polymorphic SSR markers were proven effective in hybrid identification, with efficiency ranging from 42.86 to 100%.

Keywords: eggplant, drought, hybridity testing, SSR

AS - 24

PHENOTYPING RICE (*Oryza sativa* L.) GENOTYPES FOR MORPHO-PHYSIOLOGICAL TRAITS ASSOCIATED WITH TOLERANCE OF SALINITY AT REPRODUCTIVE STAGE

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Salt stress is a major constraint across large rice production areas, especially in tropical coastal zones; because of the high sensitivity of modern rice varieties. Understanding the morphological and physiological traits associated with tolerance of salt stress provides the basis for improving yield and quality, and for sustaining productivity of saline areas. A set of 324 genotypes from a rice diversity panel and five checks (Pokkali, FL478, Jumbo Jet, IR29, and Rc222) were evaluated for salinity tolerance at reproductive stage based on morphological and physiological parameters. Four pre-germinated seeds were sown per pot then thinned to three plants per pot 2 weeks later, with water level raised to about 1-2 cm above soil surface. When seedlings were 21 d old, water was siphoned out and drained from the concrete tanks for 12 h, then flooded with either tap water (control) or saline solution (treatment) with an EC of 5 dS m^{-1} for 3 days, then raised to 10 dS m^{-1} and kept at this level until harvest. Salinity was monitored regularly and adjusted when necessary using NaCl and tap water. Salinity tolerance was highest in the aus and indica subpopulations, reflected as lowest injury scores of 6.3 and 6.4, respectively. K^+ concentration positively correlated with plant height, panicle length, chlorophyll concentrations, dry plant biomass, yield components, days to booting, and SES scores, while Na^+ concentration and Na^+/K^+ ratio positively correlated with grain yield, number of filled grain $panicle^{-1}$, and days to booting. Grain yield correlated negatively with SES scores, booting time, Na^+ concentration, and Na^+/K^+ ratio, but positively with spikelet fertility, tiller number hill-1, filled grain $panicle^{-1}$, 100 grain weight, and chlorophyll concentration. These findings help breeders to choose suitable donors for best trait combinations to develop genotypes tolerant of salt stress.

Keywords: mechanisms of salt tolerance, morphological and physiological traits, rice response to salt stress

AS - 25

VARIATIONS IN PHYTOCHEMICAL CONSTITUENTS AND ANTIOXIDANT ACTIVITY OF SELECTED PHILIPPINE NATIVE CORN VARIETIES (*Zea mays* L.)

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Native corn is an important staple for human food and animal feed in the Philippines; however the diversity and nutritional value among these native corn in terms of phytochemical content and antioxidant activity in the crop has not been investigated. Thus, the phytochemical constituents (total phenols, flavonoids and carotenoids) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity were determined in mature dried kernels of 46 Philippine native corn varieties collected around the country. Diversity analysis based on these antioxidant properties revealed significant variations among the native corn. The collection of was characterized to have, for every gram of dried corn kernel, means for DPPH radical scavenging activity of 0.64 %, phenolic content of 1.65 μg gallic acid equivalents, flavonoid content of 1.87 μg catechin equivalents and carotenoid content of 0.17 μg. Only the phenolic content was found to be significantly correlated with the antioxidant activity ($r=0.243$, $p<0.05$). The UPGMA cluster analysis based on antioxidant activity-phytochemical content and as supported by principal component analysis, revealed six distinct groupings among the native corn varieties. The data obtained can aid in breeding programs for the improvement native corn varieties with enriched phytochemical compounds and high antioxidant activities.

Keywords: DPPH, phenolic, flavonoid, carotenoid, native corn

AS - 26

DECISION MAKING OF FEMALE RICE WORKERS IN SELECTED BARANGAYS OF MALAYBALAY CITY, BUKIDNON, PHILIPPINES

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The study generally evaluates the decision making of female rice workers in three selected barangays of Malaybalay City, Bukidnon. Specifically, the study determines why women engage in rice production, to identify farm activities where they are mostly involved in decision making, to determine factors affecting their decision making and identify problems encountered by female rice workers in decision making.

A structured questionnaire was used to gather the data. The data collected include the socio-economic profile of the respondents, involvement in the farm decision making and problems usually meet in decision making. Descriptive statistics and logistic regression were employed to analyze the data.

Results showed that women engaged in rice production primarily to provide for the basic needs to the family such as food and clothing. Secondly is to lessen labor cost of working in their own farm. Female respondents were found to do the decision making on areas in land preparation, planting, nutrient management, pest management, weed management and other activities like number of laborers needed and their wages, time of harvest, manner and venue of product disposal. In the logistic regression analysis, age and family size were found to significantly affect farm decision making of women at five percent and ten percent levels of significance, respectively. Furthermore, this means that younger women and those who belong to bigger families have higher probabilities of getting involved in farm decision making. However, problems such as financial constraints in farm production would likely influence their decision making. Most of them claimed that working in the farm is dangerous, do not have safety equipment to do different farm activities, and finally lack of marketing facilities and marketing outlets.

Keywords: socio-economic, production, decision making, worker

AS - 27

Dillenia philippinesis R. (KATMON): HARNESSING ITS POTENTIAL FOR FOOD

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Dillenia philippinensis R. is one the endemic yet underutilized tree species that abound in the country. It is wild-crafted and can be seen naturally-growing in Philippine forests or along river banks in some distant municipalities of Quezon province thus unknown to many is the nutritional value of its fruits for food and even for livelihood. This paper aims to highlight the products that can be made from Katmon fruits, their nutritional content and consumer acceptability among urban consumers. Product development was carried out through a hands-on training of rural women's groups from three municipalities of Quezon province, on processing Katmon fruits using UPLB-developed procedures. Nutrient content of the products were analyzed. Consumer acceptability of the products was done through a sensory evaluation of at least 50 potential urban consumers per product. Products that can be developed from Katmon fruits include among others juice, jam, jelly, pickles, candy roll and dried powder for soursoup. Fresh katmon fruits contain 4mg vitamin C per 100 grams edible portion while every 250ml bottle of processed katmon juice contains 5 mg of Vitamin C. Sensory evaluation by potential urban consumers showed very high acceptability of 56% for katmon juice, 67% for Katmon jelly and 60% Katmon candy roll. In conclusion, katmon fruits can be developed into a variety of nutritious and potentially-sellable food products. The nutritional and economic benefits that maybe gained from developing Katmon food products should be harnessed to its full potential especially in areas where the fruits abound yet remain a wasted resource.

Keywords: *Dillenia philippinensis Rolfe*, Katmon, consumer acceaptability

AS - 28

TRANSFORMING THE LOWLY '*KAMANGEG*' (*Dioscorea luzonensis*) INTO AN ECONOMICALLY-IMPORTANT CROP

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Rootcrops are said to be the last frontier to feed the ever-growing population. This project focused on *Dioscorea luzonensis*, a lesser-yam, locally known as '*kamangeg*', which abound naturally in the wild. For while it is true that said yam could augment food gap during the lean months it is disturbing to note that harvesting practices alone poses environmental pressure to the upland ecosystem, and utilization is limited to traditional preparations, hence, this project aimed at developing a technology to domesticate the crop and explore alternatives for its consumption.

Thus, it was found that '*kamangeg*' can be domesticated and that yield could be increased through proper cultural management practices. Further, its utilization could be enhanced by processing it into flour and various food products of which are very acceptable to consumers. Aside from the high nutritive value of '*kamangeg*', the resulting flour is low in gluten, thereby, a market niche is on hand.

Generally, there is high potential of '*kamangeg*' not only in augmenting the food gap during lean months but more so as commercial crop. With this, the marginal areas could be utilized for the government's call to spur production towards food sufficiency.

Keywords: lesser-yam, marginal, indigenous, *kamangeg*, exotic

AS - 29

EFFECTS OF HORMONE PRE-TREATMENTS AND VARYING PHOTOPERIODS IN THE SOMATIC EMBRYO INDUCTION OF COFFEE (*Coffea arabica* L.)

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Somatic embryo (SE) induction is one of the most critical stages in the somatic embryogenesis of coffee. The effects of pre-treating coffee leaf explants with the hormones Naphthaleneacetic acid (NAA) and Kinetin and varying photoperiods in the SE induction of *Coffea arabica* var. Typica were investigated. The leaves were sterilized, and then soaked in 0.1 ppm NAA and 0.5 ppm Kinetin solution for two different pre-treatment durations: 12 and 24 hours. Another set of explants remained untreated to serve as control (without hormone pre-treatment). The pre-treated explants were cultured abaxial side up in a direct embryogenesis induction medium. The inoculated explants were subjected to complete darkness, 24 hours continuous light, 12h/12h light/dark and 16/8 light/dark photoperiods. Each treatment combination consisted of 30 samples. The experiment was replicated twice and performed according to a split plot design in CRD with two factors. SE induction was observed directly from the edges of the explant after 60 days. The results were analysed using two-way ANOVA and comparison of means was determined using DMRT.

Hormone pre-treatment of 12 hours under complete darkness showed the highest percentage of SE induction (94.6%), while the lowest and the slowest response was obtained in the pre-treatment of 24 hours under continuous light (40.4%). The study revealed SE induction of coffee is affected by photoperiod and plant growth hormone pre-treatment. Soaking the explants at 0.1 ppm NAA and 0.5 ppm kinetin solution for 12 hours subjected to complete darkness can be considered as the best condition in the SE induction of *C. arabica* var. Typica.

Keywords: coffee, somatic embryo, induction, plant growth hormone, photoperiod

AS - 30

EXPLORING MODES OF COMMUNITY-BASED GENEBANKING FOR CONSERVATION OF RICE GENETIC RESOURCES IN QUIRINO, ILOILO, ANTIQUE AND DAVAO ORIENTAL PROVINCES

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An inventory of rice and rootcrops in six sites, done through community interviews and focus group discussions (FGD) led to the identification of more than 300 traditional rice varieties across focus sites in the provinces of Quirino, Iloilo, Antique and Davao Oriental provinces. Local production, post-harvest, seed storage and conservation practices were assessed with the communities during conservation field schools with rice farmers.

To improve local conservation practices, raise awareness on conservation and to put communities in-charge of the conservation of their own plant genetic resources for food and agriculture, community genebanks were initiated, combining technical recommendations, local practices, traditions and resources. These were designed and managed according to the unique institutional and socio-cultural context of each community. Models of community genebanking for rice were developed, namely Ilongot tribe-inspired structure constructed by farmers and managed by women farmers as curators in barangay Wasid, Nagtipunan, Quirino province; Ifugao-inspired structure constructed and managed by the village local government and farmer leaders in barangay Jose Ancheta, Maddela, Quirino province; and local government-managed community genebanks and duplicate collection held by households, built on the local system of seed exchange in the Central Panay Mountains.

Keywords: community genebanks, traditional knowledge, rice and root crops, traditional varieties

AS - 31

FIELD SCREENING OF EGGPLANT (*Solanum melongena* L.) FOR WATERLOGGING TOLERANCE

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Eggplant is highly affected by environmental stress such as drought and waterlogging. To identify possible elite eggplant genotypes with waterlogging tolerance, 23 eggplant accessions were screened for waterlogging response under field condition in Tranca, Bay, Laguna. The plants were subjected to 2 water regime treatments: control and waterlogging. Waterlogging was imposed on six-week old plants for 10 days at a depth of 5cm above soil surface. After the waterlogging treatment, a recovery period of 10 days was imposed by draining the water to determine whether their growth will normalized after the stress is being lifted. Plant samples were processed and measured for different parameters such as biomass partitioning, root length, root volume and plant height. Results of the field trial showed adverse effect of waterlogging on morphological characteristics of eggplant such as biomass partitioning of the leaves, stem and roots as well as on plant height as indicated by significant reductions in the measurement of these characteristics ranging from 2-88%. Eggplant accessions were then ranked based on percent reduction for each plant character measured as well as the correlation coefficient of the character in relation to total shoot dry matter. In the absence of yield, total shoot dry matter was considered as the prime plant character affected by moisture stress. Eighteen (18) eggplant accessions ranked even higher than the commercial variety, 'Dumaguete Long Purple' (DLP). The top five performing eggplant accessions include PHL 1345, PHL 12097, PHL 5764, PHL 1620 and PHL 6388. PHL 9391 ranked the lowest due to higher reduction ranging from 29-79% for most of the morphological characteristics measured.

Keywords: Eggplant, waterlogging, waterlogging tolerance, field screening

AS - 32

GRAFTING TECHNOLOGY ON CUCUMBER, BITTER GOURD, SWEET PEPPER AND EGGPLANT FOR YEAR-ROUND PRODUCTION

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A project of three components: screening of solanaceous and cucurbits as rootstock for disease resistance, field evaluation of grafted plants and technology promotion was conducted from April 2012 to July 2015 at BPI-LBNCRDPSC.

The disease screening resulted to the identification of, three hot pepper, three eggplant, one wax gourd, four sponge gourd, two squash and two bottle gourd accessions which exhibited varying levels of resistance and were used in grafting.

Field evaluation revealed that tube grafting in Solanaceous and hole insertion method in cucurbits were the recommended techniques in terms of survival in the field and yield performance. Technology verification through on-farm trials in Laguna, Quezon and Cavite plants proved that there were 15 to 20 percent damage losses in using grafted plants in all trial sites while 25 to 35% in non-grafted plants which showed a yield advantage on using grafting technology on cucumber, bitter gourd, sweet pepper and eggplant.

Five batches of training were conducted in Liliw, Tiaong, Alfonso, Los Baños and Baguio City with a total of 259 participants composed of farmers, technicians and researchers. Hence, IEC materials were developed and distributed to all participants and visitors of the Center for technology promotion.

Therefore, grafting of vegetables is a feasible technology especially during off-season to attain year-round production. Thus, continuous promotion through training and technology transfer activities is necessary.

Keywords: grafting technology, rootstock, scion, disease resistance

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IMPROVEMENT OF MAIZE FOR WATERLOGGING-PRONE AREAS IN THE PHILIPPINES

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Synthetic populations from native maize inbreds with possible adaptation to water stress is one means to develop stress tolerant varieties. In this study, 2 maize synthetics were developed and tested to identify genetic material with waterlogging tolerance. The first population was formed by inter-mating 10 white S1 native maize lines with waterlogging tolerance. The second population was developed by inter-mating 5 colored S1 maize lines. Balanced bulk from the ears produced from both populations were planted to produce 214 half-sib populations. Two hundred seven of these half-sibs (or synthetic lines) were screened for waterlogging tolerance under field conditions in Sta. Barbara, Pangasinan. Grain yield (at 14% seed moisture), number of plants with adventitious roots, average number of adventitous roots per plant, date to tasseling, stand count after waterlogging treatment, number of ears, ear length, ear diameter, fresh weight and absolute grain weight significantly differed among the lines. Grain yield ranged from 0 to 3.69 t ha^{-1}. Correlation among the agronomic characters with the yield of the maize synthetics were mostly positively linear. Genetic variation for yield, number of plants with adventitious roots, number of ears, ear weight and grain weight were higher compared to the other characteristics. These differences are expected to be adequate to discriminate the waterlogging tolerant from the susceptible synthetic lines. Waterlogging tolerant lines were identified.

Keywords: waterlogging tolerance, synthetic population, inbred

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MORPHO-PHYSIOLOGICAL TRAITS ASSOCIATED WITH TOLERANCE OF IRON TOXICITY DURING SEEDLING STAGE IN RICE

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Iron toxicity is a major abiotic stress affecting rice productivity on about 50% of lowland valleys in Africa and large areas in Asia. Successful breeding for iron toxicity tolerance essentially requires detailed understanding of the traits and genes associated with tolerance to identify good sources of tolerance.

Twenty-two rice genotypes with contrasting tolerance obtained from AfricaRice germplasm were subjected to 300 ppm Fe^{2+} in a hydroponic solution during seedling stage and evaluated for morpho-physiological traits that contribute to iron toxicity tolerance.

IR841, Suakoko 8, CK90, and CK801 were considered tolerant. Iron toxicity significantly reduced photosynthetic rate, stomatal conductance, and transpiration. Correlations between intercellular CO_2 and stomatal conductance, and transpiration rate and intercellular CO_2 were positive. Leaf temperature correlated negatively with stomatal conductance, intercellular CO_2 and leaf fluorescence.

The study identified key morpho-physiological traits associated with iron toxicity tolerance. These traits could be used to select donors for use in breeding high yielding rice genotypes tolerant of iron toxicity.

Keywords: rice, iron, toxicity, leaf bronzing

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SEED MUTATION BREEDING OF PINEAPPLE USING ETHYL METHANESULFONATE (EMS)

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Pineapple (*Ananas comosus* L.) is one of the few crops in which most cultivars are produced from spontaneous mutations and natural evolution. Mutation-assisted breeding techniques using ethyl methanesulfonate (EMS) is one way of generating a variety of mutants. Therefore, the experiment was undertaken to induce point mutation in pineapple shoots using seed EMS mutagenesis. Mutation experiment was conducted at the Institute of Plant Breeding, UPLB using Smooth Cayenne and the Queen variety. The two varieties were crossed and the seeds produced were treated with six (6) concentrations of EMS (0.25, 0.50, 0.75, 1.00, 1.25 and 1.50%). The materials were evaluated using IPGRI descriptor for pineapple for five (5) qualitative traits: plant habit, foliage attitude, leaf color, spine distribution and spine color; and two (2) quantitative traits: plant height and number of leaves. Phenotypic diversity was determined by calculating the Shannon Weaver diversity index (H). Among the treatments, 0.75% EMS showed the highest diversity for the seven (7) evaluated traits with H=0.84 and 0.25%EMS treatment having the least diversity (H=0.64). The average range of diversity of the materials is from 0.64 – 0.84 and an overall mean of 0.73 ± 0.06 indicating a high genetic diversity. This range of diversity can be exploited a good source of possible novel genetic mutation. With the publication of the pineapple database, primers can be designed to screen targeted genes for induced point mutations.

Keywords: pineapple, mutation breeding, ethyl methanesulphonate (EMS), Shannon Weaver diversity index

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YIELD PERFORMANCE OF HYBRID MAIZE AND ITS CORRELATION WITH TEMPERATURE, RAINFALL, RELATIVE HUMIDITY AND SUNSHINE

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The study aimed to investigate the performance and effect of climate at different growth stage on yield of rainfed hybrid maize cultivars. The experiment was conducted in the Demonstration Field of Isabela State University in Cabagan, Isabela during the 2013-2015 dry and wet seasons using randomized complete block design with three replications. Three hybrid cultivars were used namely Monsanto's DK9132, Pioneer's P30T80 and Syngenta's NK8840. No fertilizer was applied but best cultural management practices were implemented in the entire growing period. Daily weather data during the growing periods were collected at the nearest Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) of the experiment site located in Tuguegarao City. There was no significant differences between cultivars, yield ranges from 0.94 to 3.40 t/ha. There was significant difference across season - dry season (1.28 t/ha) had lower mean yield compared to wet season (3.67 t/ha). Moreover, results showed that average temperature, rainfall and sunshine during the vegetative to reproductive (0-60DAP) (0.71, 0.70, and 0.66), reproductive to maturity (60-120DAP) (0.54, 0.69 and -0.49) and vegetative to maturity (0-120DAP) (0.68, 0.69 and 0.49) were significantly correlated with yield. There was significant negative correlation between yield and relative humidity during the vegetative to reproductive (-0.71) and the entire growing period (-0.57). The linear relationship observed suggest that the increase or decrease in the average temperature, rainfall, relative humidity, and sunshine scenarios during different growth stages could affect hybrid maize production. The findings are important in developing adaptation techniques to help maize farmers.

Keywords: maize, climate, yield, correlation analysis

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ASEXUAL AND SEXUAL PROPAGATION OF ELEPHANT FOOT YAM

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Elephant foot yam (EFY) is one of the underutilized crops in the country but cultivated as food crop in Surigao. Its germplasm are valuable for crop improvement which requires sufficient seed for evaluation. This study aimed generally to propagate different EFY accessions and specifically to develop propagation techniques and evaluate the seed yield from sexual and asexual propagation . True seeds were used for sexual propagation and corm sett for the asexual propagation. Three sett sizes, 100g, 200g, and 300g depending on the accession's corm size were studied at CMU-AES from May 2015 to September 2016. Direct seeding in furrows was adopted for sexual propagation while vertical planting of sett in furrows was done among three sett sizes for asexual propagation. The accessions were arranged systematically in separated block for each sett size. Descriptive statistical tool was used. Results revealed that using different accessions propagated by corm division, the highest percent survival and average number of cormels were obtained from 300g sett size while the 100g sett size gave the highest seed yield and heaviest corm weight. The 200g sett size gave an intermediate result. However, using similar accessions across three sizes, the 200g sett size exhibited a slight variation on seed corm size and percent survival. Sexual propagation thru direct seeding gave poor results as affected by adverse drought condition.

Keywords: Elephant foot yam, propagation, technique

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FIELD PERFORMANCE OF MUNGBEAN GERMPLASM [*Vigna radiata* (L.) WILCZEK] UNDER ORGANIC PRODUCTION SYSTEM

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The versatility of mungbean in intercroping, crop rotation, and nitrogen fixation can be very valuable in organic production systems. Identifying potential mungbean varieties for organic production system can contribute to the optimization of organic agriculture. Thus, mungbean accessions and Pag-asa check varieties were evaluated under organic condition focusing on yield performance, pest and disease reactions and seed characteristics. "Pag-asa 17" showed consistent high yield (1.7 t/ha) during the dry and wet seasons in comparison with the varieties tested. 27 accessions were selected from a total of 521 germplasm evaluated, Yield performance of these entries ranged from the targeted 1-2 t/ha and an average of 30% yield advantage over the highest yielding check varieties. Reactions to pests were moderately susceptible for aphids, *cercospora* leaf spot, and cutworms. The number of seeds per pod ranged from 11 to 13 with medium to large sizes. Among the top selections adaptable to organic crop production system were 151913, 152412, 152378, 163018, 163012. These selections shall be subjected to further evaluation and hybridization to specifically identify and design an organic mungbean ideotype.

Keywords: mungbean, organic plant breeding,

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HORTICULTURAL DIVERSITY OF *Solanum lasiocarpum* DUNAL IN ADAMS, ILOCOS NORTE

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Solanum lasiocarpum ("balbalosa") is a wild vegetable growing in the mountainous town of Adams in Ilocos Norte. The fruits are cooked into the Ilocano dish pinakbet, and now gaining popularity as an exotic vegetable dish. No formal characterization is done yet on the species. Hence, this study characterized, assessed variability and identified accessions with outstanding plant characteristics and good eating qualities. Phenotypic diversity was estimated using the standardized Shannon Weaver's diversity index (H') and clustering was done in NTSYS.

Variations in the plant and fruit characteristics were observed. The qualitative and quantitative characters registered a mean H' of 0.47, suggesting moderate variability. The 30 accessions studied are grouped into 11 distinct clusters. Sixteen accessions appeared to be a duplicate of one and/or the other in the dendrogram for qualitative characters.

Four accessions were identified promising for having good eating qualities. These have fruits with smooth peel, 5.5-5.7 °Brix and are yellow green and shiny. These are growing in Purok 3 (Accn 2 and 4), Buwaw (Accn 22) and Cadisan (Accn 29). Two more years of evaluation is required to consider them fit for recommendation as outstanding mother plants for crop improvement. Research results are necessary for subsequent varietal development, conservation and protection initiatives on the species.

Keywords: *Solanum lasiocarpum*, phenotypic diversity, cluster analysis, eating qualities, morphological characteristics

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INTRAVARIETAL VARIABILITY ASSESSMENT OF *Cosmos sulphureus* IN REGION IVA

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Cosmos sulphureus, also known as "Sulfur Cosmos or Yellow Cosmos", is an annual half-hardy herb belonging to the family *Asteraceae* which usually bears yellow, pink, or orange ray florets. The richness in the antimicrobial and antioxidant activities of this plant can be a potential source for antioxidant drugs and cure to some infectious and chronic diseases. Aside from its biopesticidal properties to control different pathogen strains and insect pests, this plant can be used as borders or potted plants in landscaping. The aesthetic value of this crop has not been fully explored in the Philippines therefore there is a need to characterize *C. sulphureus* accessions. Seven selected cosmos accessions collected in Region IVA were evaluated on the basis of 27 morphological traits, 16 of which are qualitative traits. Most cosmos accessions had medium stem pubescence and leaf color intensity, upwards head attitude, daisy disc type, ligulate and weakly incurved ray floret with medium apex incision. The plant height ranged from 70.47 to 111.66mm with accession 5 being the tallest. Only accession 1 collected from Laguna exhibited an upright growth habit and had collar segments in their flower head. Moreover, its yellow ray florets were curved along its entire length with deep incision in the apex. The height of this accession makes it more desirable for use as bush type plants in landscaping. Two collections from Tagaytay City, Cavite were observed to have longer peduncle length and wider floral diameter as compared to those accessions collected from Laguna. Assessment of variability will be very useful in enriching the cosmos germplasm and utilizing these valuable accessions for beautification and creation of diversity.

Keywords: aesthetic, accessions, *Cosmos sulphureus,* variability

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MECHANISMS ASSOCIATED WITH IRON TOXICITY TOLERANCE IN RICE DURING SEEDLING STAGE

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Excessive iron in soil is prevalent in perennially flooded lowland rice ecosystems due to reduction of insoluble Fe^{3+} to the bioavailable Fe^{2+} under anaerobic and acidic soil conditions. *Oryza glaberrima* (African rice) is considerably more tolerant of iron toxicity than *Oryza sativa* (Asian rice). Iron toxicity adversely affects plant growth and could result in seedling mortality and yield losses. Four genotypes of contrasting responses to iron toxicity were evaluated under control and excess iron (300 ppm Fe^{2+}) using hydroponic solutions in greenhouse conditions. Measurements taken included morphological and physiological traits. CK801 was least affected by iron toxicity while IR64 and Supa showed intense leaf bronzing. Excess iron resulted in stunted growth, with reduction of 69%*** and 75%*** in lengths of shoot and roots, respectively, across genotypes. Photosynthesis and transpiration were dampened under iron treatment, with the tolerant genotypes CK801 and Suakoko 8 being less inflicted. Malondialdehyde concentration was 7 fold higher under stress, and substantially higher in the sensitive genotypes Supa and IR64, indicating greater cell injury. Tolerant genotypes produced higher concentrations of antioxidants and increased activities of related enzymes. Conspicuous suberization and lignification was observed in the roots of the tolerant Suakoko 8 under stress. Understanding the physiologal traits associated with rice response to iron toxicity will facilitate breeding varieties adapted to soils containing toxic concentrations of iron.

Keywords: *Oryza glaberrima*, lowlands, problem soils, breeding

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SCREENING AND EVALUATION OF TOLERANCE TO COMPLETE SUBMERGENCE IN A DIVERSE PANEL OF RICE (*Oryza sativa* L.)

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This study was carried out to screen a panel of 311 accessions of rice for submergence tolerance to flooding stress and identify possible donors among the rice sub-populations included in the panel. The experimental design was randomized complete block design with two replicates each for non-flooded and flooded conditions. Fourteen-day-old seedlings were submerged in the submergence plot. The water depth was maintained for a period of 12 days by adding water regularly. Observations for survival, shoot and root length, dry weight, and percent chlorophyll were recorded before and after submergence. Accessions from the Indica, Aus and Temperate Japonica sub-populations showed approximately 40% survival while the Admix, Tropical Japonica and Aromatic subpopulations showed much lower (0-5%) survival. Slight increase in shoot dry weight and root dry weight were observed for all sub-populations but found to be higher in Aus and Temperate Japonica. In addition, all sub-populations exhibited extreme drop of photosynthetic pigments during complete submergence. Increased root growth during complete submergence were found to be prominent in Aus, Indica and Temperate Japonica. No significant correlation was observed between seedling survival and shoot elongation since survival results leaned towards sensitivity. However, low but significant correlation was observed between survival and photosynthetic pigments while both seedling vigor and photosynthetic pigments showed good association with root traits. Varieties which exhibited good tolerance to submergence stress were considered for further studies such as identifying alleles for use in marker-assisted breeding.

Keywords: complete submergence, tolerance, marker-assisted breeding, alleles

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MANGROVES EXTRACTION IN PASUQUIN, ILOCOS NORTE USING LiDAR DATASET

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Mangroves help in the stabilization of coastal lines, habitat for animals and as alternative resource. Due to this, restoration and rehabilitation are usually being conducted in the areas they are planted. Due to availability of LiDAR data, the inventory of this resource could be produced to high resolution maps. Therefore, the objective of the study is to extract mangroves using LiDAR dataset in Pasuquin, Ilocos Norte. The derivatives used for the map extraction were Digital Surface Model (DSM), Digital Terrain Model (DTM), Canopy Height Model (CHM), canny edge, slope, slope of slope, number of returns, hillshade and intensity. The data was processed in the eCognition software for object based image analysis. Segmentation was used first to separate the objects in order to have easier classification. Then training points for prospect mangrove objects were done in GIS. After that, support vector machine (SVM) was done to classify the image layers. This machine as a linear classifier utilizes the maximum factor to separate objects. The layer derivatives applied in SVM were values of mean, standard deviation, mode and texture values. The basis for validation points used for accuracy assessment of the extracted mangroves was the actual field structures. The structures were tracked using a Global Positioning Device. The overall accuracy using Error Based matrix based on Test Training Mask is 0.991 and Kappa Index of Agreement is 0.9751607 respectively.

Keywords: lidar, mangroves extraction, support vector machine, object based image analysis

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YIELD VARIATIONS OF NATURAL KAWAYAN TINIK (*Bambusa blumeana* J.A. & J.H. SCHULTES) STANDS IN ILOCOS NORTE, PHILIPPINES

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Improvements in processing technologies and expansion of markets for *kawayan tinik* products had increased the demand for bamboo poles resulting in overcutting and rising prices of poles. Efficient management of existing stands is necessary but information on the growth and yield of these stands is lacking. Thus, a study was undertaken to determine the culm, shoot and biomass yields of natural stands of *kawayan tinik* growing on various locations in Ilocos Norte and evaluate the effects of physiographic, edaphic and stand variables on the productivity of these stands.

Stratified sampling was used in selecting representative towns and barangays. Sample clumps were located along roads, along creeks, on backyards and on hilly areas. Clump diameter and culm characteristics (number of shoots and culms, and the biomass of culms and shoots) were measured. Selected physiographic and edaphic characteristics of the sampling locations were also determined.

Clumps growing along creeks had the biggest clump diameter, highest number of culms and biomass yields while those on hilly areas had the smallest clump diameter and lowest biomass yields. In addition, clumps along creeks have better culm, shoot and biomass yields due to the interrelationships of more favorable growth factors such as availability of moisture, moderate slope, lower elevation and better soil characteristics. Results imply that areas along creeks are more favorable for the growth and yield of kawayan tinik. This information can be used as basis in crafting management schemes for natural *kawayan tinik* stands in the province.

Keywords: biomass yield, culm and shoot production, hilly areas, physiographic location

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TREE OWNERS' PRACTICES AND PREFERENCES RELATING TO DESIRABLE TREE FORMS OF *Gmelina arborea*

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In Nueva Vizcaya, people are widely planting Gmelina (*Gmelina arborea* Roxb.), an exotic species that has become naturalized in the locality. In fact, it is the most important timber species in terms of current contribution in wood supply and the available timber stocks in almost all lands where people plant trees. Seeing possible supply problem in the future because the rate of planting is not making up for removal, there is a need to revitalize attention to efforts toward increasing wood yield in either individual tree or stand.

As every tree owner would prefer an ideal timber form that converts well to lumber, i.e., long, relatively thick stem and branchless, traits that would constitute alternative timber forms were presented to survey respondents because the ideal timber form is not always attainable in tree planting situations where control of tree growth and development is wanting such as in roadside planting, property boundaries and in wide-spacing situation.

A number of variables pertaining to tree owners' practices and perceptions and the characteristic of their stands appeared to be associated with their preferences on timber form. Examples are regeneration techniques, occupation, education, crown diameter and silvicultural practices. The findings of the study are good inputs in tree improvement process that is aimed at increasing wood yield through simple silvicultural treatments that ordinary people can do.

Keywords: *Gmelina arborea*, tree species selection, plantation silviculture

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CONSIDERING TREE OWNERS' PRACTICES AND PREFERENCES IN DEFINING THE TIMBER IDEOTYPES OF *Gmelina arborea*

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Gmelina (*Gmelina arborea* Roxb.) is the most widely planted tree in the province of Nueva Vizcaya. Its role in local wood supply has become more important as consequence of the ban on harvesting naturally growing timber. More than 90% of the wood supply is gmelina. Wood is coming from different planting configurations such as solitary trees, home gardens, road sides, riparian strips, small stands, and large plantations.

While gmelina appears to the most important tree in meeting local demand for wood, the yield per hectare is low due to poor tree management. Survey results indicate great potentials for tree improvement with effort coming from the tree owners themselves and supported by scientific approach in tree improvement. As one of the initial steps towards increased wood yield in individual timber or tree stand, research on ideotype, or conceptual model of an ideal plant, promises to play a key role.

Between-tree-traits relationships were investigated in order to see what traits might be subjected to simultaneous improvement. Many significant relationships came out that would lead to defining the desired tree forms. For example, long and unbranched bole is associated with relatively thin crown stem, small crown and circular bole, while short bole tends to be associated with large crown and presence of upright branches that are suitable for sawing.

Keywords: *Gmelina arborea*, timber ideotype, model tree form

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EFFECTS OF COW DUNG ASH-SUPPLEMENTED MEDIA ON THE MICROPROPAGATION OF BANANA (*Musa acuminata*, Colla) CV. LAKATAN IN THE PHILIPPINES

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Micropropagation of banana (*Musa acuminata*) cv. Lakatan was conducted using different concentrations of cow dung ash suspension as Murashige and Skoog (MS) medium supplements or inorganic macronutrient substitute. The objectives of the study was to determine the macro and micro nutrients present in the cow dung ash, assess the efficiency of different levels of cow dung ash supplements used in tissue culture medium on the growth of banana explant, and evaluate the performance of cow dung ash as substitute to the inorganic macronutrients component of the culture medium used in banana micropropagation. Out of five treatments used, analysis of variance indicated comparable shoot growth and leaf development of supplemented and replaced modified media with the standard medium. For the production of roots, highly significant subsequent rooting of plantlets in the medium with a mixture of 50% MS inorganic macronutrient and 50% cow dung ash was observed. The significance assessment was at 5% level.

In terms of cow dung ash nutrient content it was determined that the sample was composed of 3.536 x 103 mg/kg nitrogen, 2.4170 x 104 mg/kg phosphorus, 3.1831 x 104mg/kg potassium, 2.9931 x 104 mg/kg calcium, 2.9282 x 104 mg/kg magnesium, 134.75 mg/kg iron, 49.50 mg/kg manganese, 5.50 mg/kg copper, and 127.45 mg/kg zinc. The measured quantities of essential nutrients in cow dung ash show the sufficiency of the organic matter as supplement and inorganic macronutrient substitute to support in vitro growth of Lakatan plantlets.

Keywords: cow dung ash, shoot growth, leaf development, production of roots, nutrient content

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UNTYING THE GENETIC VARIABILITY OF *Peronosclerospora philippinensis* (W. Weston) C.G. SHAW FROM DIFFERENT LOCATIONS USING SPECIES SPECIFIC PRIMERS FOR IMPROVING CORN POPULATIONS

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Downy mildew (DM) caused by *Peronosclerospora philippinensis* is one of the most devastating diseases of corn attacking the host plant from seedling to mid-vegetative stage which can limit farmers yield for up to 80 – 100%. Still after the discovery of metalaxyl, no other control measures were effective in managing the disease. The economic and environmentally viable measure to suppress the disease is through breeding for resistance to DM. In this study a collection of corn germplasm were evaluated for resistance to DM and DM – infected samples either treated or non-treated with metalaxyl from different locations were analyzed for genetic variability using newly-designed primers MSPinITS1 F/R obtained from the internal transcribed region (ITS) 1 and CBPMisc28s F/R from the 28S region. Among the populations evaluated, UPLB Cn N15 with 18% disease incidence (DI), UPLB Cn N33 with 25.5% DI and UPLB Cn N17 with 27.0% DI that showed resistance to DM were continuously breed to improve the population. The primer pairs were found specific for *P. philippinensis* and *P. miscanthi* and reliable based on their gene sequences (KX252750 – KX252763; KX683373 – KX683376), % identity from other *Peronosclerospora* (88.6% - 94.3%), and unraveled the possible genetic diversity with 89.1 to 96.1% nucleotide sequence identity among isolates that would partly explain the various reaction of corn varieties planted on different locations, and can be used for monitoring possible spread of DM across borders that may pose risk to the exchange of germplasm.

Keywords: downy mildew, *Peronosclerospora*, corn, resistance, primers

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IMPROVING THE STORAGE AND SHELF-LIFE OF QUALITY PROTEIN MAIZE (QPM) THRU PROPER TREATMENT AND PACKAGING

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QPM is a type of corn claimed to be better animal feed than normal corn because of its high lysine and tryptophan contents. It is used as component for swine and poultry diet. Corn as feeds usually are stored for six months before it will be consumed to have readily available supply when needed. In this case poor storage condition may reduce the shelf-life of QPM into half and may result to earlier deterioration than normal corn. There was limited data on prolonging the storage life of QPM when compared to normal corn. Hence, this study was conducted to improve the shelf-life of QPM through appropriate treatment and packaging materials popularly used in normal corn storage. Specifically the study aimed to 1) assess the extent of insect damage and the incidence and severity of fungal infestation on stored QPM grains; 2) determine the most appropriate treatment and packaging materials for QPM grains. Four QPM hybrid varieties and non-QPM (check) varieties were used as tests crops. The study was arranged in 5 x 3 factorial in RCBD replicated three times Result revealed that SMQ 5050 incurred highest weight and viability loss under inoculated condition become tolerant under normal storage condition and slowly lost its viability compared to USM Var. 5 (non-QPM). Application of non-toxic seed treatment pirimiphos-methyl (Actellic®) and Diatomaceous Earth were successful in minimizing the occurrence of storage insects and aflatoxin level. SMQ 5007 and SMQ 5050 were less contaminated by aflatoxin while in storage under untreated condition. Laminated sack and plastic drum where found effective in lengthening the shelf-life of QPM and non-QPM seeds in storage.

Keywords: QPM, storage, Diatomaceous Earth, pirimiphos-methyl, seed treatment

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EFFECT OF GAMMA RADIATION, AGE OF PADDY AND PACKAGING MATERIAL ON THE STORAGE QUALITY OF BROWN RICE: SURFACE FREE FATTY ACID (FFA) DETERMINATION

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The effects of gamma radiation, packaging materials, and age of paddy on the surface Free Fatty Acid (FFA) content were determined using two different brown rice varieties, RC-160 and SL-7, packed in two different packaging materials, which were regular polyethylene bag, and Super bag irradiated at 0.5 and 1.0 kGy. Milled brown rice samples came from two-week old paddy (in Lot 1) and two-month old paddy (in Lot 2) and irradiated at the Co-60 Multipurpose Irradiation Facility, PNRI. The surface FFA content was obtained following the AOCS Official Method (1982) with some modifications. Analyses showed that the effects of variety, age of paddy and interactions of both were significant. The surface FFA of SL-7 variety was found to be significantly higher than RC-160 variety for all radiation doses. Likewise, Lot 2 paddy was observed to have higher surface FFA than Lot 1 paddy regardless of packaging material and radiation dose. The surface FFA of both varieties packed increased significantly up to the second (for RC-160 variety) or third month (for SL-7 variety) of storage and remained the same until the eight month. On the other hand, radiation dose did not significantly affect the surface free fatty acid content for all storage/ sampling time while the packaging material significantly interacted with the type of variety and radiation dose. Gamma radiation had no significant effect on the surface FFA at 0.5 and 1.0 kGy. Further analyses are needed to determine the action of gamma radiation to the integrity of the packaging materials.

Keywords: free fatty acid, brown rice, gamma radiation

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RAPID BIOASSAY FOR PESTICIDE RESIDUES (RBPR) FOR DETECTION OF RESIDUES ON VEGETABLES AND FRUITS

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Pesticide residues in raw agricultural commodities pose major concerns with regards to food safety. Rapid detection of pesticide residues can assist in consumer awareness and protection.RBPR is a rapid detection tool, based on Ellman's method, for the detection of organophosphate (OP) and carbamate (CM) pesticides residues.

Vegetables from different markets in Laguna, Quezon, Metro Manila and Benguet were sampled and analyzed for the presence of OP and CM residues. Out of 112 samples of organic labelled vegetables, 17 samples were positive (15.18%) and 7 out of 130 conventionally produced vegetables(5.38%) were positive to RBPR. Organic lettuce, tomato and conventionally grown bittergourd were the most frequently positive using RBPR test.

RBPR is a rapid detection tool useful in monitoring compliance to principles of organic farming and market collected samples for immediate action. RBPR is limited to OPs and CMs, the group of pesticides which are toxic acetylcholinesterase inhibitors and commonly used by vegetable farmers.

Keywords: Pesticide residues, organophosphate (OP), carbamate (CM), rapidbioassay for pesticide residues (RBPR)

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DELAYING THE RIPENING OF 'LAKATAN' BANANA (Musa AA) DURING SIMULATED DOMESTIC SEA TRANSPORT

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Over ripening of banana fruits after ambient sea transport from Mindanao to Manila are incurred during the summer or dry season. Effectiveness of ethylene adsorbent (EA) to regulate the ripening of 'Lakatan' was evaluated under domestic sea transport.

A trial was done simulating collection period of banana assemblers (2 days at ambient temperatures) and local sea transport (3 days at elevated temperatures). Matured 'Lakatan' fruits were harvested from Cavinti, Laguna and were left for two days at ambient conditions to simulate the delay in actual transport. Three days after harvest, fruits were packed in plastic crates (12 kg capacity) with newsprint liner and EA were inserted at varying amounts. This was followed by 3 days exposure to elevated temperatures (>30C) simulating the sea transport. Fruit evaluation was done 9-10 days after harvest.

Inclusion of EA resulted in significant delay in ripening of "Lakatan" fruits. Control fruits were all ripe and yellow 10 days after harvest while treatment with EA had fruits still at the green stages (CI 1-3). At least a 20-90% difference in volume of green fruits was gained with EA addition. The physico-chemical analyses (firmness, total soluble solids, pH) done corroborate with peel color differences indicating that fruits were at varying stages of ripeness.

Keywords: over ripening, ethylene removal, ambient sea transport

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BROWN RICE (*Oryza sativa*), GREEN MUNGBEAN (*Vigna radiata*), MALUNGGAY (*Moringa oleifera*), AND OKARA CRISPIE BAR

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The study developed a crispie bar using brown rice, mungbean malunggay, and okara. The okara and malunggay were dehydrated using the Multi-Commodity Heat Pump Dryer for 22 hours and five hours, respectively. These are mixed with brown sugar, honey, desiccated coconut, coconut oil, vanilla, and salt. A serving of the crispie bar provides 262.86 kcal, 4.61g of protein, 7.31g of fat, 44.99g of carbohydrates, 2.80g of fiber, 42.76mg of calcium, 103.36 mg of phosphorus, 1.60mg of iron, 192.61mg of potassium, 7.27mg of sodium, 0.61mg of zinc, 6.07µg of Vitamin A, B-vitamins, and 2.11mg of vitamin C. The observed shelf life of the product is three days refrigerated for the best eating experience. The product's selling price is Php76.89 with three servings per package. The results of the acceptability evaluation show that not less than 32 out of 60 of the evaluators liked the product extremely in aroma, appearance, taste, and texture.

Keywords: brown rice, green mungbean, Moringa, okara

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FOOD PRODUCT DEVELOPMENT OF AN ENERGY-DENSE VEGAN MUFFIN

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This study utilized okra as binder in making muffins. Other vegetables such as carrots and corn were also used to make the product healthier. Okra, corn and carrots were dehydrated for 10 hours using the Multi-commodity heat pump dryer. These are mixed with other dry ingredients such as, all-purpose flour, brown sugar, baking powder, and salt. Liquid ingredients used were soy milk, oil and calamansi juice, these were added one at a time. It was placed in small muffin liners, baked at 175 degrees Celsius for 30 minutes. One serving of the product contains energy (217.16 kcal), carbohydrates (31.16 g), protein (3.53 g), fat (8.9 g), fiber (5.90 g), calcium (55 g), phosphorous (48 g), potassium (168.96 g), sodium (296.92 g), zinc (0.13g), vitamin A (416.16 ug), thiamin (.25 g), riboflavin (0.21 g) niacin (0.73 g), and vitamin C (4.0 g). A total of 64 evaluators from different age group determined the acceptability of the product in terms of appearance, taste, texture and aroma. The study revealed that most of the respondents extremely liked the vegan product because of its attributes.

Keywords: okra, muffins, vegetables, heat pump dryer, vegan product

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DEVELOPMENT OF COMPOSITE EDIBLE COATING FROM JACKFRUIT SEEDS STARCH AND AGAR FOR *Lycopersicon esculentum var. cerasiforme*

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Post-harvest decay of perishable produce is mainly due to accelerated rate of respiration, transpiration and ripening as well as the microorganisms. The main objective of this study is to develop a composite edible coating from Jackfruit seed starch incorporated with agar and sorbitol to act as barrier to extend the shelf life of Cherry tomato (*Lycopersicon esculentum* var. *cerasiforme*) (CT). CT were coated with two formulations of edible coating at different concentration of Jackfruit seeds starch (JSS) 49.30%, agar 14.08%, sorbitol 36.62% (F1) and 52.63% JSS, 13.16% agar, 34.21% sorbitol (F2) and untreated samples (Control) stored at 20oC with 90-95% relative humidity for 21 days. Results showed that both formulations containing JSS edible coating effectively reduced weight loss and pH of the coated tomatoes compared to the control. However, F1 coated tomatoes had the least weight loss percentage and pH value among the three samples (8.70% and 4.4) after 18 days. The pH of the tomatoes coated and uncoated ranged from initial 3.90 to final pH 4.60 while weight loss percentage ranged from 1.30% to 9.49% after 18 days of storage. Mold growth was observed in tomato samples treated with F1 after 21 days of storage while the samples treated with F2 and the Control were observed after 15 days and 12 days, respectively. The effect of the composite edible coating found statistically significant in weight loss and pH ($p<0.05$). F1 composite edible coating effectively extended the shelf life of cherry tomatoes for 5 days longer than the standard shelf life of 14 days.

Keywords: starch, agar, composite edible coating, shelf life

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RETAINED NUTRITIONAL VALUES OF FRESH PINEAPPLE (*Ananas comosus*) USING THE MULTI COMMODITY HEAT PUMP DRYER (MCHPD)

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Pineapple is the world's third most important cultivated tropical fruit after bananas and citrus because of its nutritional contents and likewise in the locality of Cavite and Tagaytay. Generally, the study determined the retention of the nutritional contents of fresh pineapple after drying using the MCHPD. Specifically, to identify the retained important chemical constituents in grams after drying such as moisture, ash, energy, total fat, total carbohydrate, protein and calcium through proximate analysis. Pineapple fruits were directly bought at farm gate price from the farmers of Silang, Cavite. The fruits were thinly sliced at 1/8" and immediately loaded to the stainless trays of MCHPD at ideal drying conditions of 500C and 10.0% relative humidity located at the Nutrition Department Laboratory of the university. Pineapple drying lasted for 8.0 hours with retained color. The dried pineapple was submitted to the Food and Nutrition Research Institute (FNRI) of DOST for proximate analysis at 100 g per analyte. Report of analysis revealed the following results: moisture content in grams of pineapple was reduced to 3.7 from the 86.0 fresh water content; ash content (grams) was concentrated to 2.2 from the original content of 0.22 ; total fat(grams) was from 0.12 to 0.6 which indicated to be very good; total carbohydrate(grams) went concentrated from 21.6 to 89.3 ; protein (grams) went higher from 3.0 to 4.2 ; calcium (mg) was more concentrated when dried that is from 21.5 to 98.0 and calories (kcal) for dried went higher to 379 from 76. Therefore, drying pineapples using the MCHPD is very promising because of the retained nutritional values of the food product.

Keywords: Multi commodity heat pump dryer, pineapples, nutritional value

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EFFECT OF APPLIED PELLETIZED ORGANIC FERTILIZERS ON THE YIELD PERFORMANCE OF CORN (*Zea mays* L.) GROWN UNDER DIFFERENT SOIL CONDITIONS

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Molding composted animal wastes into pellets can improve the physical and chemical condition of soil. It allows for a more uniform and efficient application that releases nutrients slowly over time as crops need them. Raw materials (rice bran, rice ash, soya meal, carbonized rice hull, alumino-silicates, *Gliricidia sepium*) were used as additives to adjust the nutrient concentration of the compost products. These additives were added to swine and poultry manures and composted to maturity. The final compost products were fed to the molding machine and shaped into pellets. A plot experiment was conducted at U.P. Los Baños, Philippines to investigate the effect of pelletized organic fertilizers to corn (*Zea mays* L.) when applied to different soil conditions. The soils were collected from Batangas, Laguna, Quezon and Rizal Provinces. The soil series treatments were as follows: T1-Alipit Clay (*Typic Tropudalfs*), T2 Binangonan Clay (*Undorthentic Pellusterts*), T3 Sariaya Sandy Loam (*Cumulic Hapludolls*), T4 Lipa Clay Loam (*Typic Eutrudepts*) and T5 Ibaan Clay Loam (*Typic Eutrudepts*).

The yield performance of corn varied between treatments. At harvest time, highest yield of corn was observed in Lipa Clay Loam soil while Alipit Clay produced the lowest yield which was significantly different with other soil series. No statistical difference was observed on corn dry matter weight. Pellet organic fertilizer technology provided a gradual nutrient supply for a long period of time, which improves fertilizer use efficiency and reduces nitrogen leaching losses, as well as positive effects on both soil health and plant health.

Keywords: molded fertilizers, organic fertilizer, pellets, soil series

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EFFECT OF CORN COB BIOCHAR ON THE RATE OF CARBON SEQUESTRATION IN AN ACIDIC RED SOIL

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Biochar is a carbon (C) rich material obtained by thermal treatment of biomass under limited oxygen. Properties of biochar were highly influenced by pyrolysis conditions and raw material characteristics. It is highly stable and resistant to microbial decay which can be used as soil amendment. Carbon sequestration describes long-term storage of carbon dioxide or other forms of C to either mitigate or defer global warming. A laboratory experiment was conducted to determine the effect of corn cob biochar application on C sequestration rate in red acidic soil by measuring the carbon dioxide (CO_2) evolution in the biochar-amended soil. Biochar was applied at the rate of 10 t/ha. Ten treatments were added in Luisiana clay soil as follows: T1-soil only (control), T2-soil + biochar, T3-soil + *Gliricidia sepium* leaves, T4-soil + biochar + *Gliricidia sepium* leaves, T5-soil + rice straw, T6-soil + biochar + rice straw, T7-soil + inorganic fertilizer, T8-soil + biochar + inorganic fertilizer, T9-soil + organic fertilizer (5t/ha) and T10-soil + biochar + organic fertilizer.

Results showed that a faster rate of CO_2 release was observed in the first two weeks with peak at Day 2 and reduced thereafter in all treatments during the 12 weeks incubation period. The T3 had the highest amount of CO_2 evolved followed by T5, while T3 had its lowest. The biochar with inorganic and organic mixtures showed constant decrease in the CO_2 evolution. Results such as these showed that biochar addition can capture C into the soil even in short period of time and confirmed its use in the long term storage of atmospheric CO_2 that may mitigate or defer global warming.

Keywords: corn cob, biochar, CO_2 evolution, carbon sequestration

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CROP MANAGEMENT METHODS, WEED CONTROL, AND SEED RATES SUITABLE FOR ANAEROBIC GERMINATION TOLERANT LINES IN FLOOD-PRONE RICE ECOSYSTEM

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Rice is the staple food of more than half of the global population. However, sustaining adequate supply is becoming more challenging due to climate change, loss of land and labor to urbanization, and deteriorating natural resources. Direct seeding has been progressively adopted by farmers due to several benefits, but its large scale adoption is hindered by weed competition. Flooding after sowing offers selective advantage for rice over weeds, given that existing rice cultivars should have enhanced tolerance to anaerobic conditions during germination (AG). This study aims to assess IR64 lines introgressed with AG tolerance, under varying flood levels during germination (0, 2.5, and 5 cm water depth), weed control measures (weed-free, partial weeding, no weeding) and seeding rates (30, 45, and 60 kg ha-1), using either direct wet seeding (DWS) or dry direct seeding (DDS) under rain-fed lowlands. DWS effectively controlled weeds (by 40 %***) as compared to DDS. This is partly due to better seedling establishment under DWS with log fold change (logfc) of 1.01*** relative to DDS. Consequently, DWS resulted in higher grain yield of 1.11*** logfc compared to DDS. Survival and yield had strong positive correlations with tiller number and biomass, but negative association with weed population. The best treatment is DWS through broadcasting using 30 kg ha-1 seed rate, particularly for IR64-AG. Advantages of higher seeding rates are more apparent for DDS and mechanized wet direct seeding. Determining appropriate establishment methods combined with optimal crop management options and seed rates could potentially improve productivity and profitability of flood-prone rainfed lowland rice ecosystems.

Keywords: direct seeding, flooding, weed control, crop management

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IMPROVING CORN FARMERS' INCOME AND SOIL PROPERTIES THROUGH CORN-LEGUME CROP ROTATION

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The sustainability of corn production practices in the Philippines is becoming a serious concern as soil degradation intensifies due to continuous corn mono-cropping. Crop rotation in corn areas with grain legumes should in theory, improve the soil characteristics, decrease pest and disease incidence, and increase farmers' income. This study showed the advantages of crop rotation compared with continuous corn cropping system in terms of soil fertility and farmers' income. Yield trial experiments were conducted in four locations across the country (Laguna, Isabela, Cebu and Bukidnon). The experiments consisted of four treatments: T1 (continuous corn cropping), T2 (corn-mungbean crop rotation), T3 (corn-soybean crop rotation) and T4 (corn-peanut crop rotation). The result of the yield trials for two cropping seasons shows that corn yield under T3 was significantly higher than the other treatments in Cebu (4.14 tha-1) and Bukidnon (4.20 tha-1). However, there were no significant differences in corn yield across treatments in Laguna and Isabela. In all experimental sites corn-legume treatments exhibited higher net income compared to T1. In Cebu, T2 and T3 had an ROI advantage of 34.58 and 63.40% after deducting the costs of production. Similar trend was also observed in Bukidnon, where T2(18.78%) and T3(54.15%) advantage over T1. Meanwhile, in Laguna only T3 surpassed the check with 4.44% advantage and lastly in Isabela, T2 and T3 had an 18.92 and 54.15% advantage respectively over the check. In terms of soil properties, organic matter(%), available phosphorous(ppm), exchangeable potassium(cmol/g) and moisture content, results revealed highly significant difference compared to check.

Keywords: Corn (*Zea mays* L.), mono cropping, crop rotation

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ON-FARM RESEARCH TRIAL ON THE ADAPTABILITY OF JAPONICA RICE VARIETIES IN CAVITE

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Japonica rice commands high price rice due to its excellent eating quality. In the Philippines, it is not commonly grown because they are not adapted to tropical weather. Three Japonica rice was approved by NSIC for tropical cultivation: NSIC Rc170 (Maligaya Special 11 or MS11), NSIC Rc220 SR (Japonica 1) and NSIC Rc242 SR (Japonica 2). In this study, the agronomic performance of the three Japonica varieties was evaluated under the agro-climatic conditions of Cavite during the wet seasons (WS) of 2012 and 2013 and dry season (DS) of 2013.

The crop management of the three Japonica rice varieties was basically similar with that of Indica rice. In 2012 and 2013WS, the yield of the three Japonica rice were significantly lower than that of the popular variety in Cavite (NSIC Rc160) and the newly released variety (NSIC Rc240). However, in 2013DS, the yields of Japonica varieties were comparable with that of NSIC Rc160 and NSIC Rc240 which reached up to 5,783 kg.ha-1. Economic analysis showed that as much as P101,102.84/season can be realized from Japonica rice production in Cavite.

Acceptability of the three Japonica rice varieties was comparable with that of the commercial Japonica rice variety. Among them, NSIC RC170 was rated the highest by respondents of consumer and non-consumer subgroups, "very much liked" to "liked a lot".

The above findings revealed that Japonica rice production in the province of Cavite has a high economic potential especially during the dry season.

Keywords: Japonica rice, yield, NSIC Rc170, NSIC Rc220 SR, NSIC Rc242 SR

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DEVELOPMENT OF A SUSTAINABLE ORGANIC CONVERSION SCHEME FOR A RICE-BASED AGROECOSYSTEM

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This research assessed organic production management system for rice-based agroecosystem during the conversion period in two schemes: abrupt and gradual. Different cropping patterns involving dry season (DS) crops were evaluated along with fertilizer management options.
Yield trend shows that initially, high yield could be obtained as an effect of the residual fertility of the soil. Yield starts to decrease on the second year but mid-way to the five-year conversion period, yield significantly increases, indicative that the farm is underway to conversion.

Of the component crops, tomato consistently produced high yield throughout the conversion period. Under abrupt conversion, green manuring incorporated at maturity (MIM) produced significantly higher yield and reduces production cost by lowering nitrogen rate by 20kg. For gradual conversion, initial application of 75% inorganic fertilizer (IF) + 25% organic fertilizer (OF) significantly produced a yield comparable to the control (100% IF). Above-mentioned scheme were also most economically-viable. Likewise, comparable yield was obtained from the two manuring system hence MIM is a good option to benefit from the pod yield which is reflected as additional income of the farm-in-conversion. An increasing trend of soil nitrogen (N) and organic matter (OM) content in both conversion schemes was also observed.

Keywords: conversion, abrupt, gradual, organic

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GROWTH AND YIELD OF SWEET SORGHUM (*Sorghum bicolor* L.) AS AFFECTED BY THE DIFFERENT LEVELS OF BIO-SLUDGE

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The replenishment of the cultivated fields with nutrient and soil improving materials is necessary to ensure sustained fertility and ample harvest. The utilization of bio-sludge as organic fertilizer does not only complement to the crop farming sector to increase crop productivity but also address the environmental concern for the proper disposal of human waste. Thus a study was conducted to evaluate the potential of bio-sludge as source of organic fertilizer for sweet sorghum, determine the optimum levels and inorganic fertilizer to increase grain and juice yield and assess the economics of producing sweet sorghum using different fertilizer treatments. Results showed that height, stalk and panicle length, stalk and bagasse weight, and the juice yield of plants fertilized with the recommended rate of inorganic alone of 80-30-30, NPK kg ha^{-1} and with the addition of 25, 50 and 75% recommended rate of bio-sludge were significantly higher than those applied with the recommended rate bio-sludge alone and the untreated ones. Bigger stalk diameter resulted from the combination of higher amount of bio-sludge (50-75 % recommended rate of bio-sludge) and inorganic fertilizer. Grain yield also increased by 35% when fertilized with the combination of higher amount of bio-sludge (50-75% recommended rat of bio-sludge) and inorganic fertilizer, however, values were comparable with those applied with inorganic alone. Overall, the use of inorganic fertilizer at a rate of 80-30-30 kg NPK ha^{-1} is sufficient to improve the growth and yield of sweet sorghum and consequently, higher net return of investment. Although the application of bio-sludge did not contribute to the growth and yield of sweet sorghum, soil fertility was improved as manifested by the increase in % Organic matter, % Nitrogen, Phosphorous and Potassium.

Keywords: Bio-sludge, organic fertilizer, soil fertility, grain yield, juice yield

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POTATO SEED PRODUCTION THROUGH AEROPONICS (PHASE I: TECHNOLOGY DEVELOPMENT)

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Potato production is a very important industry worldwide. However, in the Philippines, less area had been planted with potato and with a yield of only 14.7 tons/hectares compared with China and USA with 15.8 tons/ha and 41.8 tons/ ha, respectively due to the insufficiency and poor quality of the potato seed materials. To overcome these certain production constraints, adoption and modification of aeroponics technology for production of potato seeds in the country is needed.

Initially, establishment of facilities for the aeroponics production of potato seed were done in UPLB, NMACLRC and BSU. The facility includes development of aeroponics units specific for the production of potato tubers. Also, nutrient solutions were formulated and initial trials were conducted in the UPLB. Potato seed production (mini- and micro-tubers) trials were done in three locations namely IPB, NMACLRC and BSU.

Two mini units of aeroponics namely the Drum-type and Mini-production units were developed and been used in the production of potato seeds in UPLB and BSU. Large production units were established in NMACLRC. Initial production was done in all locations using the developed nutrient solution and was able to generate an average 24 minitubers in UPLB, 21 in BSU and 17 in NMACLRC using Granola potato cultivars. About 20 micro-tubers were generated in all locations. Compared with the conventional production of potato seeds with about 10 tubers per plant, the use of the aeroponics technology generated more and uniform tubers. Also, since the aeroponics technology is a soilless technology and done in a controlled environment, pests and diseases were controlled primarily Fusarium wilt which is a highly soil-borne disease.

Keywords: aeroponics, potato seed production, minitubers, microtubers, granola

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INTEGRATING GENDER AND DEVELOPMENT (GAD) TO THE CACAO S&T COMMUNITY BASED FARM PROJECT IN BUKIDNON

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The Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development- DOST funded the Central Mindanao University project titled "S&T Community Based Farm (STCBF) for a Sustainable Cacao Production in Bukidnon" in which one of the objectives is to identify and evaluate the norms, roles and responsibilities of men and women in the production of cacao. Hence, an *Ex Ante* gender and development survey was conducted in the municipalities of Lantapan, Maramag, Malaybalay City and Valencia City, province of Bukidnon prior to the transfer of technologies. There were 33 respondents (farmer co-operators) in the survey. The 24 hour activity profile tool of the Moser Framework was adopted to gather GAD information. Moreover, time spent by male and female individuals for daily activities was segregated into productive, reproductive and leisure or personal necessities.

Regardless of municipality, both male and female respondents were performing productive, reproductive and leisure activities. In terms of productive activities, male had higher time spent (7.19 hours/day) than the female (5.35 hours/day). For reproductive activities, the female respondents engaged more time (4.96 hours/day) than the male (3.52 hours/day). Time engaged to leisure or personal necessities was nearly equal for male (13.28 hours/day) and female (13.69 hours/day) respondents. *Ex Ante* GAD survey data will be used as guide to researchers in developing as well as implementing projects in an unambiguous community to prevent gender biases in the future.

Keywords: GAD STCBF, cacao STCBF, GAD cacao, STCBF Bukidnon

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PROPAGATING *Dillenia Philippinensis R* (KATMON) USING MATURED STEM CUTTINGS

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Dillenia philippinensis Rolfe, locally known as Katmon, is one of the endemic yet endangered tree species in the country. In spite of its nutraceutical and pharmaceutical properties thus economic potential, it remains underutilized, wild-crafted and very little is known on how it can best be propagated and conserved. The study aims to determine its growth through vegetative propagation using matured stem cuttings. Planting materials were collected from fruit-bearing trees in Real Quezon province. Two-foot stem cuttings with 0.5, 0.75 and 1.0 inch diameter were planted in pots under 75% shaded condition and treated with MycoVAM and Vermicompost. The study was laid out in a three x four factorial experiment with five replications. Survival rate of plants with diameter of 0.75 to 1.0 inch is 64% and 68% at 168 days after planting while plants with 0.5 inch diameter have less than 50% survival in all treatments. Number of buds was highest in 0.5 inch diameter stem cuttings in all treatments but fail to develop further into leaves. Total number of leaves was highest in 1.0 inch diameter stem cuttings treated with combined MycoVAM and vermicompost . Similarly total number of roots was highest in combination treatments regardless of the diameter of stem cuttings but the longest length of roots was observed in stem cuttings with 0.75 to 1.0 inch diameter. Growth performance of plants in combination treatments were significantly different than the untreated plants and those grown solely with vermicompost and MycoVAM. In conclusion *Dillenia philippinensis* can be successfully propagated using 2-feet long matured stem cuttings with 0.75-1.0 inch diameter. Combining MycoVAM and Vermicompost as soil ameliorants enhances its leaf and root growth.

Keywords: *Dillenia philippinensis Rolfe*, Katmon, MycoVAM, Vermicompost, Endemic species

AS - 67

STRENGTHENING RESILIENCY AND ENHANCING FOOD SECURITY OF TABLAS ISLAND'S RAINFED AND UPLAND RICE FARMING COMMUNITIES TO CLIMATE CHANGE

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Most rainfed and upland farmers live below the poverty threshold, located in marginal areas, and lack access to most services, and thus are considered highly vulnerable (Eriksen and O'brien, 2007). Unfortunately, their situation is further exacerbated by changing climate that results in their further entrenchment in the economic margins. Through this project, PhilRice Los Baños, Romblon State University, and Romblon LGUs, identified four rice ecosystems that are considered vulnerable to climate change--upland, favorable and unfavorable rainfed, and salt water intruded rice areas. It aimed to develop the capacities of these farming communities through development of location-specific technology recommendations per ecosystem. After three years of project implementation, specific climate adaptation capacities among the communities has been enhanced--adjustment of planting calendars based on weather condition; adoption of diversified and integrated rice-based farming system; judicious use of appropriate rice varieties based on ecosystem; planting of suitable high-value crops based on local condition; and keen climate awareness. Results also showed that developing the FFS curriculum with the community; and developing its content based on their identified needs through community meetings, key informant interviews (KIIs) and focus group discussions (FGDs) is an effective way of ensuring their committed participation. While engagement of local partners from project planning to implementation, and monitoring and evaluation should also be given equal emphasis. It can also be established that a tripartite partnership between a national agency, a state university, and LGUs is a good combination when implementing similar development project.

Keywords: climate change, resiliency, farmers, rainfed, upland

BIOLOGICAL SCIENCES

BS - 01

ALTITUDINAL DISTRIBUTION AND SPECIES DIVERSITY OF FERNS (PTERIDOPHYTES) IN ADAMS FOREST, ADAMS, ILOCOS NORTE

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Ferns play an important role in man's life with their various ethno botanical uses like food consumption, aesthetic value and medicine. The interesting point about ferns is that every fern has its own preference for temperature, humidity, soil type, moisture and pH, light levels and others. With the growing interest in climate change, using ferns as indicator species for climate change has attracted more attention due to their sensitivity to environmental change. This study focused on the altitudinal distribution and diversity of ferns in Adams Forest, Adams, Ilocos Norte as influenced by environmental factors in the area. There were 23 fern species found in their respective stations: *Adiantum caudatum, Stechtaena palustris, Cyathea contaminas, Lygodium circinnatum* at SI; *Sphenomoris chinensis, Asplenium polyodon* at SII; *Phynatosorus scalopenria, Gymnocarpium dryopteris, Psomiocarpa apiifolia, Phenogopteris connectilis, Woodsia alpin* at SIII; *Angiopteris palmiformis, Diplazium esculentum, Ciniogramme subcordata, Cheilanthes farinose, Blechnum orientale, Dicranopteris linearis* at SI and SII; *Pteris melanocaulon, Gymnocarpium remotepinnatum, Cryptogramma stelleri* at SI and SIII; and *Neprhrolepis cordifolia, Athyrium felix-femina, Cyclosorus interruptus* in the 3 stations. Station I with the lowest altitude of 300-450 ft above sea level, the warmest soil and air temperatures of 19.57°C and 20.03°C, soil humidity of 37.33% and light intensity of 1489.33 lux presented the lowest diversity of ferns with diversity index (d1) and variety index (d2) of 6.62 and 0.73 respectively with 16 fern species. Station II with an elevation of 451-850 ft above sea level, soil and air temperatutres of 18.20oC and 18.93°C, soil humidity of 27.00%, light intensity of 651.33 lux presented the lowest diversity with d1 and d2 of 3.75 and 0.51 with 11 fern species. Lastly, Station III, which is the coolest station with an elevation` of 851-1400 ft above sea level, soil and air temperatutre of 16.40°C and 16.90°C, soil humidity of 25.67%, light intensity of 540.33 lux presented 4.54 for d1 and 0.87 for d2 with 11 fern species.

Keywords: Species diversity, ferns, altitudinal distribution

BS - 02

ASSESSING THE MARINE FOULING COMMUNITY IN A MAN-MADE MARINA AT MANILA BAY

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Manila Bay holds the largest port in the Philippines, hence facilitates transport of organisms from one region to another. This study aims to assess the fouling community inhabiting a man-made marina in Manila Bay and provide baseline information on its composition. The study represents a one-off assessment of macrofauna at five areas in close proximity at South Harbor of Manila Bay using artificial collectors. Fouler collector design was adapted from the North Pacific Marine Sciences Organization (PICES). Fouler collectors were deployed in 5 sampling points for 60 days, between November and December 2013 (wet season). Collected fouling organisms were identified using taxonomic keys. Species diversity (H) through Shannon Wiener Index and Species Evenness (H/Hmax) were determined. A total of 9725 fouling organisms were obtained, which belonged to 13 families. Total abundance of fouling communities did not show significant differences ($F=0.198$; $P=0.939$). A relatively consistent diversity index was observed ($H = 1.02$ to 1.42; $H/Hmax = 0.44$ to 0.55). The most common fouling organism was *Balanus amphitrite*. Other abundant organisms include anthozoans, bryozoans, and polychaetes, similar to studies around the globe. Presence of polychaete species *Capitella capitata* and *Polydora sp.* indicate that the environment is under stress due to maritime and local pollution. Two species are known to be invasive; *Mytilopsis sallei* and *Brachidontes sp.*, although their abundance show otherwise. It is important to monitor these species, particularly *Mytilopsis sallei* (origin: Carribean) since it has been detected in high densities in the Indo West Pacific region, particularly in Singapore, Hongkong, Thailand, India, Taiwan, China, Malaysia, Japan and Australia.

Keywords: macrofouling, marine, diversity, dominance, invasive

BS - 03

BIODIVERSITY INVENTORY AND ASSESSMENT IN BALINSASAYAO TWIN LAKES NATURAL PARK, NEGROS ORIENTAL

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One of the potential LTER sites is Balinsasayao Twin Lakes Natural Park (BTLNP). Situated in the municipality of Sibulan, Negros Oriental, it is one of the protected areas in the island of Negros, and home to endangered and endemic species of flora and fauna. The Central Mindanao University and Silliman University conducted a collaborative research to inventory the flora and fauna within the 2-hectare permanent plot and adjacent areas. Botanical survey revealed a total of 441 species of vascular plants. Of these, 236 are pteridophytes and 205 species are trees and other flowering plants. The richness of pteridophytes constitutes about 21% of the total number of species in the Philippines. It further showed that *Asplenium tenerum, Nephrolepis hirsutula* and *Alsophila negrosiana* obtained the highest Species Importance Value (SIV) for pteridophytes while *Aporosa leytensis, Euonymus javanicus* and *Syzygium sp.* for the trees. Diversity value of trees and pteridophytes was relatively high with H' value of 1.60 and 1.40, respectively. A total of 68 species of vertebrate fauna belonging to 36 families and 57 genera were documented in the permanent plot and adjacent areas. Of these, 45 species are birds, 10 species of mammals, 7 and 6 species of reptiles and amphibians, respectively. Thirty one species of threatened flora and fauna were documented. Of these, 21 species are threatened floras which include 7 species of trees and other flowering plants and 13 species of pteridophytes. Nine species of threatened fauna were noted which include 5 species of birds, 2 species mammals and 2 species of amphibians. To enhance awareness regarding the biodiversity in BNP, IEC materials were disseminated, and members of the Balinsasayao Twin Lakes Farmers Association Incorporated (BTLFAI) were trained to establish a Fern Garden. The information gathered is vital for long term monitoring and conservation of the remaining biological resources for policy formulation and inclusion of BTLNP as LTER site in the Philippines.

Keywords: Biodiversity, flora, fauna, Negros Island, Philippines

BS - 04

CATASTROPHIC TYPHOONS AND POST-TYPHOON RECOVERY: THE ROLE OF VEGETATION-SEDIMENT-MACROFAUNAL RELATIONSHIPS IN THE LONG-TERM SURVIVAL OF PHILIPPINE MANGROVES

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Mangroves are mostly located in coastal fringes, bearing the brunt of the strength of the typhoons. The Philippines is visited by around 20 typhoons in a year. At least four to six of it have catastrophic damages, thereby threatens the long-term survival of Philippine mangroves. We assessed the impacts of three catastrophic typhoons in five natural and three monospecific planted mangrove stands (Typhoon Fengshen in 2008 in W Visayas; Typhoon Chan-hom in 2009 in NW Luzon; and Super Typhoon Yolanda in 2013 in C and E Visayas and W Luzon), and tracked its recovery. Vegetation, sediment and macrofaunal (crabs and molluscs) analyses were conducted with time ranging from pre-typhoon to 6-years post-typhoon. Results showed severe vegetation and sediment damages with at least 70% tree mortalities in each site. The sediments are highly anoxic (-300 mV) with increased salinity (> 30 to 40 ppt) and increased temperature (8 to 10 0C) from pre-typhoon values. Macrofaunal abundance and activities are low to nil which remained until 3- to 5-yrs post-typhoon. Post-typhoon recovery varies with species and with type of stands. Natural mangroves have faster regeneration than the planted mangroves due to its coppicing capacity and high seedling recruits. Moreover, macrofaunal abundance and activities are higher in natural mangroves which also contributed to the improved sediment condition (through aeration). Our study provides the first integrative assessment (of vegetation-soil-macrofaunal relationship) of the impacts and regeneration of typhoon-damaged mangroves in the Philippines.

Keywords: mangroves, typhoon, impacts, post-typhoon regeneration

BS - 05

DISCOVERY AND REDISCOVERY OF PANAY *Begonia*

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The flora of Panay Island is under collected compared with the other islands of the Philippines. In 1919, the American botanist Dr. Elmer Drew Merrill described six species of the beautifully patterned Begonia from the island. It is unfortunate that after this discovery, there were no other reports on the plants. After securing the necessary permits, a joint expedition to Panay was conducted by botanists from the University of the Philippines, West Visayas State University, National Taiwan University and Biodiversity Research Center, Academia Sinica. The group re-visited type localities and re-discovered in the wild three of the known begonias, moreover, they found three unknown species of *Begonia*.The unknown begonias are similar in their rhizomatous stem, persistent stipules, large olivaceous, asymmetric leaves, four-tepaled flowers, inferior three-locule ovary with bilamellate placentas and pendulous, three-winged capsule. The three are clearly assignable to section *Baryandra*. Thorough studies of literature, herbarium specimens, and living plants support the recognition of the three new species: *Begonia culasiensis, Begonia merrilliana* and *Begonia sykakiengii*. Somatic chromosomes at metaphase of the 3 species were determined to be $2n=30$ for *B. culasiensis* and $2n = 28$ for *B. merrilliana* and *B. sykakiengii* which are consistent with the chromosome numbers of the section.

Keywords: *Begonia*, Panay Island, section Baryandra, somatic chromosomes

BS - 06

ENVIRONMENTAL IMPACT OF THE ARTISANAL SMALL-SCALE GOLD MINING IN TAMBIS, BAROBO, SURIGAO DEL SUR, PHILIPPINES: IMPLICATIONS FOR WATER QUALITY MONITORING AND MANAGEMENT

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An investigation of the environmental impacts of artisanal small scale gold mining (ASGM) in Barangay Tambis, with particular reference to water quality, mercury (tHg) contamination and aquatic macroinvertebrate community of Sorex and Hinatuan River was initiated from 2013-2015 as part of Responsible Mining research initiative of the Philippine government. Results show that salinity in Sorex River consistently reads high during the four sampling seasons. Sediment tHg from all Sorex River stations exceeded the 0.1 ppm standard limit of FAO and levels become further elevated extending towards upstream Hinatuan River stations during the northeast monsoons. While tHg was detected from selected three fish species, all values did not exceed the prescribed 0.5 ppm standard limit set by USEPA. Although levels of tHG in fish met the prescribed standard limits, these levels may pose potential risk of bioaccumulation in humans with constant consumption of Hg-contaminated fish in the areas studied. Overall comparison of aquatic macroinvertebrates in the two rivers show that there are distinct differences in the composition of organisms, most notably the abundance of gerrids and tipulids (Taxa 2) and planorbids (Taxa 3) in Sorex River and abundance of gastropods (*Thiariids* and *Bythinia*) in Hinatuan River of which abundance is pronounced during the rainy seasons of the year. Irrespective of the scale of operation, mining will have some degree of impact on the environment. Although ASGM, as in the case of Tambis, have several negative impacts on the aquatic environment, mitigation measures and mining regulation initiatives should be put in place to help promote environmentally responsible and sustainable development of this mineral sector. It is recommended that impact of ASGM on residents should also be assessed for possible risk of occupational Hg exposure.

Keywords: Mercury, Contamination, Responsible Mining

BS - 07

EPIPHYTIC MACROLICHENS DIVERSITY IN THE MONTANE FOREST OF MT. MALAMBO, DAVAO PROVINCE, PHILIPPINES

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Montane forest have great values as protective cover on some growing species such as the macrolichens. Changes in the diversity and ecology of epiphytic macrolichens was explored. Lichen-dominated vegetation comprises 8% of the terrestrial surface of the earth and are found in a diverse range of habitats. An inventory of the epiphytic macrolichens and its diversity along montane forest of Mt. Malambo, Davao Province was conducted. The study specifically aimed to: examined the microlichen diversity of the study sites; and determine the taxonomy, distribution, composition, lichen cover and associated growing tropical trees. Field sampling through floristic survey via transect walk was employed by recording all the species. Ocular estimates were done on the lichen cover.

The study revealed a total of 133 macrolichen species belonging to 22 genera and 9 families. The growth forms (foliose and fruticose), thallus size, color, presence or absence of reproductive structures such as soralia, isidia, phyllidia, perithecia, rhizines and apothecia were used to classify into families, genera and species.

The montane forest exhibited high species richness values such as Parmelia, Physia and Lobaria. Cladonia along with Collema also showed similar species richness. Six of the macrolichens species were documented to possess great medicinal value. Further results showed an increasing lichen cover and diversity patterns along various tree species growing at distance with prevailing light conditions, higher relative humidity, cloud foggy regions, and cold air temperature. Assessment of species and life-forms in different forest microhabitats should be explored and correlate with other remarkable physical factors.

Keywords: cloud forest, lichen cover, gradient

BS - 08

FOREST LITTERFALL PRODUCTION IN MT. APO, PHILIPPINES: A LONG TERM ECOLOGICAL RESEARCH (LTER) SITE

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This study assessed the litterfall production, leaf N, P and K and litter turnover in the established one-hectare permanent plot of the Long Term Ecological Research (LTER) Site in Mt. Apo forest, North Cotabato, Philippines for a period of 1 year and 6 months. Litter samples were collected from the traps installed below the dominant tree species and sorted to components, air-dried, oven-dried and processed at the laboratory. Leaves contributed the largest fraction (62%) of total litter, followed by woody (21%), reproductive (12%) and miscellaneous (5%) parts. Mean annual litter production was 758.41g ODW m-2 which have an estimated mean daily litter production of 1.99g ODW m-2. Phyllocladus hypophyllus contributed the highest litterfall production (24.35%), followed by Cinnamomum mercadoi (20.68%), Agathis philippinensis (19.9%), Syzygium sp. (18.18%) and Lithocarpus sp. (16.89%). The highest nitrogen (N) content was observed in the leaves of Lithorcapus sp. (3.04%) and lowest in P. hypophyllus (2.10%). The amount of potassium (K) was also highest in Lithocarpus sp. (1.70%) but lowest in A. philippinensis (0.58%) and the highest amount of phosphorous (P) was also observed in Lithorcapus sp. (0.082%) and lowest in P. hypophyllus (0.076%). Turnover rate (%/day) was faster in Lithocarpus sp. (3.29%) with a turn-over time of 68.38 days wherein slower in A. philippinensis (2.91%) with 89.69 days. Data suggests that litterfall production in Mt. Apo falls within the range of evergreen tropical forest and is dominated by gymnosperm species.

Keywords: Gymnosperms, leaf N, P and K, litter turnover, tropical

BS - 09

LAKE TAAL'S MARINE AND BRACKISHWATER HARPACTICOID COPEPODS POINT TO ITS MARINE ORIGINS

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One of the most studied freshwater in the country is Lake Taal (Batangas, Philippines), home to a combination of freshwater elements, short term migrants from the sea, and marine species that have adapted to freshwater. Its diverse flora and fauna, active volcanism, and unique limnological properties led the lake to be listed as a research hotspot for freshwater fauna. Whereas harpacticoid copepod fauna comprises majority of the biodiversity in one of the habitats in the lake, it has been surprisingly the subject of very limited research, its taxonomy has not quite progressed and its ecological role still remains unstudied. This study aims to establish the harpacticoid copepod fauna of Lake Taal through morphological examination. We also mapped out its distribution pattern in the forty-six (46) sampled sites and correlate it with several variables. Verified results show four (4) identified species, *Harpacticella oceanica, Mesochra meridionalis, Nitokra vietnamenis*, all found in marine waters, and *Folioquinpes chathamensis*, in brackishwater. Taxonomic treatment appears that these four species manifested euryhalinity, depth and habitat conditions to be the factors of its distribution and records in the lake as well. These results strongly support the marine origin of the lake wherein previous accounts of marine species adapting to the lake were also discussed. This study is the first to report marine and brackishwater harpacticoids in a freshwater in the Philippines.

Keywords: benthic, freshwater, Philippines, taxonomy, zooplankton

BS - 10

MANGROVES OF BONGABONG: DIVERSITY, STRUCTURE AND COMPOSITION IN THE RIVERINE ECOSYSTEM

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Mangroves play a significant role in the ecological and economical services such as fish breeding and nursery ground, coastal erosion prevention, wave protection, carbon sequestration and ecotourism.This study assessed the species diversity of mangroves in the riverine communities of Bongabong, Oriental Mindoro. Mangrove structure of the three barangays of Bongabong, particularly Brgy. Masaguisi, Brgy. Labasan and Brgy. Poblacion were evaluated based on their species composition and diversity. One plot per study site with a size of 50 x 50 meters was established using quadrat sampling method. Diversity indices for mangrove vegetation were calculated to determine the structural diversity of the study sites by using Shannon-Weiner Index.

The calculated diversity index of Brgy. Masaguisi, Labasan and Poblacion was at H'=1.55, 1.79, and 1.08 respectively. The diversity across species is described as relatively high in the study sites. 11 species representing true mangroves namely *Rhizophora apiculata, Rhizophora mucronata, Sonneratia alba, Avicennia alba, Avicennia marina, Avicennia officinalis, Avicennia rumphiana, Ceriops decandra, Brugueira sexangula, Brugueira cylindrica*, and *Excoecaria agallocha*, were recorded.Among the species recorded in the mangrove stand, *R. mucronata* was found dominating the mangrove forest with an IVI(Importance Value Index) of 91.04% followed by *R.apiculata* (89.51%) and *B.sexangula* (62.76%) and S.alba (54.16%). Among these species, three belongs to the family Rhizophoraceae and one to Sonneratiaceae.

Keywords: Mangrove, diversity, quadrat, Shannon-Weiner Index,Importance Value Index

BS - 11

MICROHABITAT PREFERENCES OF HERPETOFAUNA WITH NOTES ON SOCIO-ECONOMICALLY IMPORTANT SPECIES IN SAGO PALM GROWTHS AND ITS ENVIRONS OF AGUSAN MARSH, MINDANAO, PHILIPPINES`

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Assessment of herpetofauna and their microhabitat preference in Terminalia forest and *Sago* palm areas of Agusan Marsh, Mindanao, Philippines was conducted. Amphibians and reptiles play an important role particularly in pest control and bio indicators for wetland ecosystems in which they live. The study assessed species distribution, diversity and microhabitat of herpetofaunal species in two vegetation types of Agusan Marsh. The study utilized visual encounter survey, pit fall traps and opportunistic approach to capture amphibian and reptiles. Results of the study documented a total of 350 individuals from *Terminalia* forest and *Sago* palm vegetation, 11 species in 11 genera across 6 families of amphibians and reptiles. Of the 11 species documented, 6 were Philippine endemics, 3 non-endemics, while 2 were invasive. Common and widespread lowland species, including invasive inhabits disturbed areas and near human settlements. Also, most of the Philippine endemic amphibians are forest ground dwellers and inhabit in leaf litter, under logs and decayed bark of *Sago*, streams and swampy area. Freshwater turtles thrive most in streams and swampy areas, forest floor and grassy lands while lizards inhabit in barks of large trees and decayed woods while snakes mostly captured in agricultural area respectively. We highlight ecological and environmental threats (conversion to agricultural land, pollution) in the two habitat types as deserving mitigation. Further, strict implementation of laws and ordinances on the protection of herpetofaunal species with strong involvement of the local community for protection and conservation of this critically threatened wetland ecosystem. Agusan Marsh is home to 6 Philippine endemic amphibian species and should therefore be better managed and protected.

Keywords: anurans, ecosystem, marshland, microhabitat, wetlands

BS - 12

POPULATION PARAMETERS OF COMMON SMALL PELAGIC FISHES (*Sardinella gibbosa, S. fimbriata*, and *Rastrelliger brachysoma*) CAUGHT BY RINGNET IN MANILA BAY, PHILIPPINES

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The growth and mortality parameters, exploitation ratios and annual recruitment patterns for sardines (*Sardinella gibbosa, Sardinella fimbriata*) and mackerel (*Rastrelliger brachysoma*), caught by ring net in Manila Bay, were estimated based from raised length-frequency data collected for one year (January to December 2014). Data were collected for 10 to 11 days per month per site from nine selected fish landing sites. Results of the length frequency analysis are summarized. The growth parameters for the three species, are as follows *Sardinella gibbosa* ($L\infty$ = 18.49 cm, k = 0.88 yr-1); *Sardinella fimbriata* ($L\infty$ = 18.5 cm; k = 0.95 yr-1); and *Rastrelliger brachysoma* ($L\infty$ = 28. 67 cm; k = 1.3 yr-1). The results showed only a slight difference from previous studies conducted in Manila Bay. For the mortality parameters, L50 and E-values, results showed an increased values compared to previous studies. The E-values of the three species already exceeded the optimum exploitation value of E=0.5, indicating that overfishing is occurring.

Keywords: growth parameters, mortality parameters, exploitation rate, recruitment pattern

BS - 13

POTENTIAL OF FOUR NATIVE SPECIES IN RESTORATION OF DEGRADED AREAS IN MASINLOC, ZAMBALES, PHILIPPINES

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The study was conducted to add knowledge to the very limited site-species match data of the country's native species and to determine what particular species must be the used to ecologically restore the degraded areas of Masinloc, Zambales. It was focused on four native species: *Anisoptera thurifera, Callophyllum soulatri, Engelhardtia spicata* and *Guioa koelreuteria*. The growth performance of the species and the interaction of their growth performance with the environmental factors in the site were evaluated for nine months. Results revealed that all the species had high survival (>90%). It was also determined that the use of larger trees could enhance the survival rate of the species in the field. The net growth of the seedlings in terms of plant height have an order of *A. thurifera* >*C. soulattri*>*E. spicata* > *G. koelreuteri*; the increment in terms of root collar diamte have shown an order of *C. soulattri*>*E. spicata*>*A.thurifera*>*G. koelreuteria*. Significant differences among the species, in terms of its growth parameters were found. From this, *C. soulattri* was determined to be the best performing species, in terms of growth and survival in the site. The growth performance of the species also showed correlation with the environmental factors, most especially in the soil organic matter content; such that the seedling establishment could increase the soil OM. The study also revealed these native species grow well in soil having pH ranging from 5.3-5.5 and soil moisture ranging from 5-11%, and concluded that sites having similar edaphic characteristics are also suitable for these native species. Based from these results and analyses, it was determined that all four species were promising as restoration species in the degraded areas of Masinloc, Zambales.

Keywords: degraded areas, native species, restoration

BS - 14

PRELIMINARY ASSESSMENT OF MOSS FLORA ALONG MONTANE FOREST OF MT. LUMOT, CLAVERIA, MISAMIS ORIENTAL, PHILIPPINES

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To date, Mindanao forest was reported to have incomplete known bryoflora, which may hold critically the key to understand the existing taxonomic, nomenclature and distribution. The current study explored a preliminary survey on the distribution of moss species in the montane of Mt. Lumot. It specifically aimed to: identify the moss species in the montane sites; 2) determine the species richness, composition and assess the ecological status of the moss flora; and recognized the species collected as to their conservation status in terms of endemicity, vulnerability, endangerment and distribution.

A floristic survey through transect walk was employed by recording all the species within the montane sites. Site validation was employed to establish six sample plots with a 20 x 20 m quadrat. Each species were classified, identified and described according to its diagnostic characters using field lens and microscopy examinations. The habitat preference for each species and moss cover was also assessed.

Results of the study revealed a total 59 species of mosses, 32 genera and 21 families. Taxonomic characters based on habit, leaf arrangement and orientation, stem structure and sporophyte characters were used to identify the bryophytes into families, genera and species. Several species were found growing at different substrate such as on tree trunks, decayed logs, litters, rocks and soil.

Local assessment of the moss species revealed two endangered species namely: Pogonatum macrophyllum (Dozy & Molk.) Lindb and Dawsonia superva Grev. And two were listed as endemic based from IUCN red list. The floristic assessment should be done to extract taxonomic data, diversity status and understand their ecological patterns and distribution.

Keywords: floristic, montane, nomenclature, species richness, taxa

BS - 15

SHELLFISH DIVERSITY AND MANAGEMENT INITIATIVES OF A MANGROVE SANCTUARY IN BAYABAS, SURIGAO DEL SUR, PHILIPPINES

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This study assessed the shellfish diversity of a declared mangrove sanctuary in Balete, Bayabas, Surigao del Sur, Philippines. A total of ten 5x5 m2 quadrats with 200m distance from each other were laid within the two belt transect lines with 2km length in the mangrove forest and along the tidal flat within the sanctuary. A total of 38 shellfish species belonging to 13 families were identified in the mangrove sanctuary. Three species were unidentified. Species under family Neritidae, Cypraeidae and Turbinidae were widely distributed in the two stations. *Nerita undata* was the most abundant species in Station 1 (mangrove forest) and *Cypraea annulus* was relatively the most abundant species in Station 2 (tidal flat). Shellfish richness in station 1 (R=0.53) was higher than station 2 (R=0.22). Shannon-Wiener diversity index Station 1 (H'=2.77) was higher than station 2 (H'=2.35). Consequently, Simpson's Dominance Index in station 1 (Dsimpson=0.026) was lower than station 2 (Dsimpson=0.039). Species in Station 1 (EI=0.92) were relatively distributed compared to station 2 (EI=0.84). Similarity index of the two stations was calculated at 54%. Based on the World Conservation Union, most of the identified species belong to NE (not evaluated) category. It is recommended that LGU must strengthen the activities on IEC through installation of signages, tarpaulins and seminars to increase awareness of the community.

Keywords: Marine gastropods, diversity, Barangay Day- asan, *Nerita undata*

BS - 16

THE GENUS *Plagiochila* (PLAGIOCHILACEAE) OF MT. LIMBAWON, PANTARON RANGE, BUKIDNON, MINDANAO, PHILIPPINES

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Plagiochila is the largest genus of the liverworts (hepatics) that are generally medium or large size and one of the main components of bryophyte communities in tropical mossy forests. In the Philippines, there is a limited studies regarding the hepatic flora. This research was conducted to determine the species richness and distribution of *Plagiochila* based on field survey in Mt. Limbawon, Pantaron Range, Bukidnon. A total of ten species are known from the mountain, viz., *Plagiochila blepharophora* (Nees) Lindenb., *P. dendroides* (Nees) Lindenb., *P. fusca* Sande Lac., *P. javanica* Dumort., *P. philippinensis* Steph., *P. propinqua* Sande Lac., *P. renitens* (Nees) Lindenb., *P. salacensis* Gottsche, *P. trabeculata* Steph. and *P. sp*. This is about 20% of the total number of species found in the Philippines. Majority of the species observed are closely related to the species found in the neighboring island of Mindanao such as Java, Sumatra and Borneo. The study obtained the first record of *P. javanica, P. philippinensis, P. salacensis, P. trabeculata* for the island of Mindanao and one possible new species.

Keywords: hepatics, species richness, Mindanao Island

BS - 17

THE SEAWEEDS IN NORTHERN SAMAR: CHECKLIST, COASTAL ENVIRONMENT, BIODIVERSITY AND BIOAVAILABILITY ANALYSIS OF NUTRIENTS AND NUTRACEUTICALS

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The seaweeds of Northern Samar are relatively well studied and documented in comparison with the marine flora of other part of the Philippines. Seaweeds are economically important, both currently and potentially, but there has not been a thorough listing of the species recorded in Northern Samar. This aims to describe also the coastal environment as a habitat for seaweed, the biogeographic patterns of distribution of seaweeds and the bioavailability of nutrients were analyzed. A checklist is provided of the seaweeds recorded, which includes a total of 39 species belonging to 18 families of seaweeds. The coastal environment as a habitat for seaweed is also discussed in this work. This study examines the bioavailability of nutrients and nutraceuticals from the different species of seaweeds. Results demonstrated that some species of seaweeds can accumulate non-essential elements.

Keywords: seaweeds, Northern Samar, checklist, coastal environment, bioavailability

BS - 18

BIOSORPTION OF CADMIUM BY THE FUNGI ASPERGILLUS NIGER AND PENICILLIUM CITRINUM FROM THE SOIL OF A POWER-PLANT IN CABANATUAN CITY, NUEVA ECIJA, PHILIPPINES

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The use of fungi for the bioremediation of heavy metals in soil has not been fully investigated in the Philippines. Two cadmium tolerant fungi were isolated from the soil in a power plant in Cabanatuan City, Nueva Ecija, Philippines and these were *Aspergillus niger* and *Penicillum citrinum*. These fungi were exposed to cadmium concentrations of 50, 100, 250, 500, 750 and 1000 ppm. Both were able to grow vigorously in the agar medium with 50 to 250 μg ml-1 cadmium, but were inhibited at 500 to 1000 ppm. After 7 days of cadmium exposure, fungal cells were separated from the medium by centrifugation and the cadmium bound to the cell wall was chelated by EDTA. Their ability to remove cadmium from the medium thru biosorption was established in this study by flame atomic absorption spectrophotometry (FAAS). As the cadmium concentration in the medium increased, the amount of cadmium bound to the cell wall also increased. It was also noted that P. citrinum was able to adsorb significant amount of cadmium (24.4 μg ml-1 Cd per 1 gm of cells) when exposed to 250 μg ml-1 of cadmium compared to A. niger, whose peak adsorption (5.8 μg ml-1 per 1 gm of cells) was only at 100 μg ml-1 of available cadmium in the medium.

Keywords: fungi, bioremediation, biosorption, heavy metals, cadmium

BS - 19

COMPARATIVE EFFECTS OF BIOCHAR FROM BAMBOO AND SUGARCANE ON GROWTH AND NUTRITION OF MYCORRHIZAL CACAO (*Theobroma cacao*) SEEDLINGS

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The demand for cocoa (*Theobroma cacao*) beans by the Philippine chocolate industry is projected to reach an estimated 100,000 metric tons of dried cocoa beans by 2020. Biochar and arbuscular mycorrhizal fungi (AMF) are effective soil amendment to improve growth and yield of crops. This study aimed to compare the growth and nutrient status of cacao seedlings to mycorrhizal inoculation grown in acidic soil amended with biochar from bamboo trimmings (BB) and from sugarcane bagasse (BSB). Aseptically germinated seeds of cacao were inoculated with two capsules (Mykorich® containing approximately 300 spores of AMF fungi) per seedling during transplanting. Biochar (nil, 3.75%, and 15%) was mixed thoroughly in the oven sterilized soil. Six months after inoculation, results showed that the total plant dry weight and AMF spore count were higher ($p<0.05$) in BB amended soil (21-38g plant^{-1}, 11-40 spores g dry soil-1) than in BSB (20-24g plant^{-1}, 42-116 spores g dry soil^{-1}) counterpart. Highest (38.2 g plant^{-1}) total dry weight was highest in 15% BB while the lowest (20.4 g plant^{-1}) was in 15% BSB. Root colonization was not affected by the rates and source of biochar. Nitrogen uptake was highest (65mg plant^{-1}) in without biochar plants. By contrast the highest (6.9mg plant^{-1}) P uptake was obtained from plants grown in 15% BB amended soil. Phosphorus uptake in BB amended soil ranged from from 4-2 to 6.9mg plant^{-1} as compared with 3.5mg plant^{-1} in BSB soil irrespective of the biochar concentration. The results imply that BB even up to 15% is more effective as plant growth promoter of Mykorich® inoculated cacao seedlings than BSB.

Keywords: arbuscular mycorrhizal fungi, Mykorich®, sporulation, mycorrhizal root colonization

BS - 20

GROWTH OF NARRA (*Pterocarpus indicus* WILLD.) INOCULATED WITH PHOSPHATE SOLUBILIZING BACTERIA FROM MINE TAILING IN MOGPOG, MARINDUQUE, PHILIPPINES

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Rhizosphere bacteria can promote plant growth through its ability to fix atmospheric nitrogen, solubilize phosphorus, produce secondary metabolites to increase plant's resilience against pathogens. The aims of this study was to isolate phosphate solubilizing bacteria (PSB) from a copper mine tailing area in Mogpog, Marinduque where bioremediation activities (planted with tree legumes inoculated with Mykovam mycorrhizal inoculant and determine effect of PSB on plant growth. Among the PSBs, three fast growing Mogpog phosphate solubilizing bacteria (coded as MPSB1, MPSB2 and MPSB4) were chosen to inoculate narra (*Pterocarpus indicus*) seedlings with or without Mykovam (a commercial mycorrhizal inoculant) and grown in oven sterilized acidic (pH 4.3-5.0 in H_2O) red soil from Caliraya, Laguna. Generally, PSB and Mykovam treatments increased significantly height, stem diameter and plant biomass than the non-inoculated counterpart. There was a significant interaction between MPSBs and Mykovam. Based on plant dry weight, MPSB2 plus Mykovam plants gave 2.91 and 2.22 times greater root and total dry weights, respectively, relative to the negative control (no MPSB and No Mykovam; 0.268 and 0.854 g plant-1, respectively) counterpart. Moreover, this treatment promoted higher height (3.28x) and diameter (1.32x) increments than the negative control (1.36 cm and 0.568 cm). It can be concluded that combined MPSB2 and Mykovam can be useful protocol in rehabilitation of mine tailing areas.

Keywords: Phosphate solubilizing bacteria, bioremediation, heterotrophic bacteria, Mykovam®

BS - 21

OPTIMIZATION OF BANANA (*Musa acuminata x balbisiana*) PSEUDOSTEM ENZYMATIC HYDROLYSIS FOR BIOMASS PRODUCTION AND FERMENTATION

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The aim of this study was to evaluate the potential of *M. acuminata x balbisiana* (*Saba* banana) pseudostem as raw material for biomass production and fermentation of cellulosic ethanol through optimization and determination of the effects of solid loading, incubation time and amount of enzyme on yield of reducing sugars in the enzymatic hydrolysis using Response Surface Methodology (RSM). Optimized enzymatic hydrolysis of banana pseudostem (30h incubation time, 15g solid loading and 0.55%) was used. Two set-ups, activated carbon detoxified and non-detoxified sugar solutions, were used for both laboratory and large scale saccharification and fermentation systems. Specific growth rate (u_{max}) of fermenting yeast was determined to be highest in non-detoxified hydrolysate with BUM at 0.430 hr-1 which is comparable to growth rate observed in control YEPD broth (0.311 hr1). No significant difference in the glucose yield before fermentation between non-detoxified (10.67%) and detoxified (10.91%) samples. However, percent sugar consumed, biomass production and ethanol yield for both laboratory-scale and upscale fermentation were reported otherwise. Percent sugar consumed was observed to be higher (65.26 %) at non-detoxified set up for both laboratory-scale and up-scale fermentation. On the other hand, a significant difference in ethanol yield was observed in the detoxified set-up at large scale condition. The results indicate the potential of *M. acuminata x balbisiana* pseudostem in biomass production and fermentation of cellulosic ethanol.

Keywords: saccharification, response surface methodology, specific growth rate, fermentation, cellulosic ethanol

BS - 22

ROOTING PERFORMANCE OF BAHAI (*Ormosia calavensis* Azaola ex Blanco) AND BAKAN (*Litsea philippinensis* Merr.) AS AFFECTED BY DIFFERENT CONCENTRATIONS OF INDOLE-3-BUTYRIC ACID (IBA)

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A macro-somatic propagation study was conducted to assess the effects of rooting hormone and the level of concentration to the rooting performance of Bahai (*Ormosia calavensis* Azaola ex Blanco) and Bakan (*Litsea philippinensis* Merr.). The study was carried out in the clonal nursery of Central Mindanao University. The experimental design used was the 2 x 4 factorial experiment arranged in Simple Complete Randomized Design (CRD) replicated five times. The two species served as Factor A: Bahai and Bakan; while Indole-3-Butyric Acid (IBA) served as Factor B: control – no auxin , 100 ppm, 300 ppm, and 500 ppm. Finding shows that Bahai cuttings exhibited statistically higher rooting performance compared to Bakan. This is in terms of the length of the roots and number of roots treated with 300 ppm of IBA. Data show that Bahai had an average length of 2.042 cm compared to Bakan with only 1.355 cm. For the number of roots, Bahai had 1.855 compared to Bakan with 1.376. Between the two species used, Bahai shows higher survival rates with 84.42% compared to 57.63% for Bakan. Findings suggest that both species can be treated with 300 ppm of IBA to enhance higher rooting percentage where it produces greater number and longer length of roots. It is also recommended that Bahai and Bakan tree species are potential species for propagation using macro-somatic technologies.

Keywords: Rooting performance, Bakan, Bahay, Indole-3-Butyric Acid

BS - 23

PERFORMANCE OF NARRA (*Pterocarpus indicus* Willd.) CUTTINGS AS AFFECTED BY TYPES OF PROPAGATION TECHNIQUES AND LEVELS OF NAPHTHALENE ACETIC ACID (NAA)

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Narra is a multipurpose tree species capable of fixing nitrogen from the atmosphere and is readily propagated both by seed and from vegetative cutting. The latter method is promoted for tree improvement techniques. This study was conducted to evaluate the performance of narra using the vegetative propagation technique. The study was conducted using a two (2) by three (3) factorial experiment arranged in a Randomized Complete Block Design (RCBD) in three (3) replications. The types of propagation method served as the main plot and different levels of rooting hormone (Naphthalene Acetic Acid) concentration as sub – plot. Findings show that the rooting performance of Narra is highest in the non-mist propagation in terms of percent survival with 55.56% as against the mist method with only 26.67%. On mean length of roots, non-mist also exhibits the highest with 1.79 cm while mist had only 0.95 cm. In terms of levels of hormone concentration, 200 ppm had the highest percent survival of 55% while 0 ppm and 500 ppm had only 50% and 18.33%, respectively. The interaction effects between the two types of propagation method and levels of hormone concentration showed that treatment combination of non-mist and 200 ppm had the highest percent survival at 80%.

Keywords: Narra, mist and non-mist propagation, Naphthalene Acetic Acid

BS - 24

DNA BARCODING OF PHILIPPINE REGULATED AQUATIC SPECIES

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Numerous scientific reports have emphasized that Philippines is the center of marine biodiversity in the world. A remarkable marine species diversity such as this makes it imperative for us to continuously monitor these aquatic species. Unfortunately, much of this diversity is now threatened and in need of urgent conservation action. DNA barcoding can legally verify the identification of fishes in sliced meat samples, by-catches, and species under regulation that are important to protecting endangered species and sustaining fish populations. The study aims to identify the Philippine regulated aquatic species through DNA-based examination and to support the implementation of laws in fishery trade and endangered species. Tissue samples were mostly sent by BFAR regional offices, collaborators, and other partner agencies. DNA barcoding were done for species identification and analysis. Results revealed that species of whales and dolphins, marine turtles, seahorses, elasmobranchs, clams, and crabs were under CITES-listed or Philippine regulated aquatic species. Thus, through the Philippines Fisheries Code (RA no. 8550), the study gives support to law-implementing agencies through accurate species identification. The establishment of an in-house NFRDI-GFL Database of reference DNA sequences of the priority species is also one of the main outputs of the study.

Keywords: CITES-listed, Philippine Fisheries Code, Philippine Regulated Aquatic Species

BS - 25

GERMINATION PATTERNS OF NEWLY REGISTERED NATIVE GERMPLASM AT THE NATIONAL PLANT GENETIC RESOURCES LABORATORY

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Galo (*Anacolosa frutescens* Blume), lipote (*Syzygium polycephaloides* (C.B.Rob.) Merr.), and tabon-tabon (*Atuna racemosa* Rafin.) are woody perennial crops that are endemic to the Philippines with great economic potential. They are primarily propagated through seeds and, subsequently, conserved as living specimens at National Plant Genetic Resources Laboratory (NPGRL). Despite this, nothing has been reported regarding their growth and development, particularly their germination patterns which is crucial to the positioning of cotyledons in the soil. Thus, being newly registered at NPGRL, this study elucidated the germination patterns of galo, lipote and tabon-tabon according to the extended BBCH (Biologische Bundesanstalt, Bundessortenamt und CHemische Industrie) scale. Fifty seeds of each species were planted, and observations of the growth and development were carried out two to three times a week until the first true leaf unfolded. The typical epigeal and hypogeal germination patterns were observed in lipote and tabon-tabon, respectively; however, a unique epigeal type of germination was observed in *A. frutescens*. Its non-typical features include root enlargement (BBCH 016) and cotyledon utilization prior (BBCH 100) to unfolding of its first true leaf (BBCH 101). Recognizing interspecific differences, the germination patterns of native crop species in the Philippines should be elucidated in order to develop efficient propagation and conservation techniques.

Keywords: germination pattern, *Anacolosa frutescens*, *Syzygium polycephaloides*, *Atuna racemosa*, Philippine native species

BS - 26

SPECIES COMPOSITION AND LENGTH-WEIGHT RELATIONSHIPS OF FISHES IN EIGHT FLOODPLAIN LAKES OF AGUSAN MARSH, PHILIPPINES

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The Agusan Marsh is an ecologically and economically important wetland in the Philippines. The aquatic diversity in the marsh is threatened by habitat loss, over-exploitation of fishery resources, pollution, population pressure and the deliberate and accidental introduction of invasive fish species. Despite these threats, very few ichthyofauna studies were conducted throughout the years. Species composition and length-weight relationships (LWRs) of 16 fish species caught in January 2014 to January 2015 from eight floodplain lakes of Agusan Marsh, the Philippines is reported in this study. Local catching gears were also documented. The species collected belong to 9 families and were mostly introduced to the country. Samples were collected using five types of fishing gear. The "b" values in the LWR W= aLb ranged from 2.116 to 3.135 and showed a mean value of 2.689. The present study has shown clearly that introduced species (62%) have dominated the species composition of major lakes in Agusan Marsh. The majority of these introduced species were utilized as major part of the diet of marsh residents and most of the fish-eating public in Agusan Del Sur. These measurements and inventory of fishes from Agusan Marsh contribute baseline information for the management and conservation of this critical wetland.

Keywords: Invasive species, wetlands, Agusan Marsh

BS - 27

MOLECULAR CHARACTERIZATION OF VIRUSES ISOLATED FROM *Agaricus sp.* and *Lentinula sp.* IN BENGUET, PHILIPPINES

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Mycoviruses cause yield loss and reduced market potential of commercial mushrooms. There is little knowledge on the biology of viruses infecting cultivated mushrooms in the Philippines. This study aims to isolate and characterize nucleic acid sequences from viruses infecting white button (*Agaricus sp.*) and shiitake (*Lentinula sp.*) mushrooms. Cultivated white button and shiitake mushroom samples were obtained from Benguet, Philippines. Total RNA was extracted using Trizol method and cDNA was generated from the extracted RNA using SuperScript III First Strand Synthesis System. Primers specific to the coat protein (CP) gene of the *Mushroom Bacilliform Virus* (MBV) and the RNA-dependent RNA Polymerase (RdRP) gene of *Lentinula edodes mycovirus* HKB (LedHKB) and *Lentinula edodes dsRNA virus* (LeddsR) were used to isolate viral sequences using Polymerase Chain Reaction (PCR). For white button mushroom, a 597 bp product was amplified and cloned in pGEM® T-Easy vector. Analysis of the partial CP gene showed a 98% sequence identity to the CP gene of an Australian MBV isolate (Genbank: U07551). For shiitake mushroom, 786 bp (LedHKB) and 816 bp (LeddsR) products were amplified and cloned using pGEM vector. Analysis of the partial RdRP genes showed a 99% and 95% sequence identity to the RdRP genes of a Chinese LeddsR isolate (Genbank: GQ372842.1) and a Japanese LedHKA isolate (Genbank: AB646992.1), respectively. This is the first report of a white button mycovirus sequence and a shiitake mycovirus sequence in the Philippines.

Keywords: mycovirus, mushroom, agaricus, shiitake, PCR

BS - 28

MOLECULAR DETECTION OF TETRACYCLINE RESISTANCE GENES IN *Salmonella* spp. ISOLATED FROM PORK

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The emergence of tetracycline resistant strains among human and animal bacterial pathogen has been a major concern of surveillance and studies. Thus, the present study focused on the detection of tetracycline resistance determinant genes (*tetA*, *tetB*, *tetG*) on identified *Salmonella* isolates from selected municipalities of Nueva Ecija, Philippines using a molecular-based technique.

One hundred eighty (n=180) fresh pork cuts were bought from different wet markets in four municipalities of Nueva Ecija (Cabanatuan City, Talavera, San Jose City, Bongabon City), Philippines. All samples were cultured in non-selective enrichment medium (Rappaport-Vassiliadis soy peptone broth) and selective medium (xylose lysine deoxycholate agar) for Salmonella bacterial culture and isolation. Isolated colonies were subjected to colony PCR targeting the conserved invA gene of Salmonella spp. and conventional PCR for the detection of *tetA*, *tetB*, and *tetG* genes.

Eighteen isolates from the pork samples showed the expected 219 bp amplicon size. DNA sequence analysis identified two *Salmonella* species with 99% identity; these were *S. enterica* serovar Enteriditis and *S. enterica* serovar Typhimurium. Five-percent of the pork samples from Cabanatuan City, Talavera and San Jose City were positive to *tetA* and 0.91% was positive to *tetB*. However, *tetG* was not detected among all the isolates. Also, sequences of representative samples confirmed the identity of the amplified tetracycline resistance genes based on the BLAST results wherein all of them had 99% identity. Therefore, the method used was able to detect the presence of tetracycline resistance genes from the collected pork samples. However, a larger study area including all the municipalities in Nueva Ecija and the use of shorter primers for more conserved target sequences are recommended for a more intensive surveillance of tetracycline resistance in the province.

Keywords: tetracycline, *tet*, *Salmonella*

BS - 29

SCREENING OF LACTIC ACID BACTERIA ISOLATED FROM PHILIPPINE TRADITIONAL FERMENTED PRODUCTS: POTENTIAL PROBIOTIC BACTERIA WITH ANTIMICROBIAL AND CYTOTOXIC ACTIVITIES

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Thirty (30) isolates of lactic acid bacteria (LAB) from Philippine traditionally-prepared fermented products, namely: fermented soy-bean paste, fermented mustard and fermented rice-fish mixture were studied for their *in vitro* antimicrobial and cytotoxic activities. Seventeen (17) isolates were identified as *Lactobacillus plantarum*, while 13 isolates were identified as *Enterococcus* spp. using 16S rDNA sequences. The phylogenetic tree revealed that there were three clusters of LAB with 100% similarity level. Disc diffusion method was used to determine the antibacterial activity of LAB against *Staphylococcus aureus* ATCC 25923 and *Escherichia coli* ATCC 25922, while the modified agar overlay method was used to determine the antifungal activity of LAB isolates on the yeast *Candida albicans*, and the dermatophytes *Microsporum gypseum*, *Trichophyton rubrum,* and *Epidermophyton floccosum*. The filter-sterilized LAB culture supernatants were evaluated for their cytotoxicity to mammalian colon cancer cell lines HT-29 and HCT116, and normal human dermal fibrolasts HDFn using resazurin assay (PrestoBlueTM). Colchicine was the positive control. No antimicrobial activity was observed against the bacterial test organisms and the yeast *Candida albicans*. On the other hand, all of the tested LAB strains were fungicidal for all the test dermatophytes. Cytotoxicity index profiles of all the LAB supernatants tested showed that these were cytotoxic to HT- 29 and HCT116 colon cancer cell lines, but were not cytotoxic for the normal HDFn cells. Results provide strong support for the role of the lactic acid bacteria studied for antifungal treatment and anticancer therapy.

Keywords: cytotoxicity, antibacterial, antifungal, anticancer, probiotics radical scavenging activity

BS - 30

THE STANDARD REFERENCE MATERIAL (SRM) METHOD FOR AUTHENTICATION OF *Ehretia microphylla* LAM. (TSAANG GUBAT) AND *Blumea balsamifera* L. (SAMBONG) DERIVED PRODUCTS

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Ehretia microphylla Lam. (tsaang gubat) and *Blumea balsamifera* L. (sambong) are part of the top ten medicinal plants in the Philippines recognized by the Department of Health (DOH) as effective and safe alternatives to excrete urinary stones and promote intestinal motility. Despite their popularity, there is no standard protocol in assessing authenticity of readily available derived herbal products. This study utilized the Standard Reference Material (SRM) herbal barcode library method to test authenticity of eight randomly selected tsaang gubat and sambong products. The SRM comprised of 20 gene accessions of *Ehretia* species and 60 gene accessions of *Blumea* species which showed the distinctness of *E. microphylla* and *B. balsamifera.* Analysis following BLASTn and Maximum-Likelihood (ML) tree reconstruction criterion revealed that only one herbal product did not contain authentic plant material. Results of this study prompt the need to utilize an SRM approach as a standard industrial-scale protocol for the authentication of herbal products to ensure the safety of consumers.

Keywords: ITS, sambong, SRM, trnH-psbA, tsaang gubat

BS - 31

DEVELOPMENT OF GLUTEN-FREE, VEGAN BREAD

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The study was conducted to use brown rice in bread making, utilize soy bean pulp, and incorporate malunggay and squash in the developed product. The locally available ingredients were developed into gluten-free, vegan bread. Brown rice, soy bean pulp, and malunggay were dehydrated using the Multi-Commodity Heat Pump Dryer for 6, 22, and 5 hours respectively. These were then ground and mixed with other ingredients: squash, brown sugar, vegetable shortening, peanuts, salt, nutmeg, agar powder, potato starch, baking powder, soy milk, vanilla extract, and cinnamon, then baked into bread at 125°C for 1 hour and 15 minutes. The nutrient content of one serving (92g), contains 209 kcal, 3.9g of protein, 8.2g of fat, 28.6g of carbohydrate, 88mg of calcium, 60mg of phosphorus, 0.9mg of iron, 25µg of vitamin A, 0.06mg of thiamin, 0.1mg of riboflavin, 1.4mg of niacin, and 3mg of vitamin C. It is a source of niacin and protein for children and is high in dietary fiber that can benefit all ages. Sixty respondents from three different age groups: children, adolescent, and adults evaluated the product. The results showed that it was liked extremely by all ages with the highest percentage in children in all sensory attributes (appearance 75%, texture 60%, taste 85%, and aroma 90%). The bread is stored inside a box (7x3x3inches) wrapped with polypropylene plastic and can be consumed for one day when stored at room temperature and five days when kept refrigerated. The raw cost for a serving is ₱9.92. The selling price of one box (6 servings) gluten-free, vegan bread costs ₱99.30, cheaper compared with other gluten-free, vegan products. This food innovation showed that utilization of brown rice, soy pulp, squash, and malunggay for bread making is possible.

Keywords: gluten-free, vegan, brown rice, soy pulp, high fiber

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PREVALENCE OF WHITE SPOT SYNDROME VIRUS AND AHPND-CAUSING *Vibrio parahaemolyticus* IN THE PHILIPPINES

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The shrimp industry is one of the biggest sector generating billions of pesos in the country's aquaculture production. However, production growth has been significantly hampered by disease outbreaks be it viral or bacterial in nature. Two of the most devastating diseases that caused massive mortalities and great losses in shrimp production are White spot syndrome virus (WSSV), a viral disease, and a more recent one, the Acute Hepatopancreatic Necrosis Disease (AHPND), caused by *Vibrio parahaemolyticus*. The Philippines reported the presence of both diseases among ponds in the country. Routine field sampling revealed that some shrimps infected by WSSV are also positive for AHPND. Here we report and investigate the correlation between the presence of WSSV and AHPND in the Philippines. Sampling was done in various areas in the Philippines. WSSV and AHPND was detected using polymerase chain reaction (PCR). Results showed that in Luzon, 67% of samples collected were infected by WSSV and 27% of the same samples tested positive for AHPND. In the Visayas, 13% was positive for WSSV infection and 4% for Aq1HPND and in Mindanao, 7% were WSSV infected and 4% were AHPND positive. Using correlation coefficient, we found that WSSV and AHPND infection in a pond is positively correlated. Our data revealed that shrimps infected with WSSV could also harbour AHPND causing bacteria at the same time and that mortality highly depends on the effects of activity of the virus and bacteria. We conclude that, co-infections of WSSV and *Vibrio* can occur among cultured shrimps in the ponds. This is the first report on the occurrence of both WSSV and AHPND in cultured shrimps in the country. This information will have implication in shrimp disease management practices and sustainability of the shrimp aquaculture industry.

Keywords: shrimp, AHPND, WSSV, Aquaculture

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SURVEY OF THE SEROPREVALENCE OF CAPRINE ARTHRITIS ENCEPHALITIS VIRUS (CAEV) BASED ON MOLECULAR DETECTION FROM GOATS IN THE PROVINCE OF CEBU

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Cebu Province is one of the top producing region in terms of goat meat in the country. With the high economic potential value of this commodity, the need of documentation of the prevalance of health treatening diseases like CAEV is vital. Caprine arthritis and encephalitis is an economically significant multi-systemic disease in goats, resulting into bottom quartile production of seropositive animals. The study aimed to determine the presence of CAEV infection in blood samples of goats from 13 major goat production area in the province of Cebu using PCR techniques. Of the 130 blood samples, 9 (6.92%) tested positive from the different localitites and mostly from purebreeds and upgraded goats. There is no seropositive confirmation based on PCR from the blood samples of native goats used in this study indicating natural immunity from CAEV infection, although this remains to be elucidated. Considering the current increase in the consumption of meat and milk from goats in the country, it is deemd necessary to have an infection control program for CAEV infection in the country. The result of this study may be helpful in future studies and for developing monitoring program of this importance disease.

Keywords: caprine arthritis encephalitis virus, prevalence, goats, Cebu

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ANTIBACTERIAL AND ANTIFUNGAL PROPERTIES OF LEMON BALM ESSENTIAL OIL AGAINST SELECTED ORAL PATHOGENS

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Lemon balm is being used for oral application by making tinctures or by chewing a leaf mainly for cosmetic reasons as it freshens breath. The study was conducted to determine the antibacterial and antifungal properties of lemon balm essential oil against selected oral pathogens namely *Streptococcus mutans*, *Staphylococcus aureus* and *Candida albicans* through disc diffusion method. Lemon balm leaves and stems were collected and dried using the Multi commodity heat pump dryer and submitted as powdered form for oil extraction at the Chemical Testing Laboratory of ITDI-DOST. The oil extract was forwarded to the Standard and Testing Division (STD) of DOST for the disc diffusion method. Results showed that lemon balm essential oil produced complete inhibitory activity (+++) with moderate reactivity against *Streptococcus mutans* and *Staphylococcus aureus*, and it produced complete inhibitory activity (+++) with severe reactivity against *Candida albicans*. Therefore, the lemon balm oil is a potential material for mouthrinse that may reduce the pathogens in the oral cavity.

Keywords: lemon balm oil, oral pathogens, anti bacterial, anti fungal

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PHYTOCHEMICAL, ANTIOXIDANT AND ANTI-INFLAMMATORY SCREENING IN THREE SPECIES OF FERNS (POLYPODIACEAE) IN BUKIDNON, PHILIPPINES

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The total phenolic and total flavonoid contents, the anti-oxidant as well as anti-inflammatory activities were determined on methanolic extracts from rhizomes and fronds of *Drynaria quercifolia*, *Microsorum punctatum* and *Pyrrosia adnascens* (Family Polypodiacaeae) collected in Bukidnon, Philippines. Folin-Ciocalteau and aluminum chloride assays were used to measure TPC and TFC. DPPH radical scavenging activities to determine anti-oxidant activities and albumin denaturation assay to measure anti-inflammatory activity was carried out. Except in *P. adnascens*, rhizomes of the plant samples had higher TPC and TFC than fronds. Moreover *P. adnascens* had no detectable levels of TFC in both plant parts. The levels of ascorbic acid - based DPPH scavenging and anti-inflammatory activities at 56.58±2.35 mg GAE/g sample and 64.80 ± 5.79 %, respectively, in the methanolic extract of *M. punctatum* rhizome exceeded the values obtained from its frond and from the two other species.

Keywords: DPPH, anti-inflammatory, *Drynaria quercifolia*, *Microsorum punctatum, Pyrrosia adnascens*

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ASSESSMENT OF NUTRIENT UTILIZATION AND CONSERVATION IN TYPHOON-DAMAGED MANGROVES USING NUTRIENT CONTENT AND RESORPTION EFFICIENCY

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The growth and development of mangroves are affected by the availability of nutrients in the sediments and its translocation in the leaves. The occurrence of a typhoon alters the availability of nutrients through heavy dumping of organic detritus. Here, we investigated the effects of typhoon on nutrient availability and remobilization of nutrient prior to leaf abscission (referred to as resorption efficiency; RE). The study was conducted in six sites consisting natural and planted mangrove forests (Super Typhoon Yolanda-affected areas in 2013 - Bantayan Island, Cebu; Kalibo, Aklan; Busuanga, Palawan; Typhoons Emong (2009)- and Lando (2015) - affected area - Bani, Pangasinan; and typhoon-undamaged areas: Subic and Masinloc, Zambales). In each site, three sediment samples (diameter = 5.2 cm; depth = 20 cm) and 20-30 green mature and yellow senescent leaves were collected. The samples were analyzed for nutrient contents (total nitrogen and total phosphorus), and N and P resorption efficiencies (NRE and PRE). Results showed that the typhoon-damaged sites have 50% higher N in the sediments and 35 % higher P in the leaves as compared to the undamaged sites. The OM and P contents in the sediments and N content in the leaves as well as the NRE (range: 46-68%) and PRE (range: 52-74%) were comparable across sites. The PRE was found highest in the planted stands in Bantayan Island (73.82 ± 0.52%) which had a low to negligible P in the sediments. At 3-yrs post-typhoon, there were no changes in NRE and PRE, implying that the mangroves were not able to utilize the typhoon-dumped nutrients and failed to improve its nutrient conservation mechanism. The inefficient conservation of nutrients may hinder and further delay the post-typhoon recovery of the mangroves.

Keywords: Nutrient, resorption, conservation, mangroves, typhoon

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BIOLOGICAL ACTIVITIES AND GC-MS ANALYSIS OF PHILIPPINE *Cinnamomum mercadoi* VIDAL (LAURACEAE)

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Cinnamomum mercadoi Vidal locally known as Kalingag is found only in the Philippines. *C. mercadoi* is one of the few endemic plant species that is used for the treatment of several diseases. However, due to limited scientific data, further studies must be conducted to establish the scientific basis of the medicinal properties of *C. mercadoi*. Thus, the main objective of this study is to determine the biological activities and chemical constituents of the crude extract, non-polar and semi-polar fractions of *C. mercadoi* bark. The antioxidant activity was determined using the ferric thiocyanate method, the analgesic activity by the use of Planter test on Sprague-Dawley rats and the antimicrobial activity by Kirby-Bauer Disk diffusion method. The chemical constituents were analyzed by GC-MS.

The crude extract showed significant analgesic activity (84%) at 500 mg/kg body weight as compared to aspirin (72%) at 300 mg/kg body weight, the hexane extract (65.11%) at 600 mg/kg body weight and aqueous (75.0%) at 150 mg/kg body weight. The crude extract exhibited antioxidant activity with 91.76% inhibition, higher than butylated hydroxyanisole which gave 76.64% inhibition. *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans*, *Fusarium monoliforme*, and *Aspergillus fumigatus* were susceptible to the crude, hexane, aqueous, butanol and dichloromethane extracts of *C. mercadoi*. GC-MS analysis of the hexane and dichloromethane fractions confirmed the presence of methyl eugenol (20.87%), safrole (2.38%) and eugenol (1.27%). This study shows the potential of *C. mercadoi* and provides new leads for further investigation of novel therapeutic agents from Philippine endemic plants.

Keywords: *Cinnamomum mercadoi* Vidal, antioxidant, analgesic activity, antimicrobial activity, GC-MS analysis

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CASHEW (*Anacardium occidentale* L.) BARK EXUDATE AS ALTERNATIVE MOUNTING MEDIUM FOR PARAFFIN SECTIONS

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Cashew (*Anacardium occidentale* L.) bark exudate was used in this experiment as an alternative mounting media and was compared in terms of clarity and adhesion to Eukitt on toad (*Bufo marinus*) liver paraffin sections. Fifteen (15) slide samples on each test of Eukitt (To) and cashew bark exudates (T1) was evaluated through blinding by ten (10) respondents for clarity, adhesion and visibility of some cellular details. In the evaluation for clarity, each slide was graded 1 – **clear**, if liver cells are visible, 2 – **not clear**; if liver cells are not visible, and 3 – **undecided**; if the respondent could not decide directly. For adhesion, each slide was graded as 1 – **good**; if the slide is adhesive to the cover slip, 2 – **not good**; if the slide is not adhesive to the cover slip, and 3 – **undecided**; if the respondents could not decide directly. There was no significant difference on the t-test result for clarity and adhesion of cashew bark exudate and Eukitt. The presence of cellular details observed under Low Power Objectives (LPO) further confirms clarity. The study shows that cashew bark exudate is comparable to Eukitt on aspects of clarity with the visibility of cellular details (nucleus and cell membrane) and adhesion when used as alternative mounting media for paraffin sections. There was evident reduction in processing cost and time because of the elimination of complete dehydration for cashew mounted sections. Moreover, there was notable absence of hazardous odor for cashew mounted slides.

Keywords: Cashew, mounting medium, paraffin sections, light microscopy

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CRYOTOLERANCE OF POST MORTEM GOAT EPIDIDYMAL GERMPLASM AFTER PRESERVATION AT CRYOGENIC TEMPERATURE

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Small scale/backyard raised goats comprise to about 98% of the total 3.68M goat population in the country. The chevon's rising popularity in 'specialty' restaurants justifies the daily butchering of goats. With such practice, we studied the possibility of utilizing post mortem testicles to recover sperm for preservation at cryogenic temperature.Epididymal sperms immediately recovered from the dissected caudaepididymal tissue were evaluated by subjective/conventional method and objectively by Computer Assisted Sperm Analyzer (CASA). The initial motility averaged 64.2 ±1.0 % by conventional method of evaluation. Sperm motility (CASA-MOT) and progressive motility (CASA-PMOT) revealed 75.5± 3.7% and 20.5±2.9%, respectively. Sperms were processed using a modified goat semen freezing extender with 20% egg yolk. After equilibration at 5°C, the sperm suspension was dispensed in 0.5 ml semen straws. Cryopreservation took place in an ultralow freezer, followed by direct LN2 plunge and storage at cryogenic temperature of -196°C. The post thaw sperm motility reduced significantly ($p<0.05$) after evaluation either by conventional method (19.16±3%) or by CASA-MOT (32.75± 5.61%). However, the CASA PMOT value (15.28±3.26%) did not differ ($p>.05$) manifesting cryotolerance of progressively motile epididymal sperm after preservation at cryogenic temperature. Additionally livability assessment after cryopreservation using SYBR green dye fluorescence microscopy evaluation reveals that 63% of the sperm population were found live, hence suggesting cryotolerance.

Keywords: goat, epididymal sperm, CASA, SYBR

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EFFECT OF LONG DISTANCE TRANSPORT ON THE VIABILITY OF FRESH AND FROZEN-THAWED GOAT EMBRYOS STORED IN PORTABLE INCUBATOR

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The production and maintenance of viability of embryos for embryo transfer involve the proper culture, freezing, storage, thawing and transport. The use of portable incubator (P.I.) in the developmental rates of ovine and whale oocytes has been shown to work. Rhesus monkey embryos transported using a P.I. developed to advanced stages after further culture. With these findings, fresh goat embryos were stored in a P.I. at 37oC at different storage times to determine their viability.

Normally cycling does were synchronized, superovulated, anaesthesized and recovery of embryos followed using 0.9% physiologic solution. The flushed medium was collected in a 50-ml tube maintained at 37°C. Embryo searching was done under a stereomicroscope. Labeled straws were filled with pre-equilibrated synthetic oviductal fluid (SOF) medium and were loaded each with 1 embryo assigned to: Treatment (T) 1- embryos stored for 6 h; T2 for 18h and T3 for 24 h in the portable incubator. Thereafter the embryos were transferred to the petri dish with droplets of SOF medium with mineral oil and were incubated at 38.5oC in 5% O_2, 5%CO_2 and 90% N_2 gas atmosphere. The embryos were observed after 24-72 h incubation period. All morulae developed to expanded blastocysts in all treatments, and a hatched blastocyst (HB) in T2 and 2 HB in T3. For blastocysts stage embryos, embryos in T1all shrunk after 48h, 2 HB in T2 and 2 HB in T3. Twenty two frozen-thawed goat embryos that were cultured proved to be viable as evidenced by 7 HB. These results indicated the viability of fresh and frozen-thawed goat embryos stored in a P.I. for a 24h period.

Keywords: portable incubator, blastocysts, frozen-thawed, goat embryos, multi-gas incubator

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TUNA LEATHER FABRIC AS A MATERIAL FOR BI-FOLD WALLETS

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This study aimed to utilize the country's rich resource in order to come up with a new material in the production of leather goods for the garment and textiles industry. The primary goal of the research was to determine the feasibility of tuna skin wastes as an alternative source of leather. It sought to determine the sewability property of tuna leather fabric in order to produce quality leather goods. The study was purely an experimental research that used an empirical scientific approach based on observations, measurements and practical experimentation.

Through the leather tanning process, the tuna skin was proven to be a good alternative source of leather. Two types of tuna fabric were created one without finishing and the other with glazing. Both showed excellent performance when subjected to the tear strength test and surpassed the commercial leather's standard. The study formulated sewing specifications in order to determine the sewability of the tuna leather for production of bi-fold wallets, and its sewability was confirmed through the success of the production of the wallets. In addition, both types of tuna fabric showed an outstanding result when subjected to seam strength test; but the fabric without finishing showed better results. It was concluded that the tuna leather had the following sewability property: 8 to 10 SPI Stitch length, 16 or 18 needle size, 100% polyester thread and 3 to 6 tension range. These sewing specifications were proven to be compatible to the outstanding physical fabric characteristics of the tuna leather fabric.

Keywords: leather goods; tuna leather; sewability property

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FLOWERING BEHAVIOR, CHARACTERIZATION AND IRRADIATION EFFECTS ON PHILIPPINE NATIVE *Phalaenopsis* ORCHIDS

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Twelve different species of Phalaenopsis or butterfly orchids collected from different places in the country were evaluated and characterized for flowering behavior, tested for self-compatibility and growth under Los Baños conditions, and further explored for mutation breeding using tissue culture and irradiation. Twelve Phalaenopsis species flowered successfully under Los Baños conditions consistently for two years. The degree of self-compatibility varied from 3.8 to 50%. *P. aphrodite* and *P. heiroglyphica* embryos cultured *in vitro* in Knudson C medium germinated into protocorms successfully at 80-90% within three to four weeks after explanting. Proliferating protocorms of *P. aphrodite* subjected to different levels of gamma irradiation at 0, 10, 15, 20 and 25 Gy responded differently to the treatments. The number of regenerants with roots and shoots, and the number of regenerants with shoot only, also differed significantly among the treatments. Leaf length and leaf width differ significantly among the treatments after three years of growth in the screenhouse. While orchids generally flower three years after potting-out, preliminary observation indicated that irradiation using 15 Gy induced earlier flowering of one plant of *P. aphrodite* by only one year and another one flowered two years after potting-out. Natural variation for the tiger-like patterns of *P. schilleriana* was detected. This pattern differed significantly in numbers in the various leaf types of *P. schilleriana*. The leaf length and width also differed significantly. The number of leaf bands is correlated with the leaf length of *P. schilleriana*.

Keywords: breeding, butterfly orchids, irradiation, Phalaenopsis, protocorms

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IN VITRO EFFICACY OF DIFFERENT ANTIBIOTICS AGAINST BACTERIAL AND FUNGAL CONTAMINANTS OF TISSUE-CULTURED 'SABA' BANANA (*Musa balbisiana*)

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The study was conducted to identify and characterize the bacterial and fungal contaminants of tissue-cultured 'Saba' banana meriplants and to find out the most effective antibiotics against bacterial and fungal contaminants.

The experiment was laid-out in a Completely Randomized Design (CRD) with five treatments replicated three times. The treatments were as follows: T1- Control (No treatment); T2- Streptomycin (200 mg / L); T3- Nystatin (1 ml / L); T4- Streptomycin (200 mg / L) + Nystatin (1 ml / L); and T5- Benomyl (Chemical check) 100 mg / L). Data were analyzed using ANOVA and HSD tests.

Based on the study, there were two fungal contaminants identified as *Trichoderma sp.* and *Rhizopus sp.* and one bacterial contaminant identified as gram positive bacterium. During the initial stage of tissue-cultured 'Saba' banana plantlets, 15% contaminations were recorded. This comprised of 10% fungal contaminations and 5% bacterial contaminations.

Results of the in vitro test on the zone of inhibition (mm) showed that the growth of gram positive bacterium was inhibited by Streptomycin 200 mg per liter among the other treatments.

While the colony diameter (mm) of *Trichoderma sp.* in Benomyl (chemical check) 200 mg per liter had the lowest increase in colony diameter among the other treatments.

Keywords: Antibiotics, Bacteria, Fungus, Contaminants, Tissue-cultured Banana

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MORPHO-ANATOMICAL CHARACTERS AND ETHYLENE PRODUCTION IN *Hibiscus rosa-sinensis* L. IN RELATION TO TWO-DAY OLD FLORAL RETENTION

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The cultivars of *Hibiscus rosa-sinensis* are known worldwide for their aesthetic value as garden or potted plants; but they have short lifespan or 'retention' of their flowers. Due to this constraint, they have not been used as a cut flower, which limits their potential in the floriculture industry. The problem of the short floral retention of hibiscus and how it could be elucidated can be solved by finding out the factors that affect it, was the main objective of this research. The differential duration of petal retention in *Hibiscus rosa-sinensis* L. was studied through three main factors feasibly affecting it across the four breeds or varieties used, namely, Gelia Castillo (GC), Loren Legarda x Estrella F. Alabastro (LLxEFA), Reddy-or-Not (RON), and Wilcox (WX). In this research we found that morphological traits including peduncle diameter, receptacle diameter, peduncle length and petal thickness were related to floral retention of *Hibiscus rosa-sinensis* L. Meanwhile, the anatomy of the abscission zone was observed to provide a tissue-level basis for floral retention. Furthermore, ethylene concentrations were quantified to assess its relation to floral retention. There were no defined abscission zones in flowers of hibiscus instead the abscised petals had remnants, suggesting that abscission did not proceed at the petal base where abscission zone is theoretically located. In addition, ethylene production increased as abscission progressed, typically exhibiting the climacteric pattern and the auto-catalytic nature of ethylene biosynthesis.

Keywords: abscission zone, ethylene, floral retention, Hibiscus rosa-sinensis, morpho-anatomy

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PHYSIOLOGY AND ANATOMY OF SIX SPECIES OF GRASSES GROW IN ON LATERITIC SOIL OF MASINLOC, ZAMBALES, PHILIPPINES

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One of the major problems of our environment are mined-out areas. These mined out areas were products of extensive mining activities resulting into strip vegetation and heavy metal contamination of soil. This study determined the physiological and anatomical characteristics of three exotic (*Cymbopogon citratus, Imperata cylindrica,* and *Panicum repens*) and three native (*Alleopterosis semialata, Dinochloa acutiflora,* and *Machaerina disticha*) species of grasses collected from KM 21 Brgy. Taltal, Masinloc, Zambales, Philippines. Rhizobox technique was used to study the root growth and direction as well as mean daily transpiration rate, which was observed during 9 am, 12 nn, and 4 pm. Based on the results of the study, *D. acutiflora* was the only species that exhibited horizontal and spreading roots and showed the fastest root growth among the six grass species while *A. semialata* and *P. repens* were the most deep penetrating roots among the vertical forming roots. Transpiration rate was highest during 12 nn and the species with the highest transpiration rate were *A. semialata*, *D. acutiflora,* and *P. repens*. Leaf anatomical features such as thick epidermis, sclerenchyma caps (SC), extended vascular bundles (VB), and bulliform cells (BC) were found in all studied grass species. Root anatomical features found were thick epidermis, thick endodermis, large cortex filled with intercellular spaces (present in *P. repens, D. acutiflora,* and *M. disticha)*, and black spots formed in the cortex and pericycle (present in *A. semialata*). Combining species of *A. semialata*, *D. acutiflora*, and *P. repens* are recommended for phytostabilization because of their fast root growth and high transpiration rate.

Keywords: ecological restoration, phytostabilization, rhizobox

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PHYTOCHEMICAL, ANTI-INFLAMMATORY AND ANTIOXIDANT SCREENING OF *Christella parasitica* H.L AND *C. dentata* (FORSSK.) BROWNSEY AND JERMY IN CENTRAL MINDANAO UNIVERSITY

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Methanolic extracts (2mg/ml) of frond and rhizome of *Christella parasitica* H.L and *C. dentata* (Forssk.) Brownsey and Jermy in Central Mindanao University were: a) tested for the presence of alkaloids, anthraquinones, phenolic compounds, saponins, and terpenoids through thin layer chromatography; b) quantified for the total phenolic content (TPC) through the Folin-Ciocalteau Assay; c) quantified for the total flavonoid content (TFC) using aluminum chloride colorimetric method; d) evaluated for anti-inflammatory property using albumin denaturation assay; and e) evaluated for the antioxidant activity using DPPH assay. Thin layer chromatography revealed the presence of alkaloids, phenolic compounds, saponins and terpenoids in the frond and rhizome of both species. However, anthraquinones are present only in the fronds of both species. TPC was higher in *C. dentata* than in *C. parasitica* ($p<0.01$). TPC was higher in rhizome than in frond ($p<0.01$). *C. dentata* rhizome and frond contains 211.84±8.94 and 37.02±4.42 gGAE/kg extract, respectively. *C. parasitica* rhizome and frond have 159.68±20.14 and 29.46±2.97 gGAE/kg extract, respectively. TFC of *C. dentata* and *C. parasitica* rhizomes have 2.80±0.39 and 2.16±0.13 gQE/kg extract, respectively. TFC was not detected in fronds of both species. Rhizomes of *C. parasitica* and *C. dentata* showed 10.21±1.26% and 16.26±1.15% inhibition to egg albumin denaturation, respectively. Inhibition was not detected in the frond. Relative to Celecoxib, *C. parasitica* and *C. dentata* showed 35.59±4.40% and 56.66±3.99% inhibition, respectively. Rhizome of *C. parasitica* and *C. dentata* showed 5.39±0.16% and 4.49±0.59% free radical scavenging activity which is not detected in the frond. Relative to ascorbic acid, *C. parasitica* and *C. dentata* showed 8.94±0.27% and 7.46±0.98%, respectively. These results support the medicinal uses (i.e. gout and rheumatism) of *C. parasitica* and *C. dentata* with rhizome as an important part, and hence are potential species for drug development.

Keywords; phytochemicals, anti-inflammatory, antioxidant, Christella

BS - 47

ROOT GROWTH POTENTIALS AND MORPHOLOGICAL CHARACTERISTICS OF NURSERY-GROWN SEEDLINGS OF SHOREA GUISO BLANCO BLUME AND HOPEA PLAGATA BLANCO VIDAL IN BATAC, ILOCOS NORTE

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Successful reforestation of denuded forestlands depends on the quality of seedlings used. However, a reliable method of evaluating the available seedlings must be utilized so that only high quality seedlings are released for outplanting. Thus, a study was conducted to assess the morphological attributes of nursery-grown seedlings at MMSU; compare their root growth potentials (RGP) and seedling quality index (SQI); and determine the relationships among morphological traits, RGP and SQI of the seedlings.

The study was laid-out in a 2 x 2 Factorial in Randomized Complete Block Design with Factor A: species (*H. plagata* and *S. guiso*) and Factor B: height ranges (10-15 cm and 16-20 cm). Morphological variations were assessed in terms root collar diameter (RCD), height, length of longest root, and root-shoot ratio while RGP was evaluated in terms of number and length of lateral roots. Correlation analysis among morphological characteristics, RGP and SQI was also done.

Results showed that seedling height growth varies with species, while RCD and length of longest root were not affected by either species or height range. In addition, seedlings regardless of species and height were top heavy but the root-shoot ratio was still within the acceptable range. Moreover, *H. plagata* seedlings had higher SQI than the *S. guiso* seedlings. In addition, taller seedlings exhibited higher SQI and RGP than the smaller seedlings. Lastly, seedling height was positively correlated with RGP, while RCD was positively correlated with SQI.

The results suggest that height and RCD can be used to predict the RGP and SQI of *H. plagata* and *S. guiso* seedlings, respectively. However, it is recommended that these results be validated by assessing the seedlings' performance in the field.

Keywords: seedling quality index, seedling morphology, root collar diameter, root-shoot ratio

BS - 48

ITS2 IDENTIFICATION SYSTEM OF MEDICINALLY IMPORTANT *Uncaria* SPP (NAUCLEEAE—RUBIACEAE) INCLUDING THEIR PHYLOGENETIC POSITIONS

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The genus *Uncaria* has been an important source of potent immunopotentiating compounds. However, usage has been restricted to a small number of species due to difficulties encountered in identification. This study utilized ITS2 data sequences following the Best Close Match Method to determine conspecificity of 15 recently collected Philippine *Uncaria* spp. and Maximum-Likelihood (ML) and Bayesian Inference (BI) of combined ITS-rbcL-trnL-F dataset for phylogenetic reconstruction. Results of the Best Close Match Method identified seven conspecific clades and the appropriateness of ITS2 data sequences for *Uncaria* identification. ITS2 sequence data showed a barcoding a gap and an average coalescent depth was established as a threshold value for conspecificity. Phylogenetic reconstruction revealed two distinct clades, an Afro-Neotropical clade recognized for having lateral branches terminated by reproductive organs and by possessing inflorescences born on leafless lateral branches and an Asian clade recognized for having strictly axillary inflorescences. Results of this study promote the proper utilization of *Uncaria* spp. and the possible exploitation of understudied members.

Keywords: ITS, SRM, trnH-psbA, tsaang gubat, sambong

BS - 49

NOVEL INSIGHTS ON GENERIC CIRCUMSCRIPTIONS, PHYTOCHEMICAL PROFILES, AND BIOLOGICAL ACTIVITIES OF ENDEMIC PHILIPPINE ANNONACEAE SPECIES

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The family Annonaceae has been regarded as an important source of medicinally active compounds but its full utilization has been less successful due to the absence of clear-cut morphological delineation among its member genera. In recent field surveys of Luzon Island, seven interesting endemic Philippine Annonaceae species were collected. The collected samples were subjected to Bayesian Inference (BI) and Maximum-Likelihood (ML) analysis of combined *rbc*L-*mat*K-*trn*L-F for generic circumscription, phytochemical profiling, and anti-tyrosinase and MTTAssay for biological activity testing. Analyses revealed two novel species namely, *Goniothalamus polilloensis* Casing, Villaroman, & Alejandro and *Polyathia bulusanensis* Bangayan, Granda, & Alejandro and a novel genus clearly distinct by having axillary inflorescences and smooth seed coat texture. Phytochemical analyses of the seven species revealed the presence of active secondary metabolites, mostly positive anti-tyrosinase activity that suggests radical scavenging capacity, and positive cytotoxic activity. This study features the importance of accurate identification through gene markers and bio-resource of new anti-melanogenetic and anti-cancer compounds for tomorrow's drug discovery.

Keywords: Annonaceae; anti-tyrosinase; Bayesian Inference; MTT assay; Maximum Likelihood

BS - 50

SHARED MICROCRUSTACEAN (COPEPODA: CALANOIDA & CYCLOPOIDA; CLADOCERA: ANOMOPODA & CTENOPODA) ASSEMBLAGES BETWEEN SURFACE AND GROUNDWATER ECOSYSTEMS IN LUZON ISLAND POINT TO HIGH CONNECTIVITY AND POTENTIAL THREATS

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In tropical countries like Philippines, research on microcrustaceans is limited to surface waters leaving groundwater species remain poorly understood because of inaccessibility of the subsurface habitat that results in inadequate knowledge on the total biodiversity in freshwater ecosystem. In light of this, a total of 50 surface and 102 groundwater sites in Luzon Island were surveyed from 2008-2016 for microcrustacean zooplankton collection. A total of 37 species, including 17 Cladoceran and 20 Copepod, which belong to 2 cladoceran orders, 5 families and 13 genera; 2 copepod orders, 4 families and 9 genera. Among these, 32 species were restricted to surface water, 5 new species records were only documented in groundwater, and 16 species were shared by both entities. These large number of taxa shared by both ecosystems suggest high connectivity between the surface and groundwater in Luzon Island. The presence of the invasive calanoid copepod, *Arctodiaptomus dorsalis* in a groundwater habitat in northern Luzon is a cause for concern since it used to be found only in highly eutrophic surface waters may indicate contamination of previously pristine groundwater habitats. However, our data also show 4 new distribution and 1 new species records in Luzon ground waters which points to the potential of discovering unique and almost unrecognized form of biodiversity in sub-surface ecosystems in the country. The results of this study increases our current knowledge on the over-all biodiversity of freshwater microcrustaceans in the country as well as show potential threats.

Keywords: Luzon Island, microcrustaceans, surface water, and groundwater

BS - 51

SPECIES ABUNDANCE OF GASTROPODS IN TIGUA RIVER, COMAWAS, SAN FERNANDO, BUKIDNON

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The study was conducted in Tigua River, San Fernando, Bukidnon, Philippines to identify the species of gastropods, determine the species using sieve and handpicking methods and determine some physical and chemical parameters, such as temperature, depth, pH and water curent affecting the distribution of gastropods. Three (3) study stations were established and a plot of 2x5m2 was laid in each. Collection of the specimens was done using the two methods: sieve and handpicking. Data were statistically analyzed through Analysis of Variance (ANOVA). There were eight (8) identified species of gastropods under five (5) genera, three (3) families and three (3) orders. The families include Viviparidae, Thiaridae and Physidae; the orders were Architaenioglossa, Mesogastropoda and Bassomatrophorida; while the genera include *Bellamya, Melanoides, Tarebia, Thiara,* and *Physa*. Data revealed that Station 1 obtained the highest species abundance with 8 species, followed by Station 2 with 7 species and Station 3 with 5 species when sieve method was employed. In handpicking method, Stations 1 and 2 obtained the highest species abundance with 7 species and Station 3 with 3 species. Data analysis showed that species mean value of Station 3 was found to be significantly different ($P = 0.0001$). However, no significant differences were found in both methods. It is recommended that further assessment of gastropods in Tigua River be done.

Keywords: Bukidnon, gastropods, handpicking, sieve method, tigua River

BS - 52

WATER QUALITY PARAMETERS AND POPULATION CHARACTERISTICS OF THREE MUD CRAB (*Scylla*) SPECIES IN THE ESTUARIES OF NAIC, CAVITE

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A study was conducted to determine the water quality parameters and population characteristics of three mud crab species in the estuaries of Bucana, Mabulo, and Timalan, Naic, Cavite. Sampling was carried out for six months using crab liftnets. Mud crab collection was done thrice a month. The carapace width and weight of three mud crab species were determined. Sex were identified and counted to determine its abundance and sex ratio. Water parameters such as temperature, salinity, dissolved oxygen (DO), transparency and water depth were monitored during the survey.

The prevailing water quality parameters such as temperature was observed between 30.91 to 31.01 °C; salinity ranged from 8.61 to 12.39 ppt; DO level varied between 4.07 and 5.73 ppm; transparency reading was between 52.44 and 62.06 cm; and water depth ranged from 163.44 to 196.39 cm.

A total of 738 mud crabs of various sizes, sex and species were collected. The mud crab species composition was dominated by *Scylla serrata* followed by *Scylla olivacea* and *Scylla tranquebarica.* Juvenile mud crabs had higher percentage catch in three species compared to sub-adults and adults. The male crabs were relatively more abundant than the females in three mud crab species with an average ratio of 1: .85.

Keywords: mud crab, water quality, estuary, population

BS - 53

ECOTOXICOLOGICAL AND HISTOPATHOLOGICAL ANALYSIS OF JUVENILE *Oreochromis niloticus* EXPOSED TO MUNICIPAL WASTEWATER

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Urbanization in developing countries has caused several health and environmental problems and among these is the generation of large volumes of domestic wastewater (wastewater from households) through our daily activities such as bathing, laundry, and the like. Domestic wastewater is considered the main contributor of both biochemical oxygen demand (BOD) pollution and groundwater contamination from bacteria, and is responsible for a bulk of organic waste with suspended solids and coliforms found in water; however, if treated, domestic wastewater can become a valuable alternative water source. Thus, this study aims to determine the viability of wastewater effluent to be used in urban aquaculture and other non-potable purposes through an acute ecotoxicological and histopathological analysis using *O. niloticus* (Nile tilapia) as a test organism. This was done by exposing juvenile Nile tilapia to varying concentrations of the effluent for 96-hours. After this period, samples of surviving fish's liver were harvested and preserved for histopathological analyses to determine sub-lethal effects due to exposure to the toxicant. Initial results of this study show a dose-response relationship with fish mortality increasing with increasing toxicant concentration. It is expected that the LC_{50} will fall within the concentration range of 700,000 ppm to pure or 100 percent treated domestic wastewater, which shows its viability to augment fresh water demands in urban communities. Specifically, treated domestic wastewater is capable of supporting juvenile Nile Tilapia survival as long as the concentration of the toxicant used is below 700,000 ppm or 70%.

Keywords: wastewater, toxicity, *Oreochromis niloticus*

BS - 54

EFFECT OF THE SAMPUNG HALAMANG GAMOT EXTRACTS ON THE GUT BACTERIA OF BALB/C MICE

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Bacteria that colonize the human intestinal tract live in symbiosis with the host. Several factors, such as diet and drug intake, influence the balance of gut bacterial composition that will in turn affect health. Therefore, this study aimed to determine the effect of the Sampung Halamang Gamot (lagundi, ulasimang-bato, bawang, bayabas, yerba buena, sambong, ampalaya, niyog-niyogan, tsaang gubat, and akapulko) on mice gut bacteria to further elucidate the health benefits from these plants. Ten groups of five BALB/c mice were fed 200 mg/kg body weight of each plant crude extract for a month. Bacterial DNA was extracted from mice fecal samples collected before and on Day 16 and 32 of extract feeding. Relative PCR using 16S rDNA primers specific for Lactobacillus and Enterobacteriaceae was done to assess the effect on the beneficial and potentially harmful bacterial populations through time. Results showed an increase in *Lactobacilli* in the gut of mice fed with lagundi until Day 32. On the other hand, the *Lactobacilli* in the gut of mice fed with bawang, niyog-niyogan, and akapulko increased until Day 16 only. There was a decrease in the Enterobacteriaceae population in the gut of mice fed with niyog-niyogan, lagundi and bawang until Day 32. In contrast, Enterobacteriaceae population in mice given tsaang gubat, ampalaya and akapulko extracts increased after Day 16. Results imply that lagundi, bawang, niyog-niyogan and akapulko are potential prebiotics that promote the proliferation of a group of probiotic bacteria, Lactobacillus. This finding adds to the health benefit repertoire of the said medicinal plants.

Keywords: sampung halamang gamot, gut bacteria, relative PCR

BS - 55

HEAVY METAL CONCENTRATIONS IN THE LEAVES OF PLANTS GROWING IN SELECTED AREAS OF QUEZON CITY, PHILIPPINES

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Rapid urbanization and intense anthropological activities in cities pose a number of risks e.g. heavy metal pollution. Unfortunately, few studies have been done on heavy metal contamination in plants in urban areas in the country and their impacts on human and ecological health.

The study assessed the heavy metal concentrations (i.e. Cd, Cr, Cu, Pb and Zn) in senescent leaves of plants growing in sites of varying land uses in Quezon City, Philippines (e.g. watershed, parks, landfill, commercial, and residential areas). Leaf samples from selected plants were collected, washed, oven-dried and homogenized. Dry ashing was used for organic matter destruction and heavy metal concentrations were determined using ICP-MS.

The results showed variations in average foliar heavy metal concentrations ranging from 0-0.4 mg/kg for Cd, 0-10 mg/kg for Cr, 2-22 mg/kg for Cu, 0-5 mg/kg for Pb, and 11-250 mg/kg for Zn. Results for Cd and Cr were above the threshold concentrations in some plants. Cu and Zn concentrations were generally normal, though deficiencies in both micronutrients were seen in some species. All plant species had Pb concentrations below normal. However, a comparison of the results between sampling sites showed that plants growing on and around the Payatas landfill exhibited the highest levels of heavy metal contamination. This finding presents an alarming ecological and human health risks as these plants are used for their medicinal, cooking, and livestock purposes.

Keywords: heavy metals, leaves, plants, Philippines

BS - 56

SUITABILITY OF THE LOSS-ON-IGNITION METHOD IN ESTIMATING ORGANIC CARBON IN SELECTED PHILIPPINE SOILS

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Increasing interest in the soils' capacity to sequester carbon requires the development of an accurate yet cost-effective method in soil organic carbon (SOC) determination. Loss-on-ignition (LOI) measures weight losses of soil during combustion to estimate SOC. However, this method does not have a standard protocol for Philippine soils. Experiments using the three dominant soil types in the country (i.e., Inceptisol, Ultisol and Vertisol) were conducted to determine the appropriate ignition conditions for local soils. Results revealed no significant effect of sieve size and sample mass on LOI and that increasing ignition temperature and duration resulted in increasing LOI across all soil types and depths. Heating the soil with a sieve size <0.5 mm and a mass > 20 g at 450°C for 3 hrs is the most suitable condition for all soil type. In addition, a conversion factor of 1.64 can be used to estimate SOC from SOM, while a clay correction factor of 0.15 must be applied to account for the contribution of structural water loss from clay minerals. Lastly, while LOI has the advantage of being a simpler and cheaper procedure without the generation of hazardous wastes, it still overestimates SOC relative to the traditional wet chemical oxidation method. To improve the method, further studies can be conducted to determine correction factors for carbonates and sesquioxides.

Keywords: carbon stabilization, carbon sequestration, mangrove sediments, reactive iron

ENGINEERING SCIENCES AND TECHNOLOGY

EST- 01

PERFORMANCE OF DTSN PROCOTOL UNDER CONGESTION

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Consistent data delivery is vital in constrained networks such as wireless sensor networks (WSN), which has a significant role in Internet of Things (IoT), thus reliable transport protocols should be used. Data caching and congestion control are two techniques that can improve the performance of transport protocols. However, it is not yet established how these two mechanisms are related in terms of determining up to what extent data caching alone can alleviate congestion in wireless networks. This study investigates and analyses how a cache-based transport protocol, that has no congestion control mechanism and has a fixed transmission window, performs under congestion states. The transport protocol, called Distributed Transport for Sensor Network (DTSN), was tested under link and buffer congestion scenarios and the optimal performance is determined using goodput, transmission cost and cache hit metrics. Caching was able to alleviate congestion in WSN at some point. However, the amount of traffic being sent and intermediate node's cache memory should be taken into account. Our work was able to establish that a large transmission window (20 to 30 packets) with average cache size should be used at link congestions during channel contentions while smaller transmission window (7 to 10 packets) with average cache size should be used during buffer congestion at bottleneck links. These values can guarantee optimum performance of DTSN during congestion and can also be a basis for developing congestion window management in the future for other transport protocols in WSN that employ data caching.

Keywords: caching, congestion, contention, transmission window, cache size, Wireless Sensor Networks

EST - 02

EFFICIENT BLOCKCHAIN-BASED AUTHENTICATION FOR THE INTERNET OF THINGS

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Internet of Things (IoT) is steadily evolving which allows a new paradigm of smart sensors and lightweight devices interacting with one another without human intervention, also known as machine-to-machine (M2M) communication. This allows solution for various fields such as Smart Home Automation. In this scenario, the satisfaction of security and data privacy requirements play a fundamental role. The Blockchain concept, with the help of cryptography, offers a solution by facilitating transactions and the coordination of devices. The study aims to improve the current smart home by developing and implementing a blockchain-based authentication system using a Blockchain data structure along with standard cryptographic algorithms, namely Advanced Encryption Standard (AES-128), Secure Hash Algorithm (SHA-256), and Keyed-Hashing for Message Authentication (HMAC). We used the C/C++ language to implement the software and a low-cost wireless radio transceivers operating at 2.4 GHz ISM band for the hardware. In addition to that, we used open software components include Node.js and the MongoDB database to set-up the server and the database backend, respectively. To improve the running time of the cryptographic and blockchain calculations, we used a peripheral device to perform the said operations in hardware. Our results show that we have obtained a performance speedup of 5.5 and 7.9 times for AES and SHA, respectively.

Keywords: Internet of Things; blockchain; authentication

EST- 03

SUPERCRITICAL CARBON DIOXIDE (SC-CO_2) FRACTIONATION OF *Curcuma longa L.* RHIZOME

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Curcuma longa L. or turmeric, a native herb in Mindanao belongs to the family of zingiberaceae. The rhizome has a distinct color of dark yellow and has a strong odor. The sample came from a community farm in Marawi City. It was extracted through supercritical carbon dioxide with three different parameters (10 Megapascal, 20 Megapascal, and 30 Megapascal) to obtain three different fractions. Ten Megapascal fraction obtains a high percentage of oil yield at 1.43% in triplicates followed by 20MPa at 0.30% and 30MPa at 0.18%. Twenty and thirty Megapascal extracts were subjected to gas chromatography (GC) from DOST-ITDI for its fatty acid profiling. Stearic has the highest percent weight by weight in both 20 and 30 fractions. Heptadecanoic, a metabolic tracer was only found in 20MPa fraction. While 10MPa was subjected to gas chromatography- mass spectrometry scanning (GC-MS) at UP-NSRI and seventeen compounds were found in which some notable compounds were curcumene and bergamotenol that were commonly used as flavouring or a flavour enhancer. Further study will be done in investigating claims such as anti- inflammatory and potential anti- oxidant and anti- cancer agent in some specific cell lines.

Keywords: supercritical carbon dioxide fractionation, *curcuma longa*, gas chromatography, mass spectrometry, fatty acid profiling

EST - 04

DEVELOPMENT OF POROUS CERAMICS UTILIZING ILOCOS NORTE RED CLAY AND RIVER SAND WITH AN ADDITION OF SAWDUST FOR THERMAL INSULATION

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This study was conducted to develop thermal insulating material from mixtures of red clay and river sand in Ilocos Norte with an addition of indigenous waste materials like saw dust and rice hull as pore forming agent. Five formulated mixtures coded with F1 to F5 of different ratios of powdered red clay, river sand and sawdust were prepared. Test specimens of rectangular shape with a dimension of 1" x 1" x 6" were prepared through mixing the powdered materials with water to produced plastic mass and forming it by semi-plastic pressing. The formed test specimens were subjected to drying at 110oC in an electric oven for eight (8) hours and firing it in a laboratory box furnace at 1000 to 1050oC for two (2) hours. Physical and mechanical properties like bulk density, porosity, water of absorption and modulus of rupture were determined in the fired test specimens and the results were compared with the properties of industrial thermal insulating materials. The findings of this study were promising since some of the formulated mixtures of red clay, river sand, and sawdust nearly achieved the properties of industrial thermal insulating material. Red clay and river sand deposits of Ilocos Norte with an addition of indigenous waste material like sawdust can be utilized to develop industrial thermal insulating material.

Keywords: red clay, porous ceramics, and thermal insulating material

EST - 05

ELECTROCHEMICAL PERFORMANCE OF COPPER AND NICKEL-BASED NANOMATERIALS FOR SUPERCAPACITOR APPLICATIONS

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With the increasing demand for efficient energy storage systems, supercapacitors are being extensively studied because of their high power and energy densities, fast charge and discharge process and long cycle life. Transition metal oxides and hydroxides, i.e. copper (Cu), nickel (Ni), cobalt (Co), and iron (Fe), are considered as the best electrode materials especially for pseudocapacitors due to their efficient surface redox reaction. The pseudocapacitive behaviors of Cu and Ni -based nanomaterials fabricated using various methods to produce binder free electrodes were evaluated. In this study, nickel oxides/hydroxides [$NiO/Ni(OH)_2$] were grown on the surface of carbon fiber papers via hydrothermal treatment followed by annealing. On the other hand, cupric oxide and hydroxide [$CuO/Cu(OH)_2$] were prepared on Cu foil via a simple liquid–solid redox reaction. Results show that the highest capacitance for both materials was obtained at lower scan rates. A specific capacitance of 1444.9 F/g and 422.2 F/g was calculated at a scan rate of 2 mV/s for Ni- based and Cu- based electrodes, respectively. High specific capacitance makes the electrodes ideal for high-performance supercapacitors.

Keywords: pseudocapacitor, nickel, copper

EST - 06

CONDUCTANCE OF KAPOK (*Ceiba pentandra*) PAPER EMBEDDED WITH ACID-DOPED POLYANILINE MOLECULES

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Polyaniline (PAni) is an intrinsically conducting polymer. The conductivity of PAni can be increased by acid doping and can be undoped by treating the polymer with base. Kapok (*Ceiba pentandra*) fiber, a product of kapok tree with little or no economic value, can be an alternative source of fiber for paper. A paper can have its properties enhanced (e.g. conductivity) by embedding it with materials such as PAni. With this, an erasable and flexible circuit board can be derived from papers embedded with materials having inherent conductivity (e.g. PAni). This study aims to fabricate a paper with enhanced conductivity using kapok paper embedded with PAni. Kapok paper was fabricated from kapok fibers using chemical treatment. PAni was deposited on kapok papers using successive ionic layer adsorption and reaction (SILAR) method. The samples were characterized using four-point probe. The sheet conductance of the paper coated with PAni increases for increasing dipping cycles up to certain optimum run (e.g. 70 cycles). The increase in conductance can be attributed to the increase of embedded polyaniline molecules. Hence, PAni-embedded kapok paper has potential in some electronic applications such as antielectrostatic and as electronic paper.

Keywords: kapok, polyaniline, SILAR, conductivity

EST - 07

PARAMETRIC STUDY ON THE LOW TEMPERATURE SPRAY DRYING OF BIOSURFACTANT PRODUCED BY *Saccharomyces cerevisiae* 2031 FROM SUGARCANE MOLASSES MEDIA

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Low-temperature spray drying was done on the biosurfactant produced by Saccharomyces cerevisiae 2031 from molasses medium. A General Factorial Design with two factors and three levels each was applied to determine the effect of inlet temperature and maltodextrin concentration on powder recovery, moisture content and emulsification index of the powder. It was found that higher temperature and maltodextrin concentration resulted to higher powder recovery and lower moisture content of the spray-dried biosurfactant. Highest powder recovery of 75.41 % was obtained at 60 °C and 20 % (w/v) maltodextrin, while lowest moisture content of 4.98 % was obtained at 60 °C and 25 % (w/v) maltodextrin. However, the inlet temperature and maltodextrin concentration had no significant effect on the emulsification index. A numerical prediction for determining the best condition for spray drying was also done. The most favorable conditions for spray drying of biosurfactant were found at 60 °C inlet temperature and 22.59 % (w/v) maltodextrin concentration. Experimental verification at the best conditions yielded a powder recovery of 75.67 % and moisture content of 4.99 %.

Keywords: biosurfactant, parametric, maltodextrin, spray drying

EST - 08

CHARACTERIZATION OF IMELDA RED CLAY BY TG-DTA, XRF, AND XRD ANALYSIS TECHNIQUES

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The Ilocos province is known to have abundant clay materials resources for various potential applications. In this study, the thermal behavior, oxides composition, and mineralogical phases of red clay sample from Barangay Imelda, Banna, Ilocos Norte, Philippines were characterized using thermogravimetric-differential thermal analyzer (TG-DTA), x-ray fluorescence (XRF), and x-ray diffraction (XRD) analysis techniques respectively. The characterized clay sample was prepared and obtained by subsequently quartering, air drying, and fine grinding.

The resulting TG-DTA curve of the red clay showed that there are three endothermic reactions occurred specifically at temperatures 50 oC, 263.715 °C, and 497.99 °C which were associated to the removal of adsorbed water, decomposition of inorganic matter, and dehydroxylation of clayey mineral respectively. The TGA curve also showed that the clay decomposed from 100% to 86.204% losing about 13.796%. Based from the XRF analysis result, the clay contains primarily silica (SiO_2)–60.55%, ferric oxide (Fe_2O_3)–19.8%, alumina (Al_2O_3)–11.81%, magnesium oxide (MgO)–5.20%, and small amounts of TiO_2, K_2O, and CaO. The probable mineral phases identified based from the XRD curve and d-spacing of the peaks were quartz (SiO_2 at 4.25 Å, 3.34 Å, 2.45 Å, 2.28 Å, 2.13 Å, 1.98 Å, 1.82 Å, and 1.37 Å), hematite (Fe_2O_3 at 2.70 Å, 1.67 Å, and 1.49 Å), dickite (Al2Si2O5(OH)4 at 4.46 Å and 3.59 Å), and chrysotile ($Mg_3Si_2O_5(OH)_4$ at 7.36 Å). This information gathered from Imelda red clay on its thermal behavior, oxides compositions, and mineralogical phases can serve as reference for further determination of its suitable application. Likewise, this red clay material is underway for its utilization in local ceramic body and glaze formulations study.

Keywords: red clay, thermal behavior, oxides composition, phases

EST - 09

A P-GRAPH APPROACH TO CLIMATE RISK ANALYSIS IN INTEGRATED BIOENERGY SYSTEMS

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Integrated bioenergy systems (IBS) are interconnected biomass processing facilities that are developed to achieve lower carbon emissions and higher production efficiency. However, the sustainability of these systems is threatened by climate change-induced events due to its heavy reliance on agricultural production. Bioenergy production is particularly vulnerable to droughts which may result in reduction of biomass feedstocks. The effects of climate risks are even amplified because of the high interdependency between IBS components and the occurrence of simultaneous disruptive events. A systematic risk analysis is thus necessary to model the effects of varied climate risks in IBS. In this work, a P-graph-based methodology is proposed to determine the effects of an array of climate change-induced disruptions in an IBS. P-graph is a graph theory and algorithm-based approach in solving process network synthesis (PNS) and other similarly structured problems. Results show that the consequence (i.e., net output loss) of disruption is higher when the failure originates from a highly-connected plant and is proportional to the number of disrupted bioenergy plants. Insights from this work can be used to develop policies and strategies in order to mitigate climate risks and to increase the resilience of IBS. A bioenergy park case study is used to demonstrate the proposed methodology.

Keywords: P-graph; Climate Risk Analysis; Integrated Bioenergy Systems; Policy.

EST - 10

DEVELOPMENT OF THE COCONUT PROCESSING SYSTEM IN THE PHILIPPINES USING MODERN DESIGN TECHNOLOGY

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The traditional methods of copra processing such as sun-drying and direct smoke-drying or "tapahan" are still generally implemented in the Philippines by coconut farmers and manufacturers. These methods produce aflatoxin (and other related toxins) and polycyclic aromatic hydrocarbon (PAH) respectively above permissible levels in copra and in crude coconut oil (CNO) that resulted to very low prices of copra-related products in the world market. This research aims to improve the quality of the products of the Philippine coconut manufacturing industries by employing modern design engineering and technology to coconut processing that would develop high-value exportable coconut products. The Wijose process was carried out for the extraction of primary and secondary milk, recovery of coconut meat residue and production of copra using a hot-air batch dryer that was developed to eliminate toxin-contaminated copra. Seven mathematical models were examined to describe the drying behaviour of coconut meat slices at 60, 70 and 80oC using the hot-air batch dryer. The Wijose Process of coconut processing developed for the production of copra, milk and dietary flour resulted to 94.7% recovery of the coconut fruit parts and waste materials. The developed modified combined decomposition model (MCDM) predicted a drying temperature of 80oC in the shortest drying time of 188.3 min. to reach the desired moisture content of 7 per cent wet basis. The hot-air batch dryer produced high quality copra that is aflatoxin free.

Keywords: aflatoxin, coconut oil (CNO), copra, copra cake, Wijose Process

EST - 11

DESIGN OF AN AUTOMATED MANAGEMENT SYSTEM FOR A WAREHOUSE INVENTORY USING UML MODELING TECHNIQUES

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Inventory is one of the most crucial stages in businesses in order to increase market competitiveness. However, modeling this process in real-time remains a challenge to enterprises, particularly in warehousing. This paper presents a technique using unified modeling language (UML) for automated inventory management system to handle the operational data in real-time. It analyzes the current manual recording methods and captures these procedure using UML techniques to provide the inventory system's requirements, including receiving, storing, retrieval, stock balancing for actual inventory and accessible records. The results show that the UML is a potential solution to address the difficulties in the development of an automated management systems that will decrease human errors and increase the efficiency of warehouses.

Keywords: automated management system; UML; warehouse inventory

EST - 12

FLUOROPHORE-LABELED BIOENGINEERED GBP FOR MEASUREMENT OF TRANSDERMAL GLUCOSE

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Measurement of glucose is an important component of care in the intensive care unit. Current methodologies for glucose monitoring include enzymatic-based laboratory analyzers, point of care testing and continuous glucose monitoring systems. This study focuses on the development of a glucose biosensor to measure transdermal glucose (TG) by passive diffusion. Glucose binding protein (GBP) labeled with polarity-sensitive dye BADAN (6-bromoacetyl-2-dimethylaminonaphthalene) was synthesized, prepared and characterized with the aim of producing a biosensor with an operating range of micromolar levels that is compatible with transdermal glucose monitoring. This mutant of GBP H152C showed a large fluorescence intensity increase (228%) upon adding a saturating concentration of glucose. It has a binding constant (K_d) of 1.124 ± 0.2361 μM. The biosensor has a linear operating range of 0.030 – 0.460 μM, making it suitable for monitoring of transdermal glucose in healthy adults and diabetic patients. The biosensor was used to measure TG in adult healthy subjects by passive diffusion of glucose through the skin. This involves washing, drying and placing a buffer in subject's finger for 5 min. The sample collected was assayed using the GBP. Results showed that this mutant of H152C GBP is capable of measuring TG and can be used for noninvasive glucose sensing.

Keywords: Glucose binding protein, Biosensor, BADAN, Transdermal glucose

EST - 13

DECISION SUPPORT TOOL FOR THE SYNTHESIS OF ENERGY SYSTEM WITH BIOCHAR PRODUCTION

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Thermochemical conversion of biomass yields bioenergy products that can replace fossil fuel consumption while biochar as a co-product can increase soil productivity and sequester carbon dioxide in the long run. This study employs a decision support tool for the systematic design and synthesis of polygeneration energy system that utilizes syngas as a co-product with biochar from the carbonization of biomass. Previous works on energy systems synthesis have tended to generate single optimal solution. However, the single optimal solution obtained from optimization oftentimes cannot be directly implemented in industrial practice because there are uncertainties and practical constraints that have not been accounted in the mathematical model. In this work, an optimization-based decision support methodology is employed to exploit the near-optimal solution space. Alongside with the optimal solution, near-optimal solution alternatives are generated via addition of integer-cut constraints in the original mathematical problem formulation. The generated near-optimal solutions are then analyzed to arrive at rational decision options into the system synthesis task. A case study on polygeneration system synthesis is explored using the mentioned methodology. The result of the case study shows a consistent feature of good solution and suggests an interesting option that minimizes the complexity of equipment installation and control.

Keywords: biochar; optimization; near-optimal solutions; polygeneration; integer-cut constraints

EST - 14

CHEMICAL TREATMENT AND CHARACTERIZATION OF WASTE ABACA FIBERS AS GEOPOLYMER REINFORCEMENT

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Scrap abaca fibers are one of the under-utilized agricultural wastes that post threat to the environment when disposed by open burning. Valorization of these fibers for reinforcement of geopolymer-based composites is one promising alternative to manage such waste. Geopolymer, which is an inorganic aluminosilicate polymer, is gaining popularity as an eco-friendly cementitious binder because of its superior fire and heat resistance, lower embodied energy and carbon footprint as compared with that of Portland cement-based material. Reinforcing this inorganic matrix with such natural fibers could increase its flexural strength but surface modification of these fibers is needed to improve the fiber/matrix interfacial bond. Thus, this study investigates the effect of chemical treatment particularly the NaOH pretreatment and $Al_2(SO_4)_3$ solution treatment on the morphology and structure of these fibers. Fourier transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA) results revealed that the treatment removed hemicellulose and lignin from the raw fiber surfaces. Crystallinity of the fiber was found to increase based on X-ray diffraction analysis (XRD). Morphology and chemical composition of deposited aluminum compounds on the fiber surfaces were also examined using scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDS). Indication suggests from TGA that the fibers in the fly ash-based geopolymer matrix are more thermally stable as the geopolymer formed on the fiber surface. An increase of flexural strength and "graceful fracture" were also observed in the treated fiber-reinforced geopolymer.

Keywords: abaca, chemical treatment, geopolymer composites

EST - 15

IN-SITU POLYMERIZED AMINE-SILICA ADSORBENTS FOR CO_2 CAPTURE: EVALUATION OF CO_2 DESORPTION BEHAVIOR

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Post-combustion CO_2 capture through adsorption separation techniques has been receiving widespread attention over the past decade as a vital part of Carbon Capture and Sequestration (CCS). Hybrid organic-inorganic material prepared through in-situ polymerization technology is one of the leading materials used for this application because of its high CO_2 adsorption capacity. However, similar to any other sorbents, the potential for industrial application of this hybrid material is not only dependent on the CO_2 adsorption capacity but also on the regenerability. In this study, the regenerability of amine-silica sorbents prepared by in-situ polymerization of aminosilane in the pores of silica was assessed through the evaluation of CO_2 desorption behaviour in the material after CO_2 capture. In addition, different aminosilanes including (3-aminopropyl)trimethoxy silane (primary amine), [3-(methylamino)propyl]trimethoxysilane (secondary amine) and N-[3-(trimethoxysilyl)propyl] ethylenediamine (primary with secondary amine) were used to examine the effect of amine structure in the desorption behaviour of CO_2. Elemental analyser and BET surface area analyzer were used for the characterization of the sorbents prepared. Thermogravimetric analysis showed the effect of temperature in the desorption of CO_2. The CO_2 adsorbed species that can be desorbed as well as the degradation products in the material after five adsorption-desorption cycle were identified by FT-IR. Furthermore, it was observed that the desorption behaviour of CO_2 is dependent on the amine structure. Among the various amine-silica sorbents prepared, the secondary amine showed the highest stability with almost complete desorption of CO_2.

Keywords: CCS, CO_2, adsorption, desorption, amine-silica

EST - 16

MICROWAVE-CURED CEMENT-BONDED BOARD REINFORCED WITH ALIGNED ALKALI-TREATED PINEAPPLE AND WATER HYACINTH INDIGENOUS FIBERS

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Pineapple and water hyacinth fibers were treated using Na_2CO_3 and NAOH alkali solutions for 0.5, 1, 1.5 and 2 hours soaking times. Based on the results of the analysis, the best treatment conditions for pineapple fibers (PF) were 2.0 M Na2CO3 solution for 1.5 hours and in 2.0 M NaOH solution for 0.5 hours; while for water hyacinth fibers (WHF) in 1.5 M Na_2CO_3 solution for 0.5 hours and in 1.0 M NaOH solution for 1 hour. Pineapple and water hyacinth fibers have almost the same cellulose composition with 68.5% and 61.3% respectively. The untreated and treated PF showed similar spectra ranging from 2924 to 2926 cm-1 which signifies the presence of an acidic O-H stretching vibrations on a carbonyl group. The NaOH-treated WHF had the absence 2926.01 cm-1 transmittance peak as compared to the untreated WHF. Acetylation process on both fibers resulted to increase of roughness of fibers that were analyzed under SEM 100 μm magnification. Then the treated fibers were used in the fabrication of cement boards. The specimens undergone microwave curing with specific regimes under 119 W and 280 W. Microwave-cured specimens with different fiber orientations were compared; the cement board with aligned Na_2CO_3 fibers obtained the highest flexural strength with 0.5233 MPa. The aligned orientation of reinforced fibers performed 16.77% to 41.57% better than non-woven oriented fibers.

Keywords: water hyacinth fibers, crab shells, natural fiber reinforced cement board, cement matrix composite, microwave curing

EST - 17

EFFECT OF VARYING VOLTAGE AND FREQUENCY IN THE PRODUCTION OF HYDROGEN (H_2) GAS FROM GLYCEROL ($C_3H_8O_3$) BY PLASMA REFORMING USING A DIELECTRIC BARRIER DISCHARGE REACTOR

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Waste by-product called glycerol is produced in the production of biodiesel. Conversion of glycerol ($C_3H_8O_3$) to hydrogen (H_2) gas is considered to be a renewable alternative. The research determined the effect of varying the voltage and frequency in the production of H_2 gas from glycerol by plasma reforming using a dielectric barrier discharge (DBD) reactor. Carrier gas, helium (He), was used to facilitate plasma ignition in the DBD reactor. Minimum breakdown voltage to ignite plasma in the reactor was at 4 kV using Paschen's Curve analysis. The effect of frequency was also varied from 275 Hz, 285 Hz and 295 Hz. Product gases: H_2, carbon monoxide (CO) and carbon dioxide (CO_2) was analyzed through gas chromatography (GC). Efficiency was measured based on percentage conversion of glycerol and percentage yield of H_2. At 295 Hz, 61.61% glycerol has been converted. It can be hypothesized that beyond this point glycerol can reach its maximum potential of conversion. At 285 Hz, H2 yielded a peak of 18.58%. Plasma reforming of glycerol at atmospheric pressure using a DBD reactor can produce hydrogen gas. However, optimization of results can further be done to maximize its production. In addition, parameters such as varying the gas and feed flow rate will also be helpful.

Keywords: biodiesel, glycerol, hydrogen gas, plasma, renewable energy

EST - 18

PHOTODEGRADATION OF PARAQUAT HERBICIDE USING TITANIUM (TiO2) AND COPPER SULFIDE (CuS) WITH THE ADDITION OF HYDROGEN PEROXIDE (H_2O_2)

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The effects of the photocatalysts, titanium dioxide (TiO2), and copper sulfide (CuS) were observed under the photo degradation of herbicide known as paraquat. Copper sulfide (CuS) was formed using hydrothermal method and commercial grade P25 Titanium Dioxide (TiO2) was used as the other photocatalyst. The UV-Visible spectrophotometer (UV-vis) was used to identify how much the 40 ppm solution of paraquat with the photocatalyst has degraded over a given four (4) hours and the high performance liquid chromatographer was used to identify the magnitude of each compound and intermediate present in the solution. Anova test analysis was used to identify and conclude which photocatalyst would have greater effect than the other. The results showed, copper sulfide (CuS) reacted with paraquat and degraded the paraquat by 70% of its original concentration, along with the formation of some intermediates. Titanium Dioxide (TiO2) on the other hand had huge fluxes on the paraquat concentration and only degraded about 14% of the original and also had intermediates. The addition of hydrogen peroxide (H_2O_2) gave the copper sulfide (CuS) higher photodegradation.

Keywords: Photogdegradation, Titanium Dioxide, Copper Sulfide, Paraquat, UV- Light

EST - 19

KINEMATIC SIMULATION AND 3D-PRINTING OF A WEARABLE ROBOTIC ORTHOSIS DESIGN FOR THE UPPER EXTREMITIES

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The demand for more accessible and affordable devices in physical therapy and rehabilitation remains to grow along with new technologies being promoted in the healthcare sector. For the upper extremities, the focus is on the efficiency of the design in performing all its range of motion. In this study, kinematic simulation and rapid prototyping of a planned wearable robotic orthosis was performed. Individual parts and components were designed in the CAD (computer-aided design)/CAE (computer-aided engineering) software CATIA® and was simulated to determine kinematic compatibility with the user. Among the simulations performed were workspace generation and collision tests using the software's digital mock-up (DMU) feature. Rapid prototyping was then performed via 3D printing in a MakerBot z18 3D printer using poly-lactic acid (PLA) as the filament. The parts were then assembled and evaluated based on the needs of the intended user. With this approach, kinematic simulation and 3D printing proves to be one of the essential steps in designing a reliable rehabilitation device.

Keywords: wearable robotic orthosis, 3D-printing, kinematic simulation, CATIA, upper extremity rehabilitation

EST - 20

THE STUDY OF THE CHARACTERISTICS OF COPPER BENZENE-1, 3, 5-TRICARBOXYLATE (CU-BTC) METAL ORGANIC FRAMEWORKS (MOFS) AND ITS APPLICATION AS ADSORBENT OF VOLATILE ORGANIC COMPOUNDS (VOCS) BENZENE (C_6H_6), PHENOL (C_6H_5OH), AND CHLOROPHENOL (C_6H_5OCL)

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The study investigates the feasibility of copper benzene- 1,3,5 –tricarboxylate metal organic frameworks, solvothermally synthesized, as an adsorbent for volatile organic compounds benzene, phenol, and chlorophenol. Characterization of the Cu-BTC MOF, determination of the activation energy of desorption were used for classification if the adsorption is chemisorption or physisorption, and for the comparison of heats of vaporization of these VOCs. Cu-BTC is likely to adsorb noxious VOCs from the air due to its large surface area and pore volume. The VOCs were adsorbed by Cu-BTC MOF synthesized at 80°C for 24 hours with an ethanol to water ratio of 3:1 in separate desiccator set-ups for one (1) week accompanied by 3A absorbent for the absorption of moisture. The VOC infused Cu-BTC MOF was then characterized using Derivative Thermogravimetric (DTG), Thermogravimetric Analysis (TGA) and Fourier Transform Infrared Spectroscopy (FTIR). Linearized Arrhenius equations were used to obtain the activation energy of desorption for each sample. The data showed 77.91, 61.27, and 96.16 kJ/mol as the activation desorption energy for Cu-BTC-B, Cu-BTC-P, and Cu-BTC-CP, signifying chemisorption limited on a monolayer. Also, the FT-IR spectra bands, 1605, 1497, 1467 cm-1 has proven that VOC benzene is adsorbed. While bands 1175 and 1059 cm-1 confirmed that VOCs phenol, and chlorophenol were present.

Keywords: volatile organic compounds, metal organic frameworks, adsorption, Cu-BTC

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HYDRO-ENERGY RESOURCE ASSESSMENT OF LAOAG RIVER BASIN

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In response to Philippines' goal to mitigate its carbon emission by 2030 and eventual transition to renewable energy by 2050, the study was aimed to utilize remote sensing and geographic information system technologies to assess hydro-energy potential of the Laoag river basin and as well identify sites for hydro power plants. Synthetic Aperture Radar-Digital Elevation Model was used for automatic watershed delineation and flow simulation of the study area using Soil and Water Assessment Tool (SWAT). Land use land cover, soil and weather dataset from various agencies and world databases was used in the flow simulation. The SWAT-produced rich database was processed to obtain the Flow Duration Curve (FDC) for each delineated streams in the river system using eighty percent (80%) desired exceedance. Head determination algorithm programed by University of the Philippines – Diliman Hydro REMap team was used to extract head sites using a minimum head and penstock lengths criteria. Extracted head shapefiles for every penstock length criterion was spatially joined with the flow shapefile which holds the flow discharge attribute for every delineated streams. Simulated power was calculated by multiplying the head, simulated flow, gravity and efficiency prescribed by the Department of Energy (DOE). Hydro power assessment tool for ArcGIS was used in the study to simultaneously calculate the simulated power for every penstock length criterion and classify the features according to their respective power classifications. The study outputs was subjected to mapping procedure and geographic information system technologies. Results of the study revealed that the Laoag river basin has potential for hydro-energy development; potential sites for hydro-energy development in the study area was identified

Keywords: synthetic aperture radar, hydro-energy, resource assessment, geographic information system

EST - 22

PIÑA-POLYESTER FABRIC WITH VARIOUS ELECTROACTIVE MATERIALS AS SUPERCAPACITOR ELECTRODES

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The study investigates the feasibility of copper benzene- 1,3,5 –tricarboxylate metal organic frameworks, solvothermally synthesized, as an adsorbent for volatile organic compounds benzene, phenol, and chlorophenol. Characterization of the Cu-BTC MOF, determination of the activation energy of desorption were used for classification if the adsorption is chemisorption or physisorption, and for the comparison of heats of vaporization of these VOCs. Cu-BTC is likely to adsorb noxious VOCs from the air due to its large surface area and pore volume. The VOCs were adsorbed by Cu-BTC MOF synthesized at 80°C for 24 hours with an ethanol to water ratio of 3:1 in separate desiccator set-ups for one (1) week accompanied by 3A absorbent for the absorption of moisture. The VOC infused Cu-BTC MOF was then characterized using Derivative Thermogravimetric (DTG), Thermogravimetric Analysis (TGA) and Fourier Transform Infrared Spectroscopy (FTIR). Linearized Arrhenius equations were used to obtain the activation energy of desorption for each sample. The data showed 77.91, 61.27, and 96.16 kJ/mol as the activation desorption energy for Cu-BTC-B, Cu-BTC-P, and Cu-BTC-CP, signifying chemisorption limited on a monolayer. Also, the FT-IR spectra bands, 1605, 1497, 1467 cm-1 has proven that VOC benzene is adsorbed. While bands 1175 and 1059 cm-1 confirmed that VOCs phenol, and chlorophenol were present.

Keywords: volatile organic compounds, metal organic frameworks, adsorption, Cu-BTC

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SMARTPHONE CAMERA-BASED OPTICAL SENSOR FOR ELEMENTAL MERCURY VAPOUR USING GREEN SYNTHESIZED CUPROUS IODIDE NANOCRYSTALLITES

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The measurement of elemental mercury vapour is a global concern. This study proposes a simple smartphone camera-based digital imaging analysis for the detection of $Hg^0_{(g)}$. Biosynthesized cuprous iodide (CuI) nanocrystallites from red cabbage (*Brassica oleraceae*) extract was used as a colorimetric reagent for $Hg^0_{(g)}$. The CuI nanocrystallites were immobilized onto a cellulosic substrate using polystyrene to form the colorimetric sensor. The fabricated sensor exhibited a grey to orange color change when it reacts with $Hg^0_{(g)}$ in ambient air. Using a smartphone camera, digital images of the sensor reagent phase were monitored and captured. The digital images were analysed in RGB color space to measure $Hg^0_{(g)}$. Parameters including the color space values, amount of CuI, exposure time and $Hg^0_{(g)}$ concentration were investigated and optimized. The linear working range is from 129 ng to 344 ng $Hg^0_{(g)}$ with a correlation coefficient of 0.995. The limit of detection is 41 ng $Hg^0_{(g)}$.

Keywords: optical sensor, cuprous iodide nanocrystallites, smartphone camera sensing, green synthesis, elemental mercury vapour

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MODELING CABULIG RIVER BASIN FLOODED AREAS USING HYDROLOGIC MODEL INTEGRATED WITH GIS AND REMOTE SENSING APPROACHES

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Cabulig river basin is one of the Phil-LiDAR1 program sites pre-assigned to CMU to be developed with up-to-date, detailed, and high resolution flood hazard maps through flood modeling and simulation integrated with the highly accurate, geo-referenced light detection and ranging (LiDAR) Digital Elevation Model (DEM). Located in Lower Jasaan, Misamis Oriental, the river of Cabulig is periodically visited with flooding especially during occurrences of heavy rainfalls. With the application of HEC-HMS and GIS, a basin model of Cabulig River is delineated and calibrated using an actual gathered data. The model was used to simulate more discharge hydrographs using rainfall frequency data of 5-, 25- and 100-year return periods and subsequent simulation of flood hydraulics using HEC-RAS 5.0 performing two-dimensional (2D) hydrodynamic flow routing within the unsteady flow analysis portion subsequently developed into flood hazard maps as integrated with the LiDAR DEM. Application of the developed models was extended into reconstruction of typhoon scenarios caused by past typhoons of Agaton and Seniang. Generated flood hazard maps provided significant information as to the extent and depth of flood in the hazard prone areas. Moreover, number of affected infrastructures, residential and density of population led to the initial assessment of the vulnerability of the study area. Results of this research revealed higher precision of flood extents and depths of the developed flood hazard maps. The generated information of LiDAR integrated hazard maps is useful to the local governing units for improved disaster awareness and enhanced strategies for disaster mitigation, preparation, response and rehabilitation measures.

Keywords: modeling, hydrologic, GIS, Remote Sensing

EST - 25

ASSESSMENT OF AIR QUALITY IN SELECTED AGRO-INDUSTRIAL OPERATIONS

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This study aimed to assess the air quality of three selected agro-industrial operations of the Mariano Marcos State University, at Batac City, Ilocos Norte, namely the organic fertilizer (OF) production, piggery and feed mill facility. Air quality parameters were gathered at different time of the day specifically in the morning, noontime and in the afternoon. Two sets of measurement were done, one in the wet and the other in the dry season. Results showed carbon dioxide (CO_2) and carbon monoxide (CO) were found to be significantly different at different time of the day during wet season. Levels of these however passed the standard. Anytime of the day, total volatile organic compounds (TVOCs) were found to be high (17 mg/m3), exceeding the standard which is 200 to 500 $\mu g/m^3$. Nitrogen dioxide (NO_2) and ammonia (NH_3) concentrations were also found to surpass the set standard. Particulate matters (PM) both sizes 2.5 and 10 were also detected in the three facilities and did not pass the standard set by DENR. Odor detections were most notable in the piggery, less odorous in the OF facility and there is no odor detected at the feed mill facility.

Considering the apparent presence of gas emissions, dust and odor in the three facilities, workers are not compelled to employ precautionary measures by using personnel protective equipment (PPE). Continuous exposure of workers to these air pollutants may gradually have health impacts on them. It is therefore very imperative to oblige workers to use appropriate PPEs like mask, protective gear, long sleeves and others. Sources of TVOC concentrations and other pollutants in the facilities must be identified and eliminated if possible.

Keywords: Air quality, agro-industrial, air pollutants, gas, odor

EST - 26

EXTRACTION OF HYDROLOGIC DATASET USING LIDAR DTM FOR WATERSHEDS IN ILOCOS NORTE, PHILIPPINES

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Ilocos Norte is one of the provinces in the country which depends mainly on surface water for domestic, agricultural, and industrial water use especially for communities in mountainous areas. However, reliable information about the extent is critically lacking nowadays. Therefore, there is a need for alternative technologies to detailed hydrologic mapping that can be used to enable people to visualize the spatial distribution of water resources and to picture the possibilities attached to them. Watershed characterization and management requires quantitative geospatial information such as topography, drainage network, watershed boundary, channel length, and the like. With these maps, a municipality or an agency can protect their water supplies. With the aim of developing a detailed and comprehensive hydrologic maps using Light Detection and Ranging (LIDAR) Digital Terrain Model (DTM), supplemented with other remotely-sensed imageries and ancillary information from LGUs and NGAs, the effectivity of implemented processing workflows was evaluated for 7 river basins in Ilocos Norte. Extraction of streams, inland wetlands and irrigation network in Cabungaan, Gabo, Cabayoagan, Natbaon, Pasuquin, NA-Pasuquin and San Mateo River Basins were done and their extents were determined using highly technical programs. The effectivity of workflows in extracting features was evaluated using confusion matrix and reveals 98.13% accuracy. The versatility of the implemented workflows was demonstrated by its ability to be applied in other areas of the Philippines.

Keywords: DTM, catchments, streams, irrigation network, inland wetlands

HS - 01

OVICIDAL, LARVICIDAL, AND ADULTICIDAL OF THE ESSENTIAL OIL OF CLAUSENA ANISUM-OLENS (RUTACEAE) LEAVES AGAINST DENGUE AND ZIKA VECTOR, *Aedes aegypti*

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Clausena anisum-olens *(Rutaceae)* known as *Kayumanis* is an endemic plant in the Philippines and is known to have antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory effects. The volatile oil was isolated by steam distillation and the ovicidal, larvicidal and adulticidal activity against *Aedes aegypti* was determined using the Modified World Health Organization (WHO) protocol. The *kayumanis* oil is a clear pale-yellow liquid with anise-like odor and has a specific gravity of 0.896, a refractive index of 1.4766 and a viscosity of 18.1cp. The constituents of the volatile oil are alpha-pinene, d-limonene, anethole, copaene, bergamotene, and caryophyllene as determined by GCMS. Three concentrations of the volatile oil were used for larvicidal activity (100 ppm, 200 ppm and 300 ppm) while 300 ppm and pure oil were used for ovicidal and adulticidal activities. Results revealed that the isolated essential oil of the *Kayumanis* leaves exhibited the highest lethal concentration against 3rd and 4th instar larvae with an LC_{50} and LC_{90} of 91.524 ppm and 129.543 ppm, respectively. Moreover, it exhibited a 50% and 90% knockdown effect within 12.627 minutes and 32.062 minutes on adult female *A. aegypti.* The adult mosquito's mortality was 65% and 100% for Kayumanis and d-phenothrin and prallethrin after 24 hours, respectively. However, the *Kayumanis* oil is ineffective in preventing the eggs to hatch. The *C. anisum*-olens leaves essential oil proved to be a strong candidate as a natural larvicide and adulticide.

Keywords: adulticidal, Aedes aegypti, Clausena anisum-olens, larvicidal, and ovicidal

HS - 02

EFFECTIVENESS OF *Tinospora sinensis* (MENISPERMACEAE) EXTRACTS IN REDUCING THE SIGNS OF CONTACT DERMATITIS (CD) ON DINITROFLUOROBENZENE (DNFB)-INDUCED MICE USING ORAL ROUTE ADMINISTRATION

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Allergic contact dermatitis (ACD) is a type IV delayed hypersensitivity characterized by itching with erythema, vesicles, and bullae. It involves the migration of hapten-bearing dendritic cells to the lymph nodes triggering the CD4+ T lymphocytes to proliferate and emigrate to the lymphoid organs and the skin, leading to an inflammatory response. It involves two phases, namely the sensitization and elicitation phases. To explore the effectivity of the *Tinospora* extracts in the inhibition of inflammatory response, Balb/c mice model were used to mimic the two phases involved in ACD. The mice were sensitized with 0.5% dinitrofluorobenzene (DNFB) and were treated orally with the ethanolic and aqueous *Tinospora* extracts for seven days. The mice were then rechallenged with 0.2% DNFB to trigger the inflammatory response. The ear thickness was then measured at 0-, 24-, and 48-hr after elicitation. On the 24th hour after elicitation, there was significant difference on the mean percentage change of the ear thickness of the mice ($p<0.0001$). After elicitation, only the 1000 mg/kg ethanolic extract was able to inhibit inflammation and decrease the mean percentage change of ear thickness to the baseline and is comparable with the effect of Prednisolone ($p=0.059$). The *T. sinensis* ethanolic stem extract has a dose-dependent anti-inflammatory activity. *T. sinensis* can be used as an alternative to corticosteroid drugs such as Prednisolone because both extracts were able to diminish the signs of allergic contact dermatitis (ACD) ($p=1.000$).

Keywords: allergic contact dermatitis, anti-inflammatory, dinitrofluorobenzene, *Tinospora sinensis*

HS - 03

INDIGENOUS PLANTS AS POTENTIAL XANTHINE OXIDASE INHIBITOR

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The utilization of indigenous plants available in the locality as an alternative treatment with superior effect in inhibiting Xanthine Oxidase (XO) and as novel alternatives to allopurinol with potent XO inhibitory activity exhibiting lesser side effects is a challenge in current research and development.

In this study five plant species such as *Anona muricata* L.(guyabano), *Antidesma bunius* (L.) Spreng (bignay), *Pandanus amaryllifolius* Roxb. (pandan), *Piper betel* L.(gawed), and *Tetrastigma loheri* Gagnep (ariwat) were phtyochemically analysed. Carbohydrates, reducing sugars, phenolics, diterpenes, triterpenes or phytosterols, flavonoids and proteins are seen in the five plant species while tannins are identified only to be exhibited by *A. muricata* and *P. amaryllifolius*. These 2 species as well gave high TFC of 84.74 and 216.49 (QE)/g indicative of potential xanthine oxidase inhibitory activity. The low toxicity level as shown by low percentage mortality with brine shrimp and LC50 confirms the five plant species considerable potential for clinical application.

Keywords: Indigenous species, Xanthine oxidase inhibitor, antihyperuricemic,, hyperuricemia, gout

HS - 04

ALLERGEN-SENSITIZATION PROFILES OF SELECTED FILIPINOS WITH HIV USING RIDA qLine® ALLERGY SYSTEM

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The Philippines has the highest number of reported cases for human immunodeficiency virus (HIV) in June 2016 since 1984 as recorded by the Department of Health (DOH). Studies showed that patients with HIV presented increased prevalence of atopy to environmental allergens which might be due to the immunologic dysregulation induced in the early stages of the infection. However, there is dearth of information regarding allergen-specific IgE profiles of Filipinos living with HIV, particularly in adults. This study determined the inhalant allergen-sensitization profiles of 108 male adult participants with HIV ages 18-40 using RIDA qLine® Allergy system. Results showed that 48% (95% CI 39-58%) of the participants were allergic to at least 1 of the 20 allergens tested in the study. Most of them were allergic to *Dermatophagoides farinae* (*Df*), 22% (95% CI 14-30%), *Dermatophagoides pteronyssinus* (*Dp*), 19% (95% CI 12-27%), and *Blomia tropicalis* (*Bt*), 35% (95% CI 26-44%). Participants with allergic manifestations seemed to have higher mean allergen-specific IgE levels than those without, but none of the comparisons were found to be statistically significant ($p>0.05$). Interestingly, those with allergic asthma symptoms only had higher sensitization to acacia ($p=0.031$) and feather mix ($p=0.047$). Significant associations were found between having elevated total IgE (≥100 IU/mL) and specific IgE to *Df* ($p=0.001$), *Dp* ($p=0.034$), and *Bt* ($p=0.004$). There was significant correlation between the production of total IgE and specific IgE to *Df, Bt*, and *Penicillium notatum/chrysogenum (Pn/Pc)*. The allergen-sensitization profiles using RIDA qLine® Allergy system showed common inhalant allergen sensitizations to *Df, Dp*, and *Bt* among individuals with HIV. Extensive allergen-sensitization profiles would serve additional aid to clinicians for optimizing management and therapeutic monitoring among patients living with HIV having specific IgE-associated allergies.

Keywords: HIV, allergic manifestations, allergen-specific IgE, allergen-sensitization profile, RIDA qLine® Allergy

HS - 05

PHYTOCHEMICAL SCREENING AND *In-vitro* EVALUATION OF THE ANTIOXIDANT AND MORPHO-CYTOTOXIC ACTIVITY OF *Nauclea orientalis* (L.) LIN

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Plants are rich in bioactive compounds that are essential in human health. This is why many researchers evaluate them for drug discovery. However, there were many other species that until now are needed to be explored for their medicinal value. Relatedly, the *Nauclea orientalis*, one of the underutilized trees that are widely distributed in the country, was used in folkloric healing practices. Thus, the objectives of this study were to identify the phytochemicals and evaluate the leaves, flowers and fruits for their antioxidant capacity through 2,2-diphenyl-1-picrylhydrazyl (DPPH) radial scavenging and phosphomolybdenum assay; and morpho-cytotoxic activitiy in *Allium cepa*. The qualitative phytochemical analysis showed that alkaloids, flavonoids, saponins, tannins, phenols, steroids, terpenoids and cardiac glycosides were present on the ethanol extracts. These phytoconstituents has significantly provided the samples, at 40-80µg/ml, the ability to scavenge free radicals, although statistically lower when compared to the gallic acid. The leaf extract was observed to have the greatest activity while the fruit had the least. The total phenol content was measured using the Folin-Ciocalteu method and confirmed the presence of antioxidants in the analyzed plant parts. Each extract also caused toxic effects on the *Allium cepa* by reducing root initiation and development. Cytologically, 10 and 5mg/ml of the samples inhibited cell division and caused cell death. Moreover, all the extracts induced membrane damage, tri and binucleation, fragmentation and disruption of the nucleus, and some chromosomal aberrations. Hence, the *N. orientalis* could be a potential source of natural antioxidants and useful in many other therapeutic applications.

Keywords: *Nauclea orientalis*, *Allium cepa*, phytochemical, antioxidant, morpho-cytotoxicity, *In Vitro* Angiotensin –I Converting Enzyme

HS - 06

INHIBITORY ACTIVITY OF PURIFIED PEPTIDES FROM SQUID INK (*Uroteuthis duvauceli*)

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Hypertension is a common problem among people worldwide in which about 30% of adults suffer from uncontrolled high blood pressure. Among the therapeutic targets in hypertension is Angiotensin I-Converting Enzyme (ACE) Inhibition, which precludes the formation of angiotensin II, resulting in the vasodilation of arteries and veins. Peptides derived from animal proteins can be used as ACE-inhibiting compounds. The ink from the squid (*Uroteuthis duvauceli*) is a waste product of processed squid; thus, it can be utilized as a source of peptides. The angiotensin-I converting enzyme inhibitory activity of squid (*Uroteuthis duvauceli*) ink hydrolysate was studied. The ink was obtained by dissection and extraction of the ink sac. The sac was pressed until the ink is produced and was subjected to enzymatic hydrolysis with pepsin and pancreatin. In vitro angiotensin-I converting enzyme (ACE) inhibitory activity was determined using ACE kit-WST. Bioassay guided isolation of ACE inhibitory peptides using column chromatography with Sephadex G-25 yielded 19-pooled fractions with fraction 11 (85.5%) exhibiting the highest inhibitory activity. Fraction 11 was further separated by gel permeation column chromatography, and fraction 11.2 showed the highest activity against ACE with an IC_{50} of 13.66 μg/mL. An ACE inhibitory peptide from UD11.2, Pro-Gly-Pro, was identified using SALDI-TOF-MS/MS.

Keywords: Angiotensin-I Converting Enzyme, Uroteuthis duvauceli

HS - 07

TERATOGENIC EFFECT OF ORALLY ADMINISTERED METHOMYL ON THE PREGNANT ALBINO MICE

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Methomyl is a pesticide commonly used in the Philippines. Reports on its effect to human especially pregnant women are insufficient. The study was done to evaluate the effects of two dosage of methomyl in the pregnant albino mice. Specifically, it sought to: (1) assess the effect methomyl on the body weight of mice, and (2) examine its teratogenic effects on the fetus' weight, head length, head-rump length, tail length, and number of resorption.

Fifteen (15) five week-old, virgin and non-pregnant female albino mice were used for the teratogenic evaluation. For mating, two females with one male were placed in a cage overnight and examined the sign of mating in the morning. Teratogenic effect of methomyl was observed within 20 days gestation period. Cervical dislocation and caesarean section was performed to determine the effects in the fetuses. Pregnant mice were administered orally with 0.25 ml distilled water for control group, 0.25 ml of 1/30 LD50 methomyl for low dosage and 0.25 ml of 1/10 LD50 for high dosage. One-way Analysis of Variance (ANOVA) was used for statistical analysis using SPSS version 20.

Result showed statistically significant decreased of mean head length (LD:10.1,HD:9.15,C:9.15) ($p=0.000$) mean crown-rump length (LD:8.94,HD:9.64,C:11.14) ($p=0.000$), mean tail length (LD:23.38, HD:26.26 C:27.3) ($p=0.000$) and mean weight length ($p=0.000$) of the fetuses of LD groups. Furthermore, high numbers of resorptions in the HD and LD groups were also observed. An abnormality in the fetus in low dose group was also observed in the study.

Therefore, methomyl can significantly affect the weight and morphology of the mice progeny. Proper management of this pesticide should be monitored for utilization and disposal. The study recommends for hormonal assay, histological test and ovarian toxicity to fully understand its effects in the reproductive system of the mice.

Keywords: Pesticides, Methomyl, Teratogenic, Progeny, Toxicity

HS - 08

Xrcc3 c.562A>G AND *Xrcc4* G-1394T SINGLE NUCLEOTIDE POLYMORPHISMS AND BREAST CANCER RISK: ASSOCIATION WITH LIFESTYLE, FAMILY HISTORY OF CANCER, AND REPRODUCTIVE HEALTH

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Some studies have shown the association of *Xrcc3* and *Xrcc4* single nucleotide polymorphisms (SNPs) with breast cancer. However, there is insufficient data on the correlation of these SNPs with other known breast cancer risk factors. Thus, this study aims to identify whether *Xrcc3* c.562A>G and *Xccc4* G-1394T SNP interact with lifestyle, family history of cancer, or reproductive health. A total of 103 breast cancer cases seen at the UST Hospital, Manila were age and sex matched with clinically healthy controls. Genomic DNA extracted from blood samples of participants were screened for *Xrcc3* c.562A>G and *Xrcc4* G-1394T SNPs by polymerase chain reaction - restriction fragment length polymorphism (PCR-RFLP). Results show significantly higher Xrcc4 G-1394T genotype (p=0.007) and allele (p=0.003) distributions among cases than controls. *Xrcc3* c.562A>G genotype (p=0.509) and allele (p=0.678) distributions between groups were not significant. *Xrcc4* G-1394T was associated with oral contraceptive use (p=0.024), younger age at first childbirth (p=0.03), and tobacco use (p=0.012), but not family history of cancer (p=0.268). *Xrcc4* G-1394T SNP combined with passive smoking may significantly increase risk of breast cancer (OR=14.73; 95% CI= 12.53 -16.93). This study suggests that *Xrcc4* G-1394T but not *Xrcc3* c.562A>G SNP, in combination with other known risk factors, may increase breast cancer susceptibility. However, it is recommended that the number of participants is increased to validate the results.

Keywords: breast cancer, *Xrcc3*, *Xrcc4*, SNP

HS - 09

CYTOTOXIC AND ANGIOSUPPRESSIVE POTENTIALS OF *Zehneria japonica* (THUNB. EX MURRAY) S.K. CHEN (CUCURBITACEAE) CRUDE LEAF EXTRACTS

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Cancer is one of the leading causes of morbidity and mortality worldwide. *Zehneria japonica* (Cucurbitaceae), a climbing vine, has been widely distributed in the country and has been utilized as a purgative and as a treatment for diabetes. The aim of the study is to determine and to evaluate the cytotoxic and angiosuppressive potentials of *Zehneria japonica* Thunb. crude leaf extracts. The *Zehneria japonica* Thunb. crude extracts were obtained by sequential extraction using hexane, ethyl acetate and n-butanol. Firstly, *in-ovo* angiogenesis assay using *Anas platyrynchos* (duck) embryos demonstrated that *Z. japonica* suppressed the angiogenesis of the Chorioallantoic membrane in a dose-dependent manner. Subsequently, cytotoxicity study was evaluated using MTT assay with the aid of U2Os cell lines (bone osteosarcoma) and showed that *Z. japonica* crude extracts have significantly inhibited the U2Os cell proliferation in a dose-dependent manner with an IC50 of 59.74ppm, 50.33ppm and 56.99ppm (hexane, ethyl acetate, n-butanol), respectively; while hepatic cancer cell line particularly, the HepG2 cell lines (human liver cancer) showed a relative inhibition of cell proliferation in a dose-dependent manner with an IC50 of 774.01ppm, 292.76ppm and 470.30ppm (hexane, ethyl acetate, n-butanol) respectively; and lastly, HUVEC (*Human umbilical vein endothelial cells*) normal cell lines with an IC50 of 325.01ppm, 133.32ppm and 307.81ppm (hexane, ethyl acetate, n-butanol) respectively; Thin Layer Chromatography was used for the identification of the group of biochemical constituents found in the extracts and Acute Oral Toxicity was done using 6 Sprague Dawley rats.

Keywords: *zehneria japonica*, cucurbitaceae, cytotoxic, angiosuppressive, mtt assay

HS - 10

PHARMACEUTICAL ETHNOBOTANY OF THE MOST COMMONLY USED MEDICINAL PLANTS OF THE AGTA INDIGENOUS GROUP OF IRAYA, BUHI, CAMARINES SUR

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An ethnobotanical study was conducted with the objective to document indigenous knowledge of the Agta indigenous group of Iraya, Buhi Camarines Sur on medicinal plants utilization and investigate plant species that are used as medicines for the treatment of encountered health problems. This will ensure the preservation of such knowledge for future references. Informed consent was obtained and data were gathered using the snowball method through a series of informal interviews with the aid of a semi -structured questionnaire and discussion with the respondents. Most of the respondents are female, 22% were male and 78% were female. Most of the interviewees age 50-59, the oldest interviewees was an 86 year old female. They were predominantly married, mostly farmer and housewives. Most of their ethnomedicinal knowledge were passed on by their parents. The reason for use of medicinal plants were basically on budget constraints and distance from health services. The most common illnesses were musculo-skeletal pain and inflammation. A total of 108 plant species were recorded belonging to 53 families, the most number are from Zingeberaceae and Poaceae. The most common plant part used by the tribe are leaves. The most common mode of administration is by expression and decoction. These can be related to the most common method of preparation which is pounding and boiling and were mostly administered orally. As the use of medicinal plant is widely patronized by the tribe, it is imperative to preserve and cultivate more importantly the atypical species being used as medicinal plant. Further evaluation of the reported pharmacological activities obtained in the present survey may lead to potential pharmaceutical value.

Keywords: ethnobotany, agta, iraya, medicinal

HS - 11

ANTIANGIOGENIC AND AMP-ACTIVATED PROTEIN KINASE ACTIVITIES OF *Gracilaria coronopifolia* J.G. AGARDH EXTRACTS

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The discovery of new and more tailored drug that can successfully prevent and inhibit the progression of cancer cells remains a challenge for researchers. The three extracts of increasing polarity from red algae, *Gracilaria coronopifolia* (hexane, dichloromethane and methanol) were investigated for its anti-cancer activity. The presence of alkaloids, phenols, tannins and, flavonoid was detected in all semi-crude extracts of *G. coronopifolia*. Cell viability was evaluated by the 3-(4,5-dimethyl thiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) assay. The methanol extract of *G.coronopifolia* rendered an IC50 of 1.057 µg/mL, 4.77 for µg/mL dichloromethane and 11.72 µg/mL for hexane were all cytotoxic against human bone osteosarcoma epithelial cells (U2OS). Hexane and methanol extracts significantly inhibit the physiological process of angiogenesis in the duck chorioallantoic membrane (CAM). Interestingly, marine-derived product provides promising sources of bioactive compound, which can be targeted for the development as chemotherapeutic agents.

Keywords: *Gracilaria coronopifolia*, cytotoxicity, angiogenesis, duck chorioallantoic assay, U2OS cell

MATHEMATICAL AND PHYSICAL SCIENCES

MPS - 01

ANTIMICROBIAL ANALYSIS OF RIPE AND UNRIPE *Carica papaya* RIND ETHANOIC EXTRACT ON *Bacillus cereus*

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This study was conducted to seek the antimicrobial capability of *Carica papaya* rind with different ethanol concentrations against Bacillus cereus. The purpose of this paper is to promote knowledge about antimicrobial capability of *Carica papaya* in the field of education, pharmacy and medicine.

The methodologies used by the expertise that helped the researchers are fermentation method (for ethanol extraction), rotary evaporation and antimicrobial assay method. Fermentation method converts sugar to acid, gases or alcohol. Rotary evaporation is the process of reducing the volume of a solvent. Antimicrobial assay method is used to test antimicrobial activity of a certain solution, wherein the solution is suspended in a microbial suspension and the clearing zone was being calculated.

The results are as follow: samples 1, 2, 3 and 4 inhibited the growth of *Bacillus cereus* with antimicrobial indexes of 1.2, 2.0, 1.0, and 1.0 respectively.

The computed value of F, with 52.316 and significance of .000, indicates that there is no significant difference existed between the antimicrobial activities of the samples of *Carica papaya* and the control setup which is the Chloramphenicol disc.

In regard with these matters, the researchers concluded that **Carica papaya** is a possible antimicrobial agent.

Keywords: antimocrobial assay method, bacillus cereus, carica papaya, chloramphenicol disc, fermentation method

MPS - 02

BENEFICIATION OF SOLSONA WHITE CLAY

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The Solsona white is a feldspathic, siliceous type of clay found in Ilocos Norte, Northern Philippines. It is gray raw color with visible amount of metallic substances and other impurities. Deflocculation and elutriation processes were conducted using sodium silicates [$Na_2(SiO_2)nO$] to dispersed clay particles and removal of unwanted materials in the slurry. HCl treatment was also done to determine the soluble calcium, magnesium into the clay sample. Magnetic separation was also performed using magnetic ferro filter machine of 75kV, 1000W and 13.3A to remove insoluble iron.

Results shown that the used of 20% sodium silicates was more effective in dispersing clay particles. The % clay recovery of having particles sized of 75μm by means of elutriation process was 22.8%. Soluble calcium (Ca^{2+}) and magnesium (Mg^{2+}) were still higher despite treated with 1% HCl which is equivalent to 0.69 and 0.83%, respectively. An 8.22% insoluble iron (Fe^{3+}) was removed after the clay slurry passed though the magnetic separator.

Keywords: beneficiation, clay, deflocculation, elutriation

MPS - 03

BIOSORPTION OF LEAD BY POTASSIUM PERMANGANATE-MODIFIED AND UNMODIFIED CALAMANSI (*Citrus Microcarpa*) PEEL

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In this study, the potential of potassium permanganate ($KMnO_4$)-modified calamansi (*Citrus microcarpa*) peel as biosorbent for lead was tested. Factors affecting adsorption such as $KMnO_4$ solution concentration, initial pH and lead concentration were investigated. It was found that soaking *C. microcarpa* peel in 0.10 M $KMnO_4$ solution showed a notable increase in the IR band at 1650-1400 cm^{-1} and 1625 cm^{-1} which corresponds to the hydroxyl groups and carboxylate ligands, respectively. The maximum uptake capacity, q_{max}, for the $KMnO_4$ modified *C. microcarpa* peel is 26.1780 mg Pb^{2+} ions per gram biomass which is higher than that of unmodified substrate with q_{max} of 19.0840 mg Pb^{2+} ions per gram biomass. The measurements were obtained at pH 3, temperature of 28°C, agitation speed of 150 rpm, and equilibrium time of 6 hours. Based on the Langmuir constants, the $KMnO_4$ modified *C. microcarpa* peel demonstrated a higher b and q_{max} value which makes it a better biosorbent than the unmodified biomass. Moreover, $KMnO_4$ modified *C. microcarpa* peel has a steep initial slope in the conventional sorption isotherm and with a higher b value (although with a lower qmax) when compared to other biosorbents from previous studies using citrus peels. This makes a better biosorbent at lower lead concentrations. FT-IR analysis also showed that the interaction of Pb^{2+} ions with both the $KMnO_4$ modified and unmodified *C. microcarpa* peels is only a physical adsorption process exhibiting potential as regenerative biosorbent.

Keywords: adsorption isotherms, biosorption, calamansi peel, lead, potassium permanganate

MPS - 04

C. rugosa HYDROLYSIS OF POLYMERIZED SOYBEAN OIL FOR FLEXIBLE POLYURETHANE FOAM APPLICATIONS

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The flexible polyurethane foams reported here based on *C. rugosa*-catalyzed polyol product have not been reported elsewhere. The high hydroxyl equivalent weight of the polyols due to initial bodying of the soybean oil and the suggested attachment of mostly primary hydroxyls made it possible for the neutralized polyol to be highly reactive in the polyurethane formulation. In addition to the drawbacks brought about by enzyme use, the downstream processing of the hydrolyzed BSBO products made it more expensive to produce the final polyol. Multiple base washings (to remove fatty acids) and epoxy reaction to reduce acidity due to the free fatty acids cleaved off during hydrolysis are reasons for these. It is recommended that other possible routes be investigated to eliminate these flaws.

Keywords: soybean oil, enzyme; polyurethane, polyol, *C. rugosa*

MPS - 05

CHEMOMETRIC DIFFERENTIATION OF COMMON CLEAN ROOM CONTAMINANTS THROUGH PRINCIPAL COMPONENT ANALYSIS

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The electronics and semiconductor industry is the top export sector of the Philippines, and as such it comprises a large portion of the country's GDP. Most of the electronics and semiconductor in the Philippines are manufacturing components at high outputs, thus fast and reliable failure analysis is essential for their continued operation. One particularly important part of failure analysis is the identification of contaminants, immediate characterization of the contaminants is vital in isolating its source. In this paper, a training set of some common clean room contaminants was constructed.

Principal Component Analysis (PCA) was applied to the resulting Fourier Transform Infrared Spectra. The PCA plot showed effective differentiation of all of the contaminants, while three-dimensional PCA plot revealed that the contaminants investigated were clustering according to their composition (i.e synthetic, inorganic, naturally sourced).

Keywords: Principal Component Analysis, FTIR, chemical fingerprinting, electronics, chemometrics

MPS – 06

DEVELOPMENT AND VALIDATION OF A STABLE-ISOTOPE DILUTION LIQUID CHROMATOGRAPHY–TANDEM MASS SPECTROMETRY METHOD FOR THE DETERMINATION OF HISTAMINE IN PROCESSED FISH

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Isotope dilution-mass spectrometry is a potential primary reference method identified by the Consultative Committee on Quantity of Matter of the International Bureau of Weights and Measures, France. This technique using stable isotope of histamine as internal standard was used for the reference value assignment of the matrix reference material developed for histamine. Native histamine standard and isotopically labelled analog histamine dihydrochloride-D4 were applied in the development of the methodology. Both histamine in matrix samples and native histamine standards were spiked with the stable histamine isotope standard gravimetrically. These were then extracted with 0.1M HCl. Separation of the analyte was achieved using hydrophilic interaction liquid chromatography (HILIC) column with gradient elution and detected by the triple quadruple mass spectrometer. Multiple reaction monitoring (MRM) was used for the ions produced by electrospray ionization (ESI) in positive mode. Dissociation channels of m/z 112.1 → 95.1 and 116.1 →99.1 were chosen as quantifier ions for histamine and histamine-D4, respectively. In addition, m/z 112.1 →68.2 and 112.1 → 85.2 were used as qualifier ions for histamine and histamine-D4, respectively for further confirmation of the compound. Subsequent quantification was done using the masses and response ratios of the histamine standard and sample with the isotopically labelled histamine. The observed retention time of histamine was 2.3 min. The dynamic linear range obtained was 0.16 - 3.1 mg/kg and precision (%RSD) of 1-1.7. Acceptable % recovery was obtained in the control material used. This is one approach developed to establish metrological traceablility of histamine measurement to the International System (SI) of units e.g. kilogram.

Keywords: isotope dilution, histamine, primary method, liquid chromatography-mass spectrometry

MPS – 07

ECOTOURISM AND WATER QUALITY ASSESSMENT OF LAKE PANDIN, SAN PABLO, LAGUNA

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Increasing tourism activities and growing land privatization have brought concerns to the water quality of "pristine" Lake Pandin in San Pablo, Laguna. This study aims to elucidate the water quality and to evaluate Development and Management Plan (DMP) of Lake Pandin. Water quality parameters such as pH, temperature, dissolved oxygen, turbidity, phosphates, and nitrates on three different locations (spring, center and outlet) of the lake followed by interviews with the LLDA (Laguna Lake Development Authority) and the Samahan ng mga Babaeng Mangingisda at Bangkero were conducted. Results showed that Lake Pandin is still under the Class C classification based on the DENR Administrative Order (DAO 2016-08). The DMP, however, evaluated that while it ensures the sustainability of the development of the lake, it fails to consider the threats of land privatization.

Keywords: Development and Management Plan (DMP), tourism, water quality

MPS – 08

EFFECTIVENESS OF MALTODEXTRIN AND GUM ARABIC IN THE MICROENCAPSULATION OF AMPALAYA LEAVES EXTRACTS THROUGH FREEZE DRYING

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This study aimed to determine the effectiveness of maltodextrin (MD) and Gum Arabic (GA) with different formulations (7% MD, 7% GA, and 3.5% MD + 3.5% GA) in the microencapsulation of Ampalaya leaves extract through freeze drying. The freeze-dried encapsulated powders were analyzed for proximate analysis, physical properties and yield, and its morphology. Results of the proximate analysis shows that the encapsulated powder with 7% MD contained 4.9% moisture which is higher compared to 7% GA containing 4.7% and of the blend with 5.1%. Protein and ash content of the encapsulated powder with 7% GA contained 21.1% and 11.9% which was higher compared to the powder produced with 7% MD as well as the blend, whereas the powder with 7% MD exhibits higher content of total carbohydrates with 68.1%. Also, the fat content in all samples were not detected. Furthermore, the physical properties of the encapsulated ampalaya powders show that the powder with blend formulation has a higher bulk density of 0.43g/ml. The powder with 7% GA gives longer wettability time of 85.83 seconds. The yield was calculated after freeze drying in which 7% GA has a higher value with 9.6%. Lastly, the morphology of the freeze-dried ampalaya extract exhibits irregular crystalline-like shape, sharp edges and brittle texture, which are well-known features obtained from the lyophilization process. Based on the obtained results, it can be concluded that ampalaya leaves extract can be encapsulated using freeze drying technique and wall materials of different formulations of MD and GA.

Keywords: microencapsulation, ampalaya, maltodextrin, gum arabic, freeze drying

MPS – 09

ENCAPSULATION OF BACTERIA-DERIVED AUXIN, CYTOKININ AND GIBBERELLIN AND ITS APPLICATION IN COCONUT (*Cocos nucifera* VAR MAKAPUNO) CALLUS INITIATION

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The study focuses mainly on the encapsulation of bacteria-derived auxin, cytokinin, and gibberellin and its effect on the callus initiation of coconut (*Cocos nucifera* var Makapuno). The study also deals with the tracing of the encapsulated plant growth regulators.

Crude auxin (Aux), cytokinin (Ck) and gibberellin (GA) were isolated from plant gowth-promoting bacteria. The isolated crude plant growth regulators (PGRs) were successfully encapsulated, using phospholipid and β-sitosterol with encapsulation efficiency of 82.6 ± 0.50%, 84.6% ± 0.01% and 66.75 ± 0.62% for Aux-loaded, Ck-loaded and GA-loaded liposomes respectively. Improved solubility of the PGR-loaded liposomes, in aqueous solution, controlled-released behavior of the active component and stability of the encapsulated PGRs were also observed.

The effect of the PGR-loaded liposomes on the callus initiation of makapuno (*Cocos nucifera* L. var Makapuno) was also evaluated. Out of 15 treatments used in the study, 8 gave an initial callus formation with high frequency (> 75%). Considering the color, shape and frequency of the formation of initial callus, supplementation of 100% Aux-loaded liposomes on the medium gave the highest acceptable initial callus formation for the makapuno (*Cocos nucifera* L. var Makapuno). Initial callus formation was observed at 8 days following culture in contrast to the unencapsulated Aux which took about 20 days before initial callus formation.

Keywords: Encapsulation, Auxin, Cytokinin, Gibberellin, Callus

MPS – 10

FREE-RADICAL POLYMERIZATION OF N-VINYLIMIDAZOLIUM-BASED IONIC LIQUIDS AS ADDITIVE FOR ANTIFUNGAL PATCHES

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Currently, there is a widely developing resistance against antibiotic drugs. Following this trend, antifungal drugs have been unable to counter some emerging fungi which may be a concern for persisting infections. In response to these problems, imidazole-based compounds and imidazolium salts have been greatly contributing in the recent development of potential antifungal drug synthesis. In this study, poly(ionic liquid)s (PILs) from imidazolium salt monomers of varying alkyl chain lengths were synthesized through sonochemical reaction and radical polymerization. These compounds were added to polyvinyl alcohol (PVA) to create solid patches. Characterization of the synthesized monomers and polymers via FT-IR spectroscopy, ^{1}H-NMR and ^{13}C-NMR spectroscopy and gel permeation chromatography (GPC) had confirmed the synthesis and polymerization of the desired products. Fabricated patches were found positive for antifungal activity against *Candida albicans* through agar diffusion method. Furthermore, the PILs' low cytotoxicity and biocompatibility as a drug were determined after examining with trypan blue exclusion test and MTT proliferation. The results prove that these PIL-containing patches could contribute in the pharmaceutical industry.

Keywords: antifungal, sonochemical, radical polymerization, imidazole, poly(ionic liquid)s

MPS – 11

GLYCERINE BASED ANTI-OXIDANTS AS POTENTIAL OXYGEN SCAVENGER IN FOOD PACKAGING

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This study is about the synthesis of glycerin based antioxidants for potential use in food packaging. Glycerine antioxidants are also called oxygen scavengers or oxygen absorbers. These are active molecules that absorb migrating and trapped oxygen from the package. The advantages of oxygen scavengers are: they prolong the shelf life of a food product and with this also the qualities of the food - such as flavor and aroma; slows microbial growth and oxidative deterioration of flavors, color and nutrients. Glycerine antioxidants were prepared by using glycerine as the base material reacted with manganese chloride and polyhydric phenol followed by blending with slaked lime. The oxygen absorbing property at 5g was about 6-7x its weight on the 1st cycle and 11-12x more on the 2nd cycle. It absorbed oxygen at the highest of 35 mL on the 3rd day during the first cycle and gradually decreases on the 9th day then regained its absorption property on the 2nd cycle. Characterization of the glycerine antioxidants was done by FTIR. The result showed that a complex was formed after a series of chemical reactions.

Keywords: Glycerine, Anti-oxidant, Oxygen scavenger, Oxygen absorber, Manganese chloride

MPS – 12

IMPACT OF MINING ON WATER QUALITY OF THE MAJOR RIVERS AND PREVALENCE OF HUMAN DISEASES IN ZAMBOANGA PENINSULA, WESTERN MINDANAO, PHILIPPINES

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A survey on the human health and environmental impacts of the artisanal and small-scale gold mining in the selected areas in ZAMPEN was conducted from November 2015- June 2016. A total of 1,075 respondents were directly interviewed using guide questionnaires. Primary data were used in the analysis of the environmental and health assessment impacts of mining in the area. Results revealed that the pH of the water ranges from 5.63 ± 0.41 to 8.09 ± 0.50 was very low in all the sampling sites. Water analysis showed that the water samples in all sampling sites have very low dissolved oxygen (DO) that ranges from 5.52 ± 0.58 mg/L to 6.67 ± 0.64 mg/L as compared to the standard of >7.0 mg/L. The water level of all the sampling sites was very low that ranges from 24.70 ± 11.59 cm to 60.00 ± 37.70 cm depth. Water analysis showed that heavy metals like mercury (Hg), arsenic (As) and lead (Pb) were detected in all sampling sites higher than the standard levels. Guinabucan, Zamboanga Sibugay showed the highest occurrences (55) of common illnesses like fever, colds and flu. Batu Siay, Zamboanga Sibugay has the highest occurrences (47) of respiratory diseases like coughs and asthma. There were 57 occurrences of gastrointestinal diseases like LBM, diarrhea and vomiting in Rizal, Dapitan, Zamboananga del Norte. Sitio Limon, Zamboanga City has 26 occurrences of skin diseases. These occurrences are brought about by discharges of acids, chemicals, and sulfide minerals which when exposed to air and water are oxidized and harmful when inhaled or ingested. Other occurrences such as respiratory ailments and gastrointestinal problems are caused by the oxidation of these substances.

Keywords: Heavy Metals; mining; risk assessment, mercury; tailings

MPS – 13

OPTIMIZATION OF HYDROLYTIC ACTIVITY OF BIOTECH ALPHA-AMYLASE PRODUCED BY *Bacillus amyloliquefaciens* ON DIFFERENT SUBSTRATES

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The increasing demand for sucrose, glucose and fructose by the food, confectionery and other industries will require that new locally produced raw materials will have to be found and appropriate technology for their fullest use must be developed to make starch more economically significant. The objectives of this study is to develop an optimum enzymatic process for the hydrolysis of starches from potato, sweet potato, cassava, and corn and to determine which substrate gives the highest hydrolytic activity using the produced alpha-amylase. Response Surface Method (RSM) for optimization of the hydrolytic activity of alpha-amylase was used. The experimental design used for investigating the effects of pH, temperature and substrate concentration was a 3 factor x 3 level Central Composite Design. The condition needed for cassava starch to have a maximum activity was pH 6.8, incubation temperature of 41°C and substrate concentration of 2.5%. For corn starch, maximum activity can be obtained at optimal conditions of 7.2, 50°C and 3.0% for pH, temperature and substrate concentration, respectively. On the other hand, at pH 7.2, 50°C incubation temperature and 3.0% substrate concentration, crude supernatant of alpha-amylase had maximum activity using sweet potato as substrate. For soluble potato starch, it was found out that the optimal conditions are 6.8, 41°C and 2.5% for pH, temperature and substrate concentration, respectively. The optimum incubation time for cassava starch, sweet potato starch and soluble potato starch was found to be 10 min while for corn starch is 12 min.

Keywords: alpha-amylase, central composite design, enzyme, response

MPS – 14
POLY(METHACRYLIC ACID) AND POLY(ETHYLENE GLYCOL)-BASED BLOCK COPOLYMERS FOR THE ORAL ADMINISTRATION OF PHARMACEUTICALS

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The oral administration of pharmaceuticals is often the most preferred method of drug delivery since it is the most convenient and least intrusive. However, drug compounds are prone to leakage, degradation, and causing harmful side effects in the stomach, wherein the pH ranges from 1.0-3.0. The intestines on the other hand, have a pH range of 4.8-8.2. This large shift in pH between the organs poses a challenge for orally administered pharmaceuticals. Stimuli-responsive polymers are polymers that undergo reversible phase changes when a prerequisite chemical or physical change occurs in the external environment such pH, temperature, pressure, or ionic strength. This property has made these polymers well-studied candidates for the development of stimuli-responsive drug carriers. In this study, block copolymers of poly(methacrylic acid)-b-poly(di(ethylene glycol) ethyl ether methacrylate) (PMAA-b-PDEGMEMA) and poly(methacrylic acid)-b-poly(poly(ethylene glycol) ethyl ether methacrylate) (PMAA-b-PPEGMEMA) were synthesized by RAFT polymerization towards the development of stimuli-responsive carriers of poorly soluble drugs. These copolymers both display a pH-response at pH 5.15 and display thermo-responses at 26°C and 72°C for PMAA-b-PDEGMEMA and PMAA-b-PPEGMEMA, respectively. Drug-loaded micelles of the copolymers achieved loading efficiencies of up to 66.65% and loading capacities of up to 11.76%. Cumulative drug release studies using ibuprofen as a model drug indicated that at stomach conditions, drug release is minimized, but a burst and sustained drug release is achieved at intestinal pH. Moreover, cell viability assays of the blank and loaded micelles confirm that these are biocompatible, further supporting that the synthesized copolymers have potential as drug carriers.

Keywords: RAFT, drug delivery, drug loading, PMAA, PEG

MPS – 15

POTENTIALITY OF SCENEDESMUS QUADRICAUDA AS MEDIA FOR BIOREMEDIATING POLLUTED WATER

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Water pollution is one of the most common problem the world is facing today. One among many technologies or approach to deal with this problem is bioremediation. Bioremediation is a pollution control technology that uses biological systems to catalyze the degradation or transformation of various toxic chemicals to less harmful forms. The present study focuses on the potentiality of Scenedesmus quadricauda as a media for bioremediating polluted water specifically utilizing sample water from Calumpang river, Batangas. In bioremediation, microorganisms were used to degrade the organic contaminants in soil, groundwater, sludge, and solids by using them as an energy source (Tang et al., 2007). Microalgae are one kind of microorganism that can help in treating the waste, pollution and can provide purification of the water. To study the role of Scenedesmus quadricauda in polluted waters, two variables were used, (i) Polluted water with Scenedesmus quadricauda; and (ii) Polluted water without Scenedesmus quadricauda. Samples were periodically analyzed every 6th day. The sampling duration lasts in 12th day. Various physicochemical parameters such as Biological Oxygen Demand (BOD), Fecal coliform (FC), Oil and grease (OG) and pH were considered. The percent removal of the parameters after 12th day of treatment in BOD, FC, Oil and grease and pH are 85.71%, 82.31%, 0%, and 0.63%, respectively.

Keywords: bioremediation, Scenedesmus quadricada, microalgae, water treatment

MPS – 16

PURITY ASSESSMENT OF FOLIC ACID: PHILIPPINE EXPERIENCE IN INTERNATIONAL PILOT STUDY COMPARISON

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The purity assessment of a well characterized folic acid candidate reference material was conducted using mass balance approach at the Industrial Technology Development Institute. This is essential for pure substances that are used as calibrants to establish traceability of chemical measurements to International System (SI) of units. In this technique, three main sources of impurities were evaluated to assess the purity of folic acid. High performance liquid chromatography (HPLC) was used to measure the organic impurities and test the homogeneity of folic acid. The organic impurities were found to be 0.867 %. Water content was determined to be 8.41% by Karl-fischer (KF) coulometer with oven transfer. The water content was high because folic acid is a thermally unstable substance and apt to contain crystal water. Non-volatile matter and other solvent residues were not detected by thermal gravimetric analysis (TGA). The purity of folic acid pure substance was finally assigned to be 90.8 % with measurement uncertainty of 1.61 %. The major sources of measurement uncertainty were associated from volatile impurity, organic purity which is concerned with the mass fraction of impurities with similar structure and impurity not resolved from the main analyte in HPLC. The result obtained was in good comparison with other participating Metrology Institutes abroad.

Keywords: purity assessment, folic acid, reference material, TGA, KF-coloumetry

MPS – 17

REDUCTION OF MICROBIAL LOAD IN BEEF BURGER PATTIES BY ELECTRON BEAM IRRADIATION

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Being a relatively new way of sterilizing food and food ingredients, the effect of electron beam irradiation on microbial quality of food needs to be studied. This study evaluated the effect of electron beam irradiation on the Aerobic Plate count (APC), Molds and Yeast Count (MYC) and Total coliform count of in-house-prepared beef burger patties, from 0 to 5 months of storage after irradiation. Beef burger patties were prepared from freshly ground beef and other ingredients, molded, vacuum packed and stored at -180C. Vacuum packed frozen beef patties were irradiated at 2, 4, 6 and 8 kGy. APC and MYC were analyzed monthly for a period of 5 months. Total coliform count was conducted monthly for three months. Kruskal Wallis and post hoc Mann Whitney U tests were used for statistical analysis. Results showed that APC and MYC of prepared non-irradiated beef patties were statistically comparable with two commercial brands of beef patties ($P>0.05$). Electron beam treatment at 2, 4, 6, and 8 kGy significantly reduced APC to 3.13, 2.67, 2.85 and 2.52 log cfu/g, respectively, compared with non-irradiated at 4.93 log cfu ($p<0.05$). APC of irradiated beef patties did not significantly differ with storage time of five months. MYC of beef patties were also reduced with electron beam irradiation to 2.39 log cfu/g at 2 kGy and to 1.0 log cfu/g at 4, 6 and 8 kGy, compared with nonirradiated at 3.16 log cfu/g ($p<0.05$). However, at the end of the 5th month of storage, only 6 and 8 kGy were able to maintain MYC at 1.0 log cfu/g. Total coliform count of irradiated beef patties were also significantly reduced to 2.54 log cfu/g for all doses, compared with 3.16 log cfu/g for nonirradiated samples. Results of this study showed that electron beam irradiation at a minimum dose of 2 kGy may improve the microbial quality of beef burger patties, but, a higher dose of 4 to 8 kGy may further eliminate pathogens of beef patties.

Keywords: electron beam, radiation, beef burger patties, APC, MYC

MPS – 18

SYNTHESIS OF 1-ALKYL-3-METHYLIMIDAZOLIUM CARBOXYLATE IONIC LIQUIDS THROUGH ANION EXCHANGE AS ANTIBACTERIAL AGENTS

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Ionic Liquids (IL) are a class of salts which are liquid at room temperature under 100°C. Due to their applications in a wide variety of fields, these compounds have recently been the focus of many researches as greener solvents, medicines and catalysts. In line with the current investigations on the pharmaceutical properties of ionic liquids, this study focused on the synthesis of 1-alkyl-3-methylimidazolium carboxylate ILs [RMIM][RCO_2] and their application as antibacterial agents. Synthesis of ILs consisted of two steps: sonochemical reaction between 1-methylimidazole and 1-alkyl bromide to produce 1-alkyl-3-methylimidazolium bromide [RMIM]Br and the anion exchange of bromide with carboxylates using the anion-loaded resin. Successful synthesis of the ILs were proven by 1H-NMR, 13C-NMR and FT-IR spectroscopic techniques. In addition, the synthesized ILs were also subjected to antibacterial assays against *S. aureus* and *E. coli* and were proven to be active against the bacteria with minimum inhibitory concentrations ranging from less than 1% to 2.5%. Lastly, cytotoxicity assays by Trypan blue revealed that the ILs were relatively non cytotoxic with cell viabilities ranging from 50%-90%. These findings show that the synthesized ionic liquids are both antibacterial and relatively non cyctotoxic making them probable candidates as antibacterial agents.

Keywords: ionic liquids, antibacterial, anion exchange, sonochemical reaction

MPS – 19

SYNTHESIS OF NEW GENERATION 3,4-DIARYL-4-HYDROXY-2-CYCLOPENTENONE DERIVATIVES WITH ANTI-INFECTIVE, CYTOTOXIC AND ANTI-INFLAMMATORY ACTIVITIES

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The design and synthesis of chemical scaffolds based on biologically active, electrophilic natural product fragments are important concepts in anti-infective and anti-cancer drug discovery. In this study, we disclose the synthesis of highly congested 3,4-diaryl-4-hydroxy-2-cyclopentenone derivatives with antimicrobial, cytotoxic and anti-inflammatory properties. Employing a simple Aldol synthetic procedure, nine 3,4-diaryl-4-hydroxy-2-cyclopentenones were afforded from benzils and 2-alkanones in moderate to good yields and were characterized by extensive spectroscopic analysis (IR, ^{1}H and ^{13}C NMR and high-resolution ESIMS). Spectrophotometric broth microdilution assays were used to determine their inhibitory activity against *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Bacillus subtilis,* and *Candida albicans*. For measurements of their cytotoxic activity against human umbilical vein endothelial cell (HUVEC), human myeloid leukemia (K-652) and human epithelial cervix carcinoma (Hela) cell-lines, a MTT assay was employed while a microplate anti-cyclooxygenase kit (COX-1 and -2) was used to evaluate anti-inflammatory capacity. Results showed that improved antimicrobial, anti-proliferative/ cytotoxic and anti-COX activities can be attributed to the presence of a chlorine atom in the aromatic moieties and an elongated alkyl group in the C-5 position of the cyclopentenone. Thus, compounds based on chlorinated and C-5 substituted 3,4-diaryl-4-hydroxy-2-cyclopentenone scaffolds are promising anti-infective, cytotoxic and anti-inflammatory agents.

Keywords: 3,4-diaryl-4-hydroxy-2-cyclopentenone, antimicrobial, cytotoxic, anti-cyclooxygenase

MPS – 20

Trichoderma SPECIES, BEST HEAVY METAL-TOLERANT FUNGI FROM MINE TAILINGS IN ITOGON, BENGUET

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Waste from mining industries contains various heavy metals that can pollute the environment. Bioremediation using potential microorganisms can help in eliminating these heavy metal contaminants. This study aims to isolate and identify indigenous heavy metal-resistant fungi from the premier mining town in Itogon, Benguet. Water samples were collected from six mine tailing sites in Itogon. Water analysis by atomic absorption spectroscopy showed the presence of chromium (Cr), copper (Cu), lead (Pb), zinc (Zn), and nickel (Ni). Isolation of fungi was done by serial dilution and spread plate techniques using potato dextrose agar (PDA) with 20 ppm of individual heavy metal. Fungal growth was tested on PDA amended with mixture of five heavy metals. Identification of selected isolates was done through DNA sequencing using universal fungal primers. DNA sequences were aligned using Clustal W Multiple Alignment application, and then compared in GenBank by nucleotide BLAST search. Highest fungal population was observed in site 1 with 2.5 x 10^3 to 5.4 x 10^5 CFU/ml on PDA with heavy metals. Fungal population on PDA plates alone ranged from 3.1 x 10^1 to 9.5 x 10^3 CFU/ml. Of the 29 isolated fungi, four species (coded as F1, F2, F3, and F4) were selected that showed full mycelial colonization on PDA with heavy metal mixture. All four isolates have wide pH tolerance (pH 5 to 9) and can grow well at 25 and 30°C. Selected isolates all belong to genus *Trichoderma*. Sequences of F1, F2, F3, and F4 showed high similarity to *T. virens, T. harzianum, T. saturnisporum, and T. gamsii*, respectively. Growth tolerance on PDA with 0, 200, 400, 600, 800, and 1000 ppm of individual heavy metal indicated the following trend: *T. virens* > *T. harzianum* > *T. gamsii* > *T. saturnisporum*. Results indicated that the *Trichoderma* isolates can tolerate high levels of Cr and Pb while tolerance to Cu, Zn, and Ni was species specific.

Keywords: heavy metal, Trichoderma, Itogon, Benguet, mining

MPS – 21

β-SECRETASE INHIBITORY ACTIVITY OF *Haliclona koremella* DE LAUBENFELS

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β-secretase 1 (BACE1) is the rate-limiting enzyme involved in the synthesis of β-amyloid plaques that block signaling pathways for neurotransmitters causing neuronal death. Inhibiting these enzymes was considered to be beneficial for the treatment of Alzheimer's disease. The aim of this study is to determine the BACE1 inhibitory activity of the Philippine marine sponge *Haliclona koremella*. The freeze-dried sample (431.16 g) was sequentially extracted with hexane (4.23%), dichloromethane (0.3%), and methanol (5.09%). Secondary metabolites analysis of *Halicona koremella* showed that it contains alkaloids, phenols, tannins, flavonoids, steroids, and anthraquinone. Analysis BACE1 inhibitory activity of the crude extracts revealed a dose-dependent inhibition with the highest activity at 100 µg/mL. Among the three extracts, the methanol extract exhibited the highest inhibitory activity with an IC50 of 3.23 µg/mL. This suggests that *Haliclona koremella* could be a potential source of bioactive compounds for the treatment of Alzheimer's disease.

Keywords: Alzheimer's disease, BACE1, β-secretase inhibitor, Marine sponge, *Haliclona koremella*

MPS – 22

A SEASONAL WATER QUALITY ASSESSMENT OF THE MARIKINA RIVER USING BENTHIC MACRO-INVERTEBRATES WITH IMPLICATIONS TO RIPARIAN RECOVERY

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The aim of this study is to assess seasonal changes in the Marikina River by contrasting physico-chemical water quality parameters, benthic macroinvertebrate assemblages, and substrate composition across seasons. Due to altered amount of rainfall and varied degree of anthropogenic activities across sites there is a need for reassessment to see the river's reaction to the change in season. There is an increase in dissolved oxygen for all sites in the year 2015; this may be a result of chemical decomposition of organic material. The statistical variance is greatly reflected by the Wawa site which displayed the most significantly varied set of data across all parameters. A cross seasonal comparison revealed that diversity tends to increase towards the wet season. The findings regarding substrate composition strongly supports the presence of most benthic macroinvertebrate assemblages. The substrate in each site is indicative of certain assemblages of Mayflies: *Baetidae* and *Heptageniidae* in largely composed substrates, and *Lumbriculidae* and *Glossiphonnidae* which can be found in smaller or finer grained substrates. Anthropogenic factors as well as natural environmental factors have influence over diversity, level of organic pollution, benthic macroinvertebrate assemblages, and substrate type.

Keywords: Markina River, benthic macro-invertebrates, water quality

MPS – 23

DEVICE FABRICATION AND PERFORMANCE EVALUATION OF A POTENTIOMETRIC MIP-BASED SENSOR FOR CLENBUTEROL

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A potentiometric sensor based on a molecularly imprinted polymer was fabricated for the detection of clenbuterol, a β2-agonist that is frequently abused as veterinary drugs and human stimulants. The molecularly imprinted polymer for clenbuterol (MIP-CLB) was prepared via precipitation polymerization at 60°C for 20 hours under constant stirring. A clenbuterol-imprinted polymeric membrane was fabricated using the synthesized MIP-CLB as the sensing element, potassium tetrakis(4-chlorophenyl)borate, and nitrophenyl octyl ether as plasticizer, in PVC matrix. A nernstian response of 53.33 mV/decade at the linear range of 10^{-3} to 10^{-8} M was exhibited during the potentiometric measurements with clenbuterol. Furthermore, a limit of detection of 1.21×10^{-8} M or 3.80 ppb was obtained. The results were validated using HPLC. Selectivity studies revealed that the fabricated sensor was highly responsive to clenbuterol compared to analytes with similar structure such as ractopamine, salbutamol, and chloramphenicol.

Keywords: molecularly imprinted polymer, clenbuterol, potentiometry

MPS – 24

POTENTIAL OF BACTERIA ISOLATED FROM STA. MARIA HOT SPRING STA. MARIA, ILOCOS SUR FOR BIOETHANOL PRODUCTION

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Scientists have turned to their attention to microorganisms to see if they can find any that are capable of converting the hemicellulose and cellulose in lignocellulosic material into ethanol. The economically feasible production of ethanol from lignocellulosic materials requires efficient conversion of all the main carbohydrate constituents of this complex material to ethanol, and therefore, such microorganisms would be desirable. Thus, this study generally aimed to evaluate the potential of bacteria that were isolated from Sta. Maria hot spring, Sta Maria, Ilocos Sur for bioethanol production from nipa biomass. Specifically, it aimed to: (1) determine the physico-chemical characteristics of Sta. Maria hot spring, Sta. Maria, Ilocos Sur in terms of temperature and pH; (2) isolate and characterize the bacteria in terms on their morphological and biochemical characteristic and (3) evaluate the potential of the bacterial isolates in biomass degradation.

Standard microbiological assay was followed for the isolation,cultivation and characterization of bacteria. There were six(6) bacterial isolates that were characterized morphologically and biochemically. The isolates are cocci and bacilli and three (3) of the these are gram-positive (isolates 3, 5 and 6) while the others are gram-negative All the isolates are found to be protease producers , positive for starch hydrolysis test and have the ability to degrade lignin and cellulose of nipa biomass after treatment. Isolates 1,4 and 5 are not significantly different in terms on delignification efficiency of 66.67% while isolate 4 has the greatest saccharification efficiency of 3.04%.Thus, these isolates are promising biodegraders of lignocellulosic biomass for ethanol production.

Keywords: biomass, bioethanol, delignification, saccharification, lignocellulose

MPS – 25

CHARACTERIZATION OF SURFACE-SUBSURFACE INTERACTIONS AND QUALITY ASSESSMENT OF WATER IN THE PASIG RIVER BASIN BY MULTIVARIATE ANALYTICAL TECHNIQUES

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Surface-subsurface water interactions and water quality in the Pasig River basin were assessed using multivariate techniques of radiological and chemical analyses. Five tributaries along the stretch of Pasig River were selected as sites for collection of water and were tested according to the criteria of Class C water classification. Results show that none of the samples exceeded the regulatory limit set by the Philippine National Standards for Drinking Water for water hardness, pH, conductivity and salinity for both surface and subsurface water. However, radiological analysis revealed that all samples exhibited gross alpha and total beta activities which are 1 or 2 times higher than the regulatory limit for Radioactivity in water (Total β Activity Limit = 1.0 Bq/L: Gross α Activity Limit = 0.1 Bq/L). Statistical treatment on gross alpha and beta (GAB) results show significant difference between surface and subsurface water. Variations on water types for each sites denotes effects of different anthropogenic activities on the river.

Keywords: gross alpha, total beta, Pasig River

MPS – 26

TANDEM MUKAIYAMA-MICHAEL ADDITION REACTIONS TOWARD ELECTROPHILIC CYCLOPENTENONE DERIVATIVES WITH ANTITUBERCULOSIS AND ANTI-CANCER ACTIVITY

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Electrophilic natural products based on the cyclopentenone moiety are widespread in nature and exhibit innate anti-infective and cytotoxic properties owing to the reactivity of their α,β-unsaturated handles with cellular nucleophiles. Synthetic derivatives thus far explored offer promise in the development of new generation anti-microbial and anti-cancer agents. We hereby disclose a new synthetic methodology developed in our laboratory for cyclopentenone-butenolide/pyrrolidenone and cyclopentenone-ester hybrids. The synthesis involves a Lewis-acid catalyzed addition of 2-siloxyfurans/2-siloxypyrroles/siloxyenol esters to Boc or acetyl protected 4-hydroxycyclopentenones. To improve yield and *syn/anti* diastereomeric ratio, screening of different Lewis acids, solvents, and temperature was performed to optimize reaction conditions. Overall, a high selectivity towards the syn diastereomer was observed in moderate to good yields. Biological activity evaluation of the derivatives showed moderate to good activity versus *Mycobacterium tuberculosis* $H_{37}Rv$ (MIC = <64 μg/mL) and cancer-cell lines (myelogenous leukemia and HeLa) (GI_{50} or CC_{50} = <40 μg/mL).

Keywords: cyclopentenone, Mukaiyama addition, Michael addition, cytotoxic, antitubercular

MPS – 27

AN EIGENVECTOR METHOD FOR GRAPH COLORING

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We study a system of polynomial equations that model the 3-colorability property for graphs. In particular, a graph is 3-colorable if and only if the corresponding system of polynomial equations has a solution. If a solution exists, then we use the eigenvector method to find all 3-colorings of the graph. In particular, we read off the eigenvectors of a matrix whose eigenvalues are polynomials evaluated at the solutions. We use this method to generate all possible 3-colorings of a particular graph.

Keywords: graph coloring, eigenvector method

MPS – 28

ON THE INTERIOR BERNOULLI FREE BOUNDARY PROBLEM

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This paper investigates the interior Bernoulli free boundary problem. As in (Bacani, 2013), the Bernoulli problem will be formulated into a shape optimization problem. We consider the minimization of the Kohn-Vogelius-type cost functional subject to Dirichlet boundary value problem and a Neumann boundary value problem. This paper will focus on obtaining the first-order Eulerian derivative of the cost functional using two approaches -- the approach that uses Hoelder continuity of the state functions and an approach that uses the shape derivatives of the states.

Keywords: free boundary problem, boundary value problem, shape derivative, interior Bernoulli problem

MPS – 29

OPTIMAL CONTROL FOR A PREDATOR-PREY MODEL WITH DISEASE IN THE PREY POPULATION

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An optimal control problem is studied for a predator-prey model with disease in the prey population. The model is adapted from a Lotka-Volterra system with Holling type II predation response and an inclusion of SI epidemic dynamics on the prey population. Two controls are introduced to the system: a separation strategy that is intended to set apart the sound preys from the infected prey population, and a treatment policy which is applied to reduce the rate of death caused by the disease. A finite-time horizon optimal control problem is then formulated by minimizing the infected prey population and cost induced from the application of the controls at final time. Characterization of the optimal controls are obtained through Maximum Principle of Pontryagin. Numerical experiments, obtained using a forward-backward sweep method on the first order necessary conditions, are carried out to examine the impact of the controls to the problem.

Keywords: optimal control, predator-prey, Pontryagin's optimality principle, forward-backward sweep method

MPS – 30

r-ASSOCIATION SCHEMES, MENON DESIGNS, AND STRONGLY REGULAR GRAPHS OBTAINED FROM CERTAIN 2*r*-DIMENSIONAL SUBSPACE OF (2*r*+1)-DIMENSIONAL VECTOR SPACE OVER THE GALOIS FIELD *GF*(2)

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Let $\mathcal{V}(2r+1,2)$ be the $(2r+1)$-dimensional vector space over the Galois field, $GF(2)$, and let $\mathcal{V}_{2r} \subset \mathcal{V}(2r+1,2)$ be the $2r$-dimensional subspace of $\mathcal{V}(2r+1,2)$, which consists of 2^{2r} vectors of even parity, specifically, $\mathcal{V}_{2r} = \{\mathrm{vi} \mid i = 1, \ldots, 2^{2r}\}$, where $\mathrm{v}_i = (\mathrm{v}_{i1}, \mathrm{v}_{i2}, \ldots, \mathrm{v}_{i2r}+1)$ such that $\mathrm{v}_{i2r}+1 = (\mathrm{v}_{i1} + \mathrm{v}_{i2} + \cdots + \mathrm{v}_{i2r})\mathrm{mod}2$.

Form the $2^{2r}\times(2r+1)$ matrix, $M = [m_{ij}]$, whose rows are all the vectors of $\mathcal{V}_{2r}$, i.e., $m_{ij} = v_{ij}$, and obtain the matrix, $W = (ME^T + EM^T)/2 - MM^T$, where E is the all-ones matrix with the same size as M. With $n = 2^{r-1}$ and $s = 0$ whenever $r = 1, 4 \pmod 4$ and $s = 1$ whenever $r = 0, 3 \pmod 4$, the following results are claimed:

1. Matrix W can be decomposed as $W = 0\cdot W_0 + 1\cdot W_1 + \cdots + \mathrm{r}\cdot W_r$ such that the set $\mathcal{W} = \{W_k \mid k = 0, 1, \ldots, r\}$ together with the set of vectors, $\mathcal{V}_{2r}$, form an association scheme $(\mathcal{W}, \mathcal{V}_{2r})$ with r classes.
2. Matrix $A = W\mathrm{mod}2$ is both the incidence matrix of a Menon design with parameters $(4n^2, 2n^2 + (-1)^s n, n^2 + (-1)^s n)$ and the adjacency matrix of a distance regular graph with intersection array $(b_0, b_1; c_1, c_2) = (2n^2 + (-1)^s n, n^2 - 1; 1, n^2 + (-1)^s n)$.
3. Matrix $J–A–I$ is the adjacency matrix of a strongly regular graph, $SRG(4n^2, 2n^2 + (-1)^s n–1, n^2 + (-1)^s n–2, n^2 + (-1)^s n)$, where J and I are the all-ones and identity matrices of order $4n^2$, respectively.
4. Matrix $H = 2A–J$ is a regular Hadamard matrix of order $4n^2$ with row sums (column sums) equal to $(-1)^s 2n$.

Keywords: association scheme, Menon design, regular Hadamard matrix, distance regular graph, strongly regular graph

MPS – 31

SHAPE OPTIMIZATION OF THE BERNOULLI PROBLEM BY TRACKING THE NEUMANN DATA: A LAGRANGIAN FORMULATION

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We examine the solution of the exterior Bernoulli free boundary problem by reformulating it into a shape optimization setting. More precisely, we choose, for a given domain, the Dirichlet boundary condition on the free boundary to obtain a well-posed state equation, and then determined the optimal boundary by tracking the Neumann data in a least-squares sense. The shape derivative of the corresponding cost functional is established through a Lagrangian formulation coupled with the velocity method.

Keywords: shape optimization, shape derivative, Kohn-Vogelius cost functional, Lagrange method, minimax formulation

MPS – 32

TESTING AUTOMATED LANGUAGE PHYLOGENY USING A FEATURE-SENSITIVE METRIC ON THE BASHIIC FAMILY OF LANGUAGES

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This study aims to apply a distance-based phylogenetic algorithm on Philippine languages. Using the entries elicited first-hand from our 505-word list, we calculate distance between languages on the basis of historical sound changes. Relative distance is calculated based on relative probability of occurrence. Words across languages are aligned using the Levenshtein al- gorithm and corresponding letters are evaluated based on the sound change involved. Using these distances a phylogenetic tree is produced by the unweighted pair group method with arithmetic mean (UPGMA). The tree pro- duced by this metric is compared with trees obtained: 1. by using simple Levenshtein,; and, 2. by using feature-weighted Levenshtein. These trees obtained quantitatively will also be compared with existing trees obtained qualitatively by experienced linguists. As a test case, we present our computations using python on the Bashiic family of languages.

Keywords: Phylogenetic trees, feature-sensitive metric, Levenstein distance, Bashiic languages

MPS – 33

THE ASSOCIATED GRAPHS OF HV-GROUPS AND HV-SEMIGROUPS WITH APPLICATION TO ALGEBRAIC HYPERSTRUCTURE OF SOME CHEMICAL ELEMENTS

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An algebraic hyperstructure is a nonempty set H together with a function $\bullet : H \times H \rightarrow \wp(H)$ called hyperoperation, where $\wp(H)$ denotes the set of all nonempty subsets of H. A hyperoperation $\bullet$ is called weak associative in H if $(x \bullet y) \bullet z \cap x \bullet (y \bullet z) \neq \varnothing$, for all x, y, z in H. The hyperstructure $(H;\bullet)$ is called an Hv-semigroup if "$\bullet$" is weak associative and an Hv-semigroup $(H; \bullet)$ is called an Hv-group if $x \bullet H = H \bullet x = H$.

Let H be an Hv-semigroup with identity e, that is, for all $a \in H$, $a \in a \bullet e \cap e \bullet a$. The associated graph $\Gamma_e(H)$ of H is the graph whose vertices are the elements of H and for distinct $x, y \in H$, there is an edge connecting x and y, denoted by $x - y$ if and only if $l(\{x, y\}) = \{e\}$, where $l(\{x, y\}) = \{h \in H \mid e \in h \bullet x \text{ and } e \in h \bullet y\}$.

This paper extends the study of Hv-semigroup and Hv-group to associated graphs. It aims to establish properties of the associated graphs of Hv-semigroup and Hv-group and describe the associated graphs of Silver, Copper, Gold, Tin, and Indium whence providing another look of the properties of these chemical elements.

Keywords: Hv-group, Hv-semigroup, hyperstructure, associated graphs, weak associative

MPS – 34

THE BI-PERIODIC FIBONACCI-LUCAS MATRIX

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Define the bi-periodic Fibonacci-Lucas Matrix as the two-by-two matrix $J:=[ab/2 \quad (ab+4)/2; \; ab/2 \quad ab/2]$, where a and b are nonzero real numbers. This research focuses on the remarkable property of this matrix to derive various properties and relationships of the two number progressions namely the bi-periodic Fibonacci and bi-periodic Lucas sequences. The study of these sequences were first done by Edson et al. in 2009 and by Bilgici in 2014, where both literature utilized generating functions to investigate different identities involving these sequences. Methods used in this study are analogous to those of Demirtürk in 2010 for the classical Fibonacci and Lucas sequences.

Keywords: bi-periodic Fibonacci sequence, bi-periodic Lucas sequence, generalized Fibonacci sequence, matrix methods

MPS – 35

THE SOLUTIONS OF THE DIOPHANTINE EQUATION $p^x + q^y = z^2$ FOR COUSIN PRIMES p AND q, AND NONNEGATIVE INTEGERS x, y and z

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The paper is about the infusion of the concept of cousin primes to the study of Diophantine equations. Cousin primes are two prime numbers that differ by four. Examples include 3 and 7, 7 and 11, 19 and 23, 67 and 71, and many more. Diophantine equations, on the other hand, are equations that only require integer solutions. The classical Diophantine equations that are still of interest of many mathematicians and math enthusiasts today include the linear equation $ax + by = c$, the Pythagorean equation $x^2 + y^2 = z^2$, and exponential Diophantine equations such as $a^x + b^y = c$, where a, b and c are positive integers.

The main goal of this paper is to find all solutions of the Diophantine equation $p^x + q^y = z^2$

where p and q are cousin primes, and the variables x, y and z are in the set of nonnegative integers.

Keywords: Diophantine equation, cousin primes

MPS – 36

WEAKLY CONNECTED CLOSED GEODETIC NUMBERS OF GRAPHS

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Given a connected simple graph G and $S \subseteq V(G)$, the geodetic closure $I_G[S]$ of S is the set of all vertices lying on some u - v geodesic (shortest path joining vertices u and v in graph G) where u and v are in S. In this paper, select vertices of graph G sequentially as follows: select a vertex v_1 and let $S_1 = \{v_1\}$. Select $v_2 \neq v_1$ and let $S_2 = \{v_1, v_2\}$, then determine $I_G[S_2]$. If $I_G[S_2] \neq V(G)$ then successively select a vertex $v_i \notin I_G[S_{i-1}]$ and let $S_i = \{v_1, v_2, \ldots, v_i\}$ for $i = 1, 2, \ldots, k$. Then determine $I_G[S_i]$.

A subset S of $V(G)$ is called a weakly connected closed geodetic set of G if the selection of vertex v_k in the given manner yields sgn(G) is the smallest k such that there is a sequence $\langle v_1, v_2, \ldots, v_k \rangle$ for which $I_G[S_k] = V(G)$ and $S_w = N[S], E_w$ with E_w consists of edges $uv \in E(G)$ such that $u \in S$ or $v \in S$. The minimum cardinality of a weakly connected closed geodetic set is called the weakly connected closed geodetic number $wcgn(G)$ of G. In this paper, the weakly connected closed geodetic sets of some common graphs and graphs resulting from the join of graphs are characterized. Also, the weakly connected closed geodetic numbers of these graphs are determined.

Keywords: closed geodetic number, weakly connected closed geodetic set, weakly connected closed geodetic number

MPS – 37

ADSORPTION OF CARBON MONOXIDE, HYDROCARBONS, AND CARBON DIOXIDE EMITTED BY A VEHICLE USING NATURAL ZEOLITE AS EXHAUST FILTER

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Increasing levels of CO_2 from car emissions is becoming one of the highest contributors in greenhouse gases in the atmosphere, but these may be sequestered using vehicle filters. With the many applications of zeolite as adsorbent, this study focused on the effectivity of natural zeolite to adsorb pollutants, particularly carbon monoxide, carbon dioxide, and hydrocarbons emitted by a motor vehicle. The researchers made a prototype exhaust filter composed of natural zeolite powder, sponge, and screen attached to a muffler. The experiment was run for a blank sample namely the muffler with no natural zeolite filter, and for the test utilizing the natural zeolite as vehicle exhaust filter. Each standard vehicle emission test underwent through three trials; the results showed that on the average, a 36.60% decrease for CO, 59.96% for hydrocarbons, and 32.07% for CO_2 was achieved by using the filter prototype. Also, the effect of filter in engine performance was determined through knowing its speed with and without the filter. The results showed that the engine performance decreased by 2% with the installation of the exhaust filter, which is relatively comparable to the effects of installation of other types of filters for vehicles.

Keywords: sanitary permit, food handlers, drainage system

MPS – 38

APPLICATIONS OF SAGO STARCH FILMS FILLED WITH POLY (N-VINYL CARBAZOLE) PVK NANOPARTICLES

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The effects of PVK as fillers on the characteristics and properties of sagu starch solution and films, the antimicrobial, water vapour permeability and UV-VIS transmission of the sagu stach were investigated in this work. The sagu starch filled with PVK was homogenized and incorporated into sagu starch solutions at different concentrations. Introduction of PVK fillers to sagu starch solutions significant increased the viscosity of the solution and significantly decreased the permeability of the films to water vapour. Solubility to different solvents, moisture content was decreased. The sagu starch solutions filled with PVK nanoparticles had 30% UV transmittance. The sago starch films filled with PVK exhibited excellent antimicrobial activities against *S.aureus* and *E. coli*. These properties suggest that the prepared biocomposites has the potential as filler in starch based products for use as active materials in packaging and in pharmaceutical and textile industries.

Keywords: sagu starch, PVK, antimicrobial, biocomposites

MPS – 39

COPRECIPITATION SYNTHESIS AND CHARACTERIZATION OF MAGNETITE NANOCOMPOSITES STABILIZED BY POLYETHYLENE GLYCOL

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In this study, magnetite (Fe_3O_4) nanoparticles were synthesized via coprecipitation method using ferrous and ferric cations with the incorporation of polyethylene glycol (PEG) to stabilize and hinder agglomeration. The prepared bare and PEG-coated Fe_3O_4 nanoparticles showed crystalline structures when analyzed using X-ray diffraction crystallography (XRD). Scanning electron microscopy (SEM) revealed that the uncoated and PEG-coated Fe_3O_4 both have particulate morphology with estimated particle diameters of 12.5 nm and 75 nm in powder form, respectively. Dynamic Light Scattering (DLS) analysis was used to determine the average particle diameter of uncoated and PEG-coated samples in aqueous medium and found particle sizes of 78.02 nm and 73.95 nm, respectively. Polydispersity index values also showed that both PEG-coated and bare Fe_3O_4 are monodisperse sufficiently with values 0.372 and 0.356, respectively. Furthermore, the addition of PEG led to a more stable Zeta potential (ZP) of -33.0 mV compared to -29.3 mV for the bare Fe_3O_4. The results showed nano-size range, sufficiently monodisperse, and stable PEG-coated Fe_3O_4.

Keywords: A. Magnetite nanoparticles; B. Polyethylene glycol; C. Polymer stabilization; D. Coprecipitation synthesis

MPS – 40

DEVELOPMENT AND EVALUATION OF QUERCETIN-LOADED NANOEMULSION FROM *Raphanus sativus*

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The nanoemulsions from the hydroalcoholic extract from the stem and leaves of *Raphanus Sativus* were prepared by sub-phase inversion temperature (sub-PIT) method. The leaves of Raphanus Sativus contains a natural quercetin that is a potent inhibitor of 5-α-reductase. The formulation presented optical transparency and high quercetin amount (420.21 mg/ml). The preparation method was optimized in terms of Hydrophilic-lipophilic balance (HLB) mixture, temperature, and concentration of surfactant and alcohol. The best dispersity index was accomplished at 50°C by rapid cooling under continuous stirring. The particle size of the prepared nanoemulsion was observed ranging from 60-80 nm. Thermodynamic, rheological properties, and morphology were assessed. Accelerated stability testing was also observed. The nanoemulsion has a potential use for delivery of quercetin and as a formulation for hair growth product.

Keywords: nanoemulsion, sub-PIT, *raphanus sativus*, quercetin, 5-α-reductase

MPS – 41

ELECTROSPINNING OF THINNER POLYMERIC NANOFIBERS BY IONIC LIQUID DOPING

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Polymeric nanofibers are a special class of nanomaterials with a myriad of applications ranging from tissue engineering to supercapacitors. Due to their utility, many researches are currently focused on developing procedures in the production of nanofibers with enhanced surface area, porosity and morphology to increase their functionality. In this study, we present the use of electrospinning and ionic liquids (IL) as a facile approach in the fabrication of nanofibers with thinner fibers, hence greater surface area. Polymer solutions of polyvinyl alcohol (PVA) doped with 1-ethyl-3-methylimidazolium bromide (EMIMBr) and 1-ethyl-3-methylimidazolium chloride (EMIMCl) were electrospun horizontally at a voltage of 30kV with collector distance and flow rate set at 15 cm and 2mL/h, respectively. Successful incorporation of the ionic liquid into the fabricated nanofiber was proven by FT-IR spectroscopy showing significant peaks both for the IL and PVA. In addition, DSC and TGA analysis revealed that the materials' thermal properties were relatively unaffected by the addition of the ionic liquids. Lastly, based on SEM and AFM, IL-doped nanofibers have thinner diameters of approximately 40 nm (for EMIMBr) as compared to the ones prepared using pristine PVA. These findings reveal that the addition of ionic liquids in the electrospinning of polymer solutions leads to thinner and thermally robust nanofibers which may have potential application as solid polymer electrolytes for special materials like supercapacitors.

Keywords: electrospinning, ionic liquid, nanofiber, polyvinyl alcohol

MPS – 42

FABRICATION OF POLYURETHANE FOAM COMPOSITES WITH REINFORCED NATURAL FIBERS EXTRACTED FROM PINEAPPLE LEAVES

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The utilization of natural fibers as reinforcement in the fabrication of polyurethane foam (PUF) composites will lead to composite materials with better properties than the neat PUFs. Polyurethane foams are known to have a low thermal conductivity and is widely used as insulation materials. In this work, new PUF composites were fabricated utilizing natural fibers extracted from pineapple (*Ananas comosus*) leaves. The natural fibers from pineapple leaves (PALF) were treated with alkali and subsequently bleached to enhance its fiber-matrix adhesion. The PUF composites have been prepared by incorporating 10% natural fibers extracted from PALF during polyurethane synthesis. Scanning electron microscope images revealed that reinforcement of natural fibers produced closed cell structures suitable for insulation material. Fourier transform infrared spectra revealed broad peak around 3410 cm-1 which corresponds to the intermolecular and intramolecular H-bond of the free OH- of natural fibers from PALF. It is believed that the stoichiometric ratio of the isocyanate and the polyols was close to unity which preserves the good quality of the polyurethane foam composites. The physico-chemical, spectral and thermal properties of the PUF composites and the natural fiber reinforced PUF composites are presented.

Keywords: natural fiber; polyurethane; composite materials; pineapple leaves

MPS – 43

SYNTHESIS AND CHARACTERIZATION OF OXALATE-PHOSPHATE-AMINE METAL ORGANIC FRAMEWORKS FOR POTENTIAL SUSTAINED FERTILIZER RELEASE APPLICATIONS

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Development of a material that could be used as a carrier of desired nutrient which has sustained release properties could address the issue of N and P loss in crop fertilizer treatment. Inhibition of the conversion and breakdown of nutrients is also a viable option to address the issue. Porous Metal-Organic Frameworks (MOFs) offers non-toxic, biodegradable porous materials that could be loaded with significant amount of fertilizer and release it in a controlled manner. Some developed MOFs has degradation products that also could serve as inhibitors to nutrient degradation process (e.g oxalate, a common MOF-ligand portrays a huge role for bacterial assisted mineralization). Thus, certain MOFs could serve 2 purposes; 1) Fertilizer Carrier and Controlled Release Material, 2) Source of ligands that could be essential to agricultural processes. In this study, Oxalate-Phosphate-Amine Metal Organic Frameworks (OPA-MOFS) powder was synthesized using the solvothermal method. Physical morphology of the MOFs was characterized using Scanning Electron Microscopy (SEM). The crystallinity of the material was assessed using Powder X-ray Diffraction Crystallography (PXRD). Elemental Analysis to confirm the N and P content of the OPA-MOFs was done using Energy Dispersive X-ray (EDX). Thermal stability of the framework was assessed by Thermogravimetric Analysis (TGA).

Keywords: A. Iron Oxalate Complexes; B.Metal-Organic Frameworks; C. X-ray Diffraction Crystallography; D. Framework Materials

MPS – 44

THE EFFECT OF THERMAL ANNEALING ON THE GAS SENSITIVITY OF GRAPHENE/POLYMER NANOCOMPOSITE LOADED ON NYLON MEMBRANE

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This study presents the effect of thermal annealing on different polymer nanocomposites filled with reduced-graphene oxide (rGO) as nanofiller to the gas sensitivity of ammonia. The polymer nanocomposites composed of polyaniline (PAni), chitosan (Chi) and poly-styrene sulfonate (PSS) was solution mixed with rGO. The prepared nanocomposites were loaded on a nylon membrane via vacuum assisted method and it was thermally annealed at 105°C for 3 hours. A low percolation threshold was observed ranging from 0.3-0.5% volume fraction. The thermally annealed polymer nanocomposites showed a decreased of 100-folds on sheet resistance and on film thickness. Furthermore, the gas sensitivity for a 20 ppm (by volume) NH3 conservatively increased by maximum of 40% compared to non-annealed nanocomposites. The rGO/polymer nanocomposites were characterised by ATR-FTIR, raman spectrohotometry and scanning electron microscope (SEM).

Keywords: thermally annealed, graphene, polymer nanocomposites and gas sensor

MPS – 45

THE PROPAGATOR OF A DAMPED COUPLED HARMONIC OSCILLATOR USING WHITE NOISE ANALYSIS

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Richard Feynman successfully derived the third formulation in quantum mechanics, the Feynman Path Integral (FPI). This FPI gives the quantum mechanical propagator of the system. However, due to its lack of mathematical foundation, T. Hida and L. Streit introduced a mathematically well-defined approach in solving a propagator of a quantum system which is known as the white noise analysis. In this paper, the said approach was used to evaluate the quantum mechanical propagator of a Damped Coupled Harmonic Oscillator with a Lagrangian of the form

$$L = \left[\tfrac{1}{2}m(\dot{x}_1^2+\dot{x}_2^2) - \tfrac{1}{2}m\Omega^2(x_1^2+x_2^2) - \lambda x_1 x_2\right]\exp[(\gamma_1+\gamma_2)t]$$

In evaluating the propagator in the context of white noise analysis, one has to express first the integrand in the FPI into a white noise functional by parametrizing the paths, making a correspondence and fixing the endpoint. Given the white noise functional, one can solve the propagator by taking the T-transform of the white noise functional provided that the constraint is turned off.

As a result, the propagator of a damped coupled harmonic oscillator in the context of white noise analysis was evaluated as

$$K_{new} = \frac{m}{2\pi i\hbar}\sqrt{\frac{\sqrt{\Omega_1^2-\frac{\gamma_1^2}{4}}\sqrt{\Omega_2^2-\frac{\gamma_2^2}{4}}\exp\left(\frac{\gamma_1 t_1}{2}\right)\exp\left(\frac{\gamma_2 t_1}{2}\right)}{\sin\left(\sqrt{\Omega_1^2-\frac{\gamma_1^2}{4}}t_1\right)\sin\left(\sqrt{\Omega_2^2-\frac{\gamma_2^2}{4}}t_1\right)}}\exp\left[\left(\frac{im\sqrt{\Omega_1^2-\frac{\gamma_1^2}{4}}}{4\hbar\tan\left(\sqrt{\Omega_1^2-\frac{\gamma_1^2}{4}}t_1\right)}-\frac{im\gamma_1}{8\hbar}\right)(x_1''-x_2'')^2\exp(\gamma_1 t_1)\right]$$

$$\times\exp\left[\left(\frac{im\Omega_{2\gamma}}{4\hbar\tan\left(\sqrt{\Omega_2^2-\frac{\gamma_2^2}{4}}t_1\right)}-\frac{im\gamma_2}{8\hbar}\right)(x_1''+x_2'')^2\exp(\gamma_2 t_1)\right]$$

From this propagator, one can describe damped coupled harmonic oscillator quantum mechanically.

Keywords: damped coupled harmonic oscillator, propagator, white noise functional, Feynman path integral

SOCIAL SCIENCES

SS – 01

SPONTANEOUS ANTICIPATORY BEHAVIOR: DO FILIPINO CHILDREN SAVE FUTURE CHANCE IN ANTICIPATING FUTURE REWARD?

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Future-oriented thinking or the ability to think and plan for the future has been a recent concern in the field of memory development. The nature of its emergence and development particularly among children has been the subject of research in the past decade. This study is an attempt to understand future-oriented thinking of Filipino children by way of exploring children's anticipatory behavior. This study involved 60 children aged four to six (30 girls and 30 boys). Using the saving paradigm, (less-rewarding present condition and more-rewarding future condition), we employ a basketball-type game where participants can save balls in the first session (less reward for made shots) to be added in their balls for the second session (more reward for made shots). The distance between the child and the goal is 1.5 meters in the first session and 2 meters in the second session. Instructions were all made using local dialect to counter possible influence of their differences in receptive language abilities.

The results indicate that the time between four and five years old seems to be the critical period in the emergence of anticipatory thinking and behavior among the participants. A little over 20 percent of four years old showed some signs of anticipatory thinking compared to the 65 and 70 percent of five and six years old who saved more balls in the first session for use in the second session. Using chi square analysis, the differences between age groups were significant at five percent level of significance ($x2 = 5.14$, $p = .04$). Findings support previous claims that the age of four is the pivotal year in the development of future-oriented thinking.

Keywords: future-oriented thinking, children, anticipatory behavior

SS – 02

EVALUATION OF THE SIN TAX REFORM LAW IN THE PHILIPPINES

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The paper endeavored to present the multi-dimensionality of the sin tax reform law or RA 10351 and evaluation of its implementation using the different evaluation criteria.

In the historical analysis, there have been a number of Tobacco Reform Programs to discourage smoking and promote healthier life but despite these efforts, statistics on smoking related diseases and number of smokers continue to soar high. Social analysis shows fair evidence on the problem related to smoking. This served as solid ground on imposing the law. Economic analysis enumerates the effects of the sin tax reform law to the economy. Incremental increase in tax collection was evident but illicit production was found one drawback to the law's implementation. In the political dimension, the President Aquino administration proved strong political will that the bill succeeded after it has been pending for nearly 16 years in congress because of conflicting interests. Huge tobacco industries are burdened with its approval. Environmental dimension enumerates a number of the disadvantages of tobacco production and manufacturing to the environment.

The sin tax reform law is relevant to the government's goal of promoting health among the smoking populace. While other laws are ineffective to discourage smoking, placing a huge tax is another way found by the government to promote health. In the aspect of effectiveness, the paper cited a number of studies and even primary data to see the immediate outcomes of the law. National survey statistic shows that there is a decrease in the consumption pattern of smokers but some studies deviates with the result. Regression result shows that increase in income also increase the number of sticks consumed by the smoker. This implied that most of the consumers are not so responsive to the increase in price. The sin tax reform law is fairly achieving its goal of increasing revenue but reforms are suggested to further the effectiveness of the law.

Keywords: sin tax, evaluation, policy analysis

SS – 03

LONELINESS AND PET CARING AMONG MIDDLE AND LATE ADULTS

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Literature says that pets are beneficial to humans in many ways. Likewise, literature says that Old adults are vulnerable to feelings of loneliness at this stage of their lives. This study aimed to determine if pet ownership has an effect on the level of loneness among middle and late adults.

Using convenient sampling, a total of 209 middle and late adult pet owners and non-pet owners participated in this study. The UCLA Loneliness Scale Version 3 that was translated in Tagalog was used to gather the respondents' level of loneliness.

This study found that among adults in the middle and late adulthood stage, pet owners have a low level of loneliness while non-pet owners have a high level of loneliness. Also, findings indicated that pet's entertainment was the most frequent reason why middle and late adult owns a pet. On the other hand, health risk factors on animals were the only reason why middle and late adults do not own a pet. Furthermore, sex, civil status, pet ownership, and wanting to have a pet were found to have a significant relationship with the respondent's level of loneliness.

The findings provide additional support that pets are beneficial to humans. Pet caring may help battle the loneliness experienced by middle and late adults.

Keywords: Loneliness, Pet caring, Adults

SS – 04

ACCURACY OF SELECTED EARTHQUAKE-FOCUSED PHILIPPINE TV DOCUMENTARIES

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After the release of the Valley Fault System (VFS) Atlas in 2015, there was heightened discussion on the possible movement of the West Valley Fault (WVF), the large magnitude earthquake that it can produce dubbed as "The Big One" and the large damage it might cause in Greater Metro Manila Area. TV documentaries were produced to deliver information about the WVF, Earthquake, Earthquake Hazards, and Earthquake Preparedness. The accuracy of the information provided in the earthquake-related episodes of Red Alert, Investigative Documentaries, and Motorcycle Diaries were reviewed with technical consultancies from two geologists and a structural engineer from the Philippine Institute of Volcanology and Seismology (PHIVOLCS). The three documentaries varied in their approach and highlighted different issues. Common discrepancies in the use of terminologies, sources, and animations were found. Inaccurate visualizations and incorrect information might cause unwarranted panic and inadequate preparedness. Despite the inaccuracies, there were valuable information presented that would help promote awareness and preparedness of the viewers. The findings in this research would help PHIVOLCS in improving its services and the media in providing accurate and useful information to the public.

Keywords: earthquake, Valley Fault System (VFS) Atlas, TV documentary, West Valley Fault, The Big One

SS – 05

SPATIO-TEMPORAL ANALYSIS IN SEAWEED GATHERING AND MARKETING IN SELECTED COASTAL AREAS IN ILOCOS NORTE

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Space-time accessibility measures explicitly acknowledge the importance of gender roles as a key social and spatial constraint for women, constraining their behavior, limiting their activities and confining them to a smaller geographic area than men. This study aims to depict the differentiated roles that men and women significantly play over time and space in the seaweed gathering and marketing. A descriptive statistics was used in the analysis of data from gatherers and sellers in the four coastal towns of Ilocos Norte. While both gender can gather seaweeds in the supra and intertidal zones, only the males travel the subtidal zone. This is so because of the time spent and the risk involved in travelling the subtidal zone beacuse they go there by boat. It proved once more in the attitude of the respondents that "man are more risk taker". With a lesser time spent, the females are confined in the nearby supra and intertidal zone. Some women said, "saan kami met a mabuteng nga agbalsa, ngem nasapa da unay a rummuar, adu met pelang atendaran mi nga aktibidades ditoy uneg tibalay" ("we are not afraid in riding the boat to reach the subtidal zone, only, these men have to leave early, whereas, we still have to attend to our children and other household chores")

While men are the seaweed gatherers at the subtidal zone, women take the burden in sorting, classifying and cleaning the gathered seaweeds alone and ultimately drying the seaweeds solely.

Keywords: spatio-temporal, gender mapping, supra and intertidal zone, subtidal zone

SS – 06

THE LIFE OF STREET CHILDREN: AN INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS

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According to UNICEF, an estimated 100 million children worldwide live at least part of their time on the streets. In the Philippines approximately two million children where part of their lives is on the street. This qualitative study utilized an interpretative phenomenological lens to understand the subjective world of street children. Interpretative phenomenology explores in detail how participants interpret and make sense of their personal and social world (Giorgi & Giorgi, 2013), and it involves two-stage interpretation or a double hermeneutics on which participant is trying to make sense of his or her world whereas the researcher is trying to make meaning of how the participant is trying to make sense of his or her experiences (Palmer, 1969).

Participants were permanent dwellers of the street and engaged in scavenging. Data were collected through a series of participant observation and *pakikipagkuwentuhan*, recorded, transcribed and analyzed using the interpretative phenomenological lens. Data analysis established four higher orders of themes that captured the lived experiences of street children, the experiences were clustered into four superordinate themes such as (1) the experiences of having threatening atmosphere, (2) the experiences of being lost in the shuffle, (3) the experiences of being stereotyped, and (4) the experiences of being resilient. The first theme further described by, exposed to street violence, hunger and malnutrition, child labor and poor environment beside polluted canal and malarial swamp. The second theme relates to emotional struggle connected to loss of parental resources, psychological distress and spiritual paralysis. The third theme is associated to negative attributes such as criminals and gangsters, dropped-out and sex workers. And the last theme is linked to the survival technique as being *matiisin, kontento and lumalaban.*

Keywords: interpretative phenomenological analysis, street children

SS – 07

LEVELS OF AWARENESS AND PRACTICE IN CONDUCTING ACTION RESEARCHES OF THE TEACHERS OF DUPAX DEL NORTE NATIONAL HIGH SCHOOL: BASES FOR INITIATING A MENTORING PROGRAM

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Conducting researches is one of the advocacies of DepEd in solving school-related problems hoping to improve learners' and teachers' performances. This quantitative-descriptive action research was pursued to find out the relationship of the respondent-teachers' profile variables in their levels of awareness and practice in conducting researches. The 20 teachers of Dupax del Norte National High School served as the respondents. Through frequency counts and percentage distribution, the respondents have been in the teaching profession ranging from 1-4 years but have not tried to propose and implemented any research study despite the fact that some of them have undergone some local and regional levels of trainings about research writing. As per weighted mean, the respondents are aware about the importance of research writing, however, they do not conduct researches. Using E_2, the number of action research proposed and approved and the level of awareness of the respondents relate significantly with one another. The number of action research implemented does not relate significantly with the teacher-respondents' level of awareness but it does relate very significantly with their level of practice. Meanwhile, the number of trainings attended by the respondents relates significantly with the level of awareness but does not relate significantly with their level of practice. The highest level of training attended by the respondents relates significantly with both their levels of awareness and practice. Finally, along the correlation of the level of awareness and level of practice, the computed r- value -0.367 has moderate degree of correlation. Also, the computed t- value -1.674 is less than the critical t- value 1.734 at which tells that the relationship is "not significant". The respondents level of awareness does not relate significantly with their level of practice. Generally, they are aware but they do not practice action research writing. Thus, initiating a mentoring program regarding action research writing for the teachers is highly recommended.

Keywords: awareness, practice, action research writing

SS – 08

PREDICTORS OF LEARNING PERFORMANCE OF ACHIEVING AND UNDERACHIEVING GIFTED STUDENTS FROM SELECTED PSHS CAMPUSES IN THE PHILIPPINES

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Learning science in different perspective and diverse learners is a challenging but worth knowing. This enables us to understand their way of understanding science based on their own capabilities and interest. The study identified the predictors of learning performance of achieving and underachieving gifted students. The profile of the gifted students were obtained and based on intellective and non-intellective variables. Achieving and underachieving gifted students were identified based on IQ and grades from the records of the guidance counselor and the school registrar from selected campuses. Checklists and questionnaires were distributed to the gifted students through mail delivery and campus visit. First to fourth year gifted students from four (4) regional Philippine Science High School (PSHS) campuses that represented Luzon, Visayas, and Mindanao were the respondents. Descriptive-Correlation Research Design and Standard Multiple Regression were used in the study. There were four (4) predictors of the learning performance of gifted students: nature of residency, I.Q., perceptual learning style preferences and study habits. Based on the results and analysis, the nature of residency, I.Q., study habits and perceptual learning style preferences can predict the learning performance of gifted students. The equation used to predict the learning performance of the gifted student was: $\mathbf{LP = 2.708 - 0.00749\ R_1 + 0.0293R_2 + 0.07807R_3 + 0.0495R_4}$. The nature of residency was the number first predictor of the learning performance of the gifted students. The dormer gifted student who resided at the school dormitory academically achieved more than the non-dormer when given a proper educational environment. Second, the good study habits of gifted students are enhanced through the proper implementation of rules and regulations set by the school dormitory. Third, gifted students will attain their utmost learning capability if their preferred learning styles matched to the teaching styles of the teachers and their individual learning interests. Finally, identification of gifted students through the IQ test will help them given an appropriate learning program and services to help them achieve their maximum learning potentials.

Keywords: Predictors, Learning Performance, Achieving and Underachieving Gifted Students

SS – 09

GENDER VULNERABILITY AND COPING MECHANISMS TO CLIMATE CHANGE OF RICE FARMING HOUSEHOLDS IN NORTHERN PHILIPPINES

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Gender vulnerability and coping mechanisms to climate change of rice farming households in several farming villages in Ilocos Norte, Philippines were studied to determine resilience according to Turner's Vulnerability Model. Male farmers tended to be less vulnerable to the effects of climate change, thus, exhibiting a higher level of resiliency than female farmers. The propensity to vulnerability of female farmers to climate change is attributed to their lesser exposure to disposing factors than their male counterparts. Economically, the farmers, both male and female, registered low vulnerability to the adverse effects of climate change due to their engagement in off-farm business. Some coping mechanisms correlate significantly high with gender. Although female farmers practice a variety of coping mechanisms, these are mostly applied to household management in which the males are feebler in this respect. Involvement in more coping mechanisms by both genders in and off the farms makes them more resilient to the effects of climate change.

Keywords: coping mechanisms, vulnerability, climate change

SS – 10

HIGH SCHOOL ENTRANTS' PROBLEM SOLVING MANIFESTATIONS OF CONCEPTUAL UNDERSTANDING IN ELEMENTARY MATHEMATICS

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Problem solving plays an important role in mathematics. Appropriate skills necessary to solve problems enable students to arrive at accurate solutions. The research study aimed to describe and determine the manifestations of students conceptual understanding in mathematics – problem solving in particular. The study was descriptive-qualitative research using frequency and percentage. There were fifteen problems involving whole numbers, measurement and rational numbers administered to 419 high school year entrants of the Solano High School. Four options were provided and the respondents were instructed to show complete solutions following a designated time of thirty minutes. Based on the results and analysis, it was found out that 84.97% of the students performed poorly in problem solving involving whole numbers, measurement and rational numbers. Specifically, the solutions made were classified into full, partial, lacking in and unfounded conceptual understanding. There were 13.72% of the students had full conceptual understanding on whole numbers, 14.46% on measurement and 19.25% on rational numbers. Hence these results revealed that majority of the students lacked conceptual understanding. The students lacked the skills if interpreting and comprehending the problem and selecting appropriate information to apply a strategy for an accurate solution. The students manifested accuracy on four fundamental operations, however the appropriate instances for their application were not evident in their solutions. The results of the study implied that the high school entrants need remediation and intervention on the application of whole numbers, measurement and rational numbers particularly on the strategies in solving problems and should be exposed to a lot of teaching-learning experiences that may enhance their conceptual understanding of elementary mathematics.

Keywords: high school entrants, manifestation, problem solving, conceptual understanding

SS – 11

EXPLORING TEACHING STRATEGIES FOR STUDENTS WITH READING DISABILITIES

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Solano High School in its second year of implementing Special Education has a great concern about how to handle Children with Special Education Needs (CSENs). It was found out in the Philippine Informal Reading Inventory (PhilIRI) test to students in English that there are many students who have difficulty in reading. Their common problem is difficulty of understanding the relationship between sounds, letters and words. This study sought to identify the reading disabilities, describe the Individualized Education Program (IEP), determine and describe the teaching strategies that could enhance the reading fluency and comprehension of students with reading disabilities. It used qualitative research specifically case study and simple descriptive statistics to substantiate the results of the data gathered. The participants of this study were the five CSEN learners with reading disabilities. They underwent 20 push-in sessions in which varied reading strategies were employed. The resource teacher noted observations about their reading behavior, word recognition and comprehension. Pre-test and post-test were also conducted to validate the effectiveness of the strategies employed. Strategy preferences of the learners were determined through a survey questionnaire. Findings revealed that the students with reading disabilities have adequate improvement in terms of behavior, word recognition and comprehension. Thus, guidance and instruction of the resource teachers are necessary. To enhance the students' reading fluency and comprehension, the learners were exposed to different strategies. These strategies yielded medium effect on their performance. There was only a small effect in identifying words and words meanings using context clues. A large effect was observed on checking correct spelling of words. Employment of cognitive strategies yielded medium effect to learners. The strategies employed demonstrated significant improvement to students' reading behavior in general. Accommodating their preferences increases their motivation to learn.

Keywords: reading comprehension, fluency, individualized education plan

SS – 12

STRESS AND COPING STRATEGIES OF GRADE 10 STUDENTS OF SOLANO HIGH SCHOOL: ITS RELATION TO THEIR PROFILE AND ACADEMIC PERFORMANCE

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Stress is part of everyday life. It is not always bad, though, stress within the comfort zone can help us perform under pressure, motivate us to do our best. But when stress becomes irresistible, it can damage our health, mood, relationships, and quality of life. The study aimed to evaluate stress level and coping strategies of the 238 grade 10 students of Solano High School. Specifically, this study wanted to determine the profile of the students and the significant differences of the sources of stress when grouped according to gender and the relationship of their profile to the coping strategies indicated. The research was a descriptive - quantitative research which utilized analysis of variance and correlation. A questionnaire was given for their profile, academic performance from third to fourth quarter and their responses to the questions in a Likert scale categorized as sources of stress and coping strategies. Based on the results of analyses, the students had experienced stress however at their age, stress is not that big deal. Male and female students had no significant difference based on the source of stress they encountered in their lives. With respect to the coping strategies, the male and female demonstrated no significant difference. Regarding the relationship of the students' profile, the occupation of father and mother and circle of friends have negative correlation to the manner of expressing feelings as coping strategy. Likewise, the difference of grades had negative correlation on being self- reliant as coping strategy. Moreover, the type of residence and circle of friends had negative correlation on developing social support as coping strategy. Finally, emotional security of students must have careful attention. Teachers must be aware of diversity of learners and capabilities of handing problems. Counseling programs will widen their perspective in dealing with varied stressors in life.

Keywords: stress, coping strategies, profile, relation, academic performance

SS – 13

INAYAN: ANO BA YAN
AN ATTEMPT TO UNDERSTAND THE CONCEPT OF *Inayan*

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This study focused on the aspect of customary lore of Sagada people. This means that it tried to discover patterned or repeated behaviors which are indicative of membership in the community which may be reflected in special words or gestures that are different from the usual behaviors. Data were obtained through an interview from key informants whose ages range from 25-35. There were several behaviors that were mentioned, but there is one concept which was common to all of them- the concept of *inayan*.

During the interview, the informants were asked to tell something about *inayan* and if possible, give several utterances in which the word can be used in order to have a clearer view or perspective about what it is.

Results of the interview showed that *inayan* has multifaceted meaning as revealed by the different respondents: a) As a guiding principle which serves as their basis of good conduct towards other people not only within the community but also tourists; b) As a source of honesty and humility; c) Related to *lawa* or *lawasa* which denotes of wrong doing; and d) A concept of introspection/self-reflection or examining his own mental and emotional processes before or during taking a particular action.

The differences in the perception of Sagada people regarding *inayan* can be attributed to several factors which may be geared towards several theories. As posited by other researchers, the meaning of *inayan* can be influenced by culture and language.

Although *inayan* has different meaning to the Sagada people, it has a great influence on their life, the function of which is mostly regulatory and is used to make sense of their everyday lives.

Keywords: *inayan*, customary lore, behavior, *lawasa* or *lawa*

SS – 14

EMPOWERING LANGUAGE CLASSROOMS THROUGH WEB-ENHANCED INSTRUCTION AND BLENDED LEARNING (WEI-BLA)

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The study was conducted to establish the effects of Web-Enhanced Instruction (WEI) and Blended Learning Approach (BLA) on the achievement in English of sophomore students of the Nueva Vizcaya General Comprehensive High School (NVGCHS).

The research combined the quasi–experimental design with immersion learning and descriptive analysis to 76 respondents from the two classes (39 for the experimental and 37 for the control group).
The researcher employed observation, participation in the classroom interaction, hosting (and administering) the social network group, and interview for feedbacks on WEI-BLA. The study covered the second quarter of School Year 2013-2014.

Data were statistically analyzed using mean, frequency distribution, percentage, standard deviation, and t-test. Observable traits, skills, and attitudes of the respondents were also noted.

Results indicate no significant difference between the experimental and control groups in pretest scores but show significant difference in posttest scores. While the two sets of respondents gained knowledge in both approaches, students under experiment displayed significantly higher achievement in the posttest. **This finding warranties that WEI-BLA is far more effective and useful compared to the conventional or traditional learning styles**.

Positive behaviors were also observed among the students under the WEI-BLA: (a) increased interaction among the students, learning materials, and the teacher; (b) independent learning; (c) enhanced and structured learning styles; and (d) more defined focus in learning and more sustainable interest in the area of study.

The researcher recommends (1) classroom teachers to create and design computer-aided and web-enhanced lessons, and (2) schools to put up their own web pages (social networks e.g. Facebook) so that students can also have queries or share their insights regarding their current lessons.

Keywords: web-enhanced instruction, blended leaning, ICT

SS – 15

EFFECTIVENESS OF STUDENT TEAM ACHIEVEMENT DIVISION (STAD)IN TEACHING TRIGONOMETRY

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Mathematics is identified as one of the most important subjects in the curricula for it provides a wide range of application and is used in almost every field of endeavors. In spite its importance; students are encountering difficulties in most math subjects. Trigonometry is one of the branches of mathematics that is taught in the curricula. The students need to comprehend and master this subject because of its application in real life situation. Just like other math subjects, some students find this subject complex and difficult to understand. This premise is the rationale of this study, and purposely to help students overcome difficulties in learning the subject.

The effectiveness of Student Team Achievement Division (STAD) in teaching Trigonometry among Second Year college students in MinSCAT Bongabong Campus was determined in the study. A quasi-experimental design was utilized in this study to sixty students who were divided into two groups: the control and experimental groups. The control group was taught using the traditional teaching approach while the experimental group was taught using STAD. A comprehensive test previously pre-tested and validated was used as the data gathering tool. Pre-test and post-test were administered to both groups of participants. The data was treated using Mean, Frequency: percentage, Standard Deviation and t-test for independent samples. The result of the study showed that student under the experimental group performed better than those in control group. Further, there is a significant difference between the performance of the participants in experimental and control group. Based on the study, the STAD is effective in teaching Trigonometry.

Keywords: quasi experiment, student team achievement division, Trigonometry

SS – 16

WORLDWIDE RELATION BETWEEN FAST FOOD AVAILABILITY AND OBESITY RATES

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The global obesity epidemic has reached an alarming rate and an examination of the determinants of this phenomenon has become imperative. The study focused on the relationship between fast food availability and obesity. Country level data on the number of McDonald's restaurants, number of KFC restaurants, number of fast food restaurants, globalization index, disposable income, and obesity rates were correlated and regressed to determine whether associations between the dependent variable, obesity rates and independent variables such as number of persons per fast food establishment, number of persons per McDonald establishment, population, index of globalization, disposal income are established. A total number of 93 countries were included in the study.

Correlation results show that only globalization index has a positive relationship with obesity rates. Income classification of countries, population, number of persons per McDonald's outlet and number of persons per fast food outlet are negatively correlated with obesity. Only three variables are found to predict obesity rates: number of persons per McDonald's outlet and number of persons per fast food and population. The adjusted R square for multiple regressions indicates that the three predictors of obesity can account only 25 percent of total variability in obesity levels. Hence, there are still many determinants of obesity aside from fast food availability. Results only established some strong correlations between the fast food and obesity but not causal links.

Keywords: obesity, fast food

SS – 17

DIMENSIONS OF FAMILY LIFE SATISFACTION AMONG FILIPINO ADOLESCENTS: AN EXPLORATORY ANALYSIS

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The family is an important coping resource and support system adolescents rely upon when challenges and stressful events come to one's life. Theoretical perspectives on counseling and psychotherapy recognized the crucial influence of family life satisfaction to the development and quality of life of adolescents. Thus, understanding the dimensions and characteristics of what makes a happy family life seen through the lens of adolescents is important to explore. Through factor analysis, this study explored and identified the dimensions of family life satisfaction as perceived by 304 Filipino adolescents. Data gathered were validated and significant themes yielded seven factors. A satisfying family life has family positive communication, support for each member; safety and security; togetherness, acceptance, and affection. Definitions and interpretations for each factor were identified and also discussed. Finally, the overall findings of the study may serve as basis for counselors, clinicians, educators, community leaders, family advocates, and researchers to further understand the underlying structures and nature of family life satisfaction among Filipino adolescents, which may lead to improveD practices in guiding the Filipino youth and the family they belong to.

Keywords: Filipino adolescents, Filipino family life satisfaction

SS – 18

MOTIVATION AND PERFECTIONISM AMONG VARSITY PLAYERS

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The study determined the relationship between motivation and perfectionism among varsity players. The researchers used the dimensions of self-oriented perfectionism (SOP), socially prescribed perfectionism (SPP) and other- oriented perfectionism (OOP) in tackling the perfectionism. The respondents of the study involved 191 varsity players in different universities in Cavite. The result shows that perfectionism significantly differs in terms of gender, type of school and sports moderators. This implies that male, varsity players who came from private universities, and plays track and field, athletics, swimming and pep squad have the high level of perfectionism. Moreover, external self-concept motivation (ESC), instrumental motivation (INS), and goal internationalization (GI) motivation have a significant positive relationship to self-oriented perfectionism (SOP) and socially prescribed perfectionism (SPP). This implies that varsity players who are motivated by authority, have received incentives and engaged in activities for a cause are varsity players who aim to attain the standards for oneself and the standards imposed by others.

Keywords: source of motivation, perfectionism and varsity players

SS – 19

SMS-BASED NATURAL DISASTER REPORTING AND ALERT SYSTEM OF PDRRMC BENGUET

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Extreme weather conditions and natural disasters are taking an increasing toll in both human and economic terms. Thus, this study focuses on the innovative solution of responding to disaster related issues through SMS-Based Natural Disaster Reporting and Alert System of Provincial Disaster Risk Reduction and Mitigation (PDRRMC) of Benguet that mitigates and respond to a community alert. Further, evaluation of the system was also conducted to identify the extent of usability of the proposed system.

The study rigorously follow the scrum methodology and integrates Natural Language Processing (NLP) concepts in the information extraction, processing and summarization of the categorized information sent by the community in the system for faster dissemination of information to the community and respond to emergency alerts.

Key features of the system includes the notification and alert management and the reporting mechanism. As to the extent of usability of the system, there are 450 users who validated the system using the Usefulness, Satisfaction and Ease of use (USE) tool. 76.6% of the respondents agreed that the system is useful and easy to use. Likewise, users are satisfied in using the system. Overall, the researchers conclude that the system may not prevent natural disaster, but, it can reduce risk of disasters.

Keywords: disaster mitigation, Short Messaging Service, Natural Language Processing

SS – 20

EFFECTIVENESS OF NETWORK MEDIA DURING CALAMITIES: BASIS FOR THE DEVELOPMENT OF INTEGRATED WEATHER INFORMATION DISSEMINATION SYSTEM (IWIDS) PROTOTYPE

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Nowadays, Social Media and SMS has become a necessity for every day situation. During calamities such as typhoon, information dissemination is relevant for the safety of the community. Students mostly rely on these technologies for news and announcements from their schools.

The study aims to assess the level of effectiveness of network media specifically Social Media and mobile network in providing information to the students during calamities. Furthermore, it also aims to develop a system prototype that integrates such technologies to provide quick response and services to the students during those times.

A total of 50 student respondents were selected randomly from a local junior high school in the municipality of Sto. Tomas, Batangas. Descriptive research is used in the study while system development life cycle (SDLC) methodology was employed to come up with the system prototype.

Major results revealed that the students under study always rely on the use of Social Media and mobile network. It is also highly effective and highly needed to keep updated on weather news and announcements like class dismissals as well as in communicating with their loved ones.

Keywords: Network Media, Social Media, Mobile Network, Calamities, Information System

SS – 21

SOCIAL MEDIA AS A TOOL IN TEACHING

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Webopedia defines social media as "a term used to describe a variety of Web-based platforms, applications and technologies that enable people to socially interact with one another online."

Nowadays very few people do not use a social medium in order to communicate, share or simply store documents, pictures or even videos. Approximately 95\% of college students worldwide have facebook accounts. Facebook may be considered as one of the most popular social media site being used by netizens.

Social media has also found its way in the classrooms. Because of technology, teaching strategy has evolved to involve the use of the internet in teaching and learning. It is the goal of this paper to give a peep on the use of social media as a tool in education. A survey on the use of social media as an education tool was done using Social Monkey and uploaded to Facebook and Research Gate. Respondents to the survey are in cognito. Sixty four responded to the survey, majority of which are male. Age range is from 22 to 61 years old and majority are teaching in college. Of those surveyed, 61\% use social media in their teaching. The most popular social media site is Facebook. Other sites are Edmodo, Twitter, Google Apps, I-ready, Quipper school, Slide Share, Instagram and Khan Academy

This paper will discuss some of the above mentioned media sites, particularly: Faceook, Edmodo, Google Apps, Quipper School and Khan Academy. A short discussion on Twiducate shall be included also. Although Twiducate did not appear as one of the choices of the respondents, it is very popular abroad and the author believes deserve some attention.

Keywords: education, teaching strategy, education tool, social media

SS – 22

THE COMMUNITY ENGAGEMENT PROCESS: A GOVERNANCE APPROACH IN ADAPTATION TO CLIMATE CHANGE

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This action research was aimed at creating and implementing a participatory process for the coastal communities working towards decision-making in matters of governance in terms of adaptation to impacts of climate change. Eight (8) coastal communities from Gubat, Sorsogon participated in this process. Initial data were gathered starting in 2014. The research approach used allowed for a better understanding of the climate change and sea-level rise phenomena and enabled participants to make decisions regarding adaptation efforts needed. These communities' residents admit that more work is necessary to reach others in the area and to communicate the reasons behind the selected options. Results demonstrate that some citizens in the communities have already been adapting, acting mostly on an individual basis, as opposed to having government agencies support and direct adaptation measures. Yet, this work shows how difficult it can be for small communities to find resources and support at government levels and then to act according to their own perceptions and wishes.

The use of both local traditional knowledge and scientific knowledge has enabled researchers to understand local concerns better and to enhance the residents' views and understanding of climate change impacts and adaptation. Researchers also benefited from the research experience, gaining a better understanding of how communities appropriate scientific language and information according to their reality. During the engagement with residents, researchers found the process may be handicapped when participants wait for answers from the 'experts' since they feel those answers cannot come from the community itself. In fact, often participants said 'tell us (speaking to the researchers) what is the right approach' all along the process. Very often participants looked to the 'specialists' for answers whereas researchers wanted to proceed with a bridging of local knowledge and scientific information to enhance a locally owned decision process. Finally, the governance perspective shows that the academics in social science can play a major role in linking the complexity of climate change effects and socio-political issues.

Keywords: Climate Change, coastal communities, impacts

SS – 23

RESEARCH PRODUCTIVITY OF FULL-TIME TEACHING FACULTY MEMBERS AT DE LA SALLE UNIVERSITY-DASMARINAS

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This study was done to identify the factors that affect the research productivity of teaching faculty members at De La Salle University-Dasmarinas. It is expected that the results of this research work will provide De La Salle University-Dasmarinas a research-based guide on the policies to be implemented regarding research.

This study revealed that 44.81% of full-time teaching faculty members did not have any research output in the last five years. When all full-time faculty members were classified into unproductive, moderately productive, and very productive in research, the data showed that 78.14% was unproductive, 14.06% was moderately productive, and only 7.77% was very productive.

A survey conducted among all full-time teaching faculty members showed that the five most important factors preventing faculty members from doing research were lack of time (33.4%), lack of research funding (20.3%), conflict with teaching duties (18.2%), conflict with graduate studies (9.7%), and family concerns (5.1%). Also, the survey showed that the five most important factors that would encourage faculty members to do more research were more deloading (36.6%), adequate research funding (21.9%), additional incentive/promotion (16.1%), better facilities/equipment/internet (9.2%), and better research schedule (7.7%).

Among the independent variables related to research productivity, educational attainment obtained the highest correlation coefficient (0.47). This was followed by academic rank with a correlation coefficient of 0.43.

Keywords: research, productivity, faculty

SS – 24

ESTIMATING THE VALUE OF ECO-TOURISM IN SOHOTON COVE, SOCORRO, SURIGAO DEL NORTE, PHILIPPINES

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Sohoton Cove located in Bucas Grande Island is part of the Siargao Islands Protected Landscapes and Seascapes (SIPLAS). Estimating the value of eco-tourism in Sohoton Cove is crucial in determining the conservation fee to be collected from every recreational visitor. With the increasing number of tourist arrivals in Sohoton Cove and the vision of the Siargao Islands to be the major eco-tourism destina-tion in Mindanao and in the country, a sustainable financing derived from conservation fees should be in place. This study aims to esti-mate the economic value of Sohoton Cove This study uses the open ended contingent valuation method to reveal willingness-to-pay (WTP), based on a survey of 169 recreational visitors to Sohoton Cove, 7 resort owners, 27 tour operators and 222 local residents of Barangays Sudlon and Dona Helena. The results show that the mean WTP is found to be Php 396.00 (visitor), Php 1,357.00 (resort own-er), Php 321.00 (tour operators) and Php 214.00 (local residents), respectively. Visitors' WTP suggest that entrance fee could be in-creased substantially from current Php 100.00 per person . While the resort owner, tour operators and local residents' WTP express the value for conserving the Sohoton Cove for the sustainability of eco-tourism activity . With the estimated increase of 50% tourist arri-val in 2017 from 42,606 visits, the revenues would generate Php 25,307,964.00 from conservation fees. Financing mechanism for conservation of Sohoton Cove is recommended for sustainable eco-tourism. It is also important to consider the desire of the visitor for improvements in the quality of services provided.

Keywords: eco-tourism, willingness to pay, contingent valuation, Sohoton Cove

SPECIAL NAST POSTER

ESTIMATION OF ALKALI SPREADING VALUE AND GELATINIZATION TEMPERATURE OF SOME PHILIPPINE RICE VARIETIES USING DIGITAL PHOTOMETRY

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Gelatinization temperature (GT) is an important property of the rice grain which affects its cooking and eating quality. The most reliable method for determining GT needs expensive equipment, namely differential scanning calorimeter (DSC). An alternative method is digital photometry (DP) which uses an inexpensive digital camera and free-access image processing software to determine the alkali spreading value (ASV) and GT of milled rice. The starch gel area of the images of alkali-gelatinized grains is measured using ImageJ software after a given gelatinization time. In the present study literature GT values based on DSC (GTDSC) for eight rice varieties/breeding lines were correlated with experimental values of the relative increase in gel area (RIA) after alkali-based gelatinization. The images were taken with a digital camera inside a fabricated light box and analyzed using ImageJ. The natural logarithm of RIA (ln RIA) was found to be highly correlated with GTDSC values and was identical (within experimental uncertainty) with published ASV data. The correlation equation of ln RIA versus GTDSC allowed determination of GT values for three additional rice varieties and correctly predicted GT values for 29 rice varieties based on literature ASV data. Thus, DP can be used as a cheaper and faster method of estimating GT values that may complement ASV data which are routinely determined in rice varietal development programs.

Keywords: alkali spreading value, differential scanning calorimetry, digital photometry, gelatinization temperature, image analysis, milled rice, RGB values

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