

ABSTRACTS OF PAPERS

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*Caring for the Country's
Carrying Capacity*

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Caring for the Country's Carrying Capacity

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AGRICULTURAL SCIENCES

AS – 01

ANALYSIS OF THE WILLINGNESS TO PAY FOR CHARCOAL BRIQUETTES OF FOOD ESTABLISHMENTS IN LOS BAÑOS, LAGUNA, 2018

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This study was undertaken to analyze the willingness to pay for charcoal briquettes of food establishments and to provide recommendations that will increase the marketability of the product. Hence, increasing the demand for the briquetting technology.

Descriptive statistics, Chi-Square Test, Attribute Importance Rating Analysis, Satisfier-Dissatisfier Analysis, and Price Sensitivity Analysis were employed to analyze the data obtained from the surveys conducted through personal interview of 42 registered food establishments in the municipality of Los Baños, Laguna as of 2017.

Based on the results of the study, 59.5 percent of the respondents are willing to pay for charcoal briquettes; 7.1 percent will utilize the briquettes as a main fuel source of their business, 9.5 percent as an additional fuel source, and the rest of the 42.9 percent as an alternative fuel source. Their willingness to pay ranges from 15 to 80 PhP/kg, with a mean of PhP44.28/kg. However, most are willing to pay at PhP30/kg. Price Sensitivity Analysis, on the other hand, revealed that the acceptable price per kilo of charcoal briquettes ranges from PhP36.00 to PhP66.50 with indifferent and optimum prices per kilo at PhP43.00 and PhP55.00, respectively.

The respondents are more willing to pay for the product when briquettes are easier to handle, easier to ignite, emit higher intensity of heat, has manageable heat intensity, last longer, and has lower selling price. Product improvement, introduction of product complement, market penetration, and appropriate product positioning, promotion and pricing must be taken into account to increase the marketability of the charcoal briquettes.

Keywords: willingness, WTP, charcoal, briquettes, biomass

AS – 02

APPLICATION OF BIOCHARS DERIVED FROM AGRICULTURAL WASTES: AN ECOLOGICALLY SOUND TECHNOLOGY THAT PROMISES IMPROVEMENT OF SOIL PROPERTIES AND CROP PRODUCTIVITY

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World hunger statistics highlights the importance of technologies that can help attain food security. In recent years, biochar has been identified as a potential tool to increase agricultural productivity and enhance agriculture's resilience to the impacts of climate change. Biochar is not a fertilizer. It is useful as soil conditioner applied as an additive to nutrient sources like fertilizers.

A series of pot experiment was conducted in the field laboratory of Agricultural Systems Institute, U.P. Los Baños to evaluate the effects of fertilizers treated with biochars on soil properties and growth performance of corn. Two types of biochars: corn cobs and corn husks and their combinations with mineral and organic fertilizers were applied as treatments. Corn var Macho F1 was used as the test crop grown in an acidic clay loam soil (*Typic Eutrudepts*). The treatments used are as follows: T1 NPK mineral fertilizer alone; T2 organic fertilizer (OF) alone; T3 NPK+corn cob (CC) biochar; T4 NPK+corn husk (CH) biochar; T5 OF+CC biochar; T6 OF+CH biochar. Results showed significant positive changes in plant growth and development, and soil chemical properties when fertilizers were combined with biochar relative to sole fertilizer application. It was hypothesized that these changes are due to the potential of biochar to reduce nutrient leaching and increase nutrient holding capacity of the soil. Corn cob and corn husk biochars complemented the fertilizer in increasing root and aboveground biomass, soil pH, soil organic matter, soil P and soil K concentration, and soil cation exchange capacity. Biochar is a technology that provides conditions suitable for crop improvement by providing necessary nutrients for growth, development and yield.

Keywords: agricultural wastes, pyrolysis, soil conditioner, agriculture

AS – 03

ARE WE FOOD INSECURE? A COMMUNITY-BASED AGRICULTURAL SYSTEMS ASSESSMENT TOOL FOR FOOD SECURITY

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With the current threats to food security, it is of high importance at this time to look at agriculture based on the four dimensions of food security: availability, stability, access and nutrition-sensitivity/food safety. The aim is to provide information that may serve as basis for planning, developing and implementing agricultural interventions to ensure that foods are available at all times, inspite the natural and anthropogenic disruptions, able to supply the nutritional requirement and food safety standards are followed, enhances capability to obtain variety of food sources through agricultural livelihood. Measurable indicators were determined for each food security dimension and indicator values are obtained using the Likert scale. Availability indicators focused on the production of staple crops, diversity of the crop production systems including the presence of alternative food crops. Temporal availability of foods are considered critical. Stability indicators focused on the condition of the natural and socioeconomic resource base that will affect food production. Food access emphasized physical and economic access to food. Capability to supply the basic nutrients and to comply with food safety standards completed the indicators. Results can be plotted in a radar graph to clearly illustrate weaknesses and strength of the production system from which RDE and policy recommendations can be formulated to ensure that the production system addresses food security. A test of the methodology was done in a diversified farming system in in Lucban Quezon. The tool provides an easy to understand, easy to follow procedure and the results can be easily translated into actions and policies at the local level.

Keywords: food security, agricultural systems

AS – 04

THE PHILIPPINE GARLIC INDUSTRY: KNOWLEDGE INVENTORY AND NETWORKS

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A three-year project was carried out to undertake an inventory of the knowledge system on garlic (*Allium sativum* Linn) in Region 1, Philippines. This inventory aimed to discover *what kind, in what mode, over time and space*, bodies of knowledge to each particular aspect on *pre-production, production* and *post-production* phases of the garlic industry, were generated or have existed and how these were processed. The inventory, made primarily through secondary data analysis, covered a span of 47 years (1969-2016). Based on the inventory, there is a dual knowledge system in the garlic industry, the formal-scientific and the local-indigenous. The formal-scientific knowledge system (FSKS) dominates the widely shared KS which are produced by formal organizations, mostly government entities and academe. The local indigenous knowledge system (LIKS), is highly regarded, practiced, and shared by farmers and stakeholders. The FSKS was at its peak in the 1980s (1980-1989), half-dived during 1990-1999, and remained low during the inventory-decade before and after 1980s. On a per life-cycle basis, researches on the production phase was almost twice the number on pre-production and post-production phases combined. Across the phases, researches were predominantly applied rather than basic. After knowledge or technology generation, only a few, if any, gets published and/or presented in appropriate forums intended for end-users. Results of the inventory show the need for a more aggressive generation and dissemination of knowledge and technologies that provide solution to the problems of the garlic industry in the country.

Keywords: knowledge inventory, formal, indigenous, tacit, explicit

AS – 05

CAN VARMIX SYSTEM BE AN ALTERNATIVE TECHNOLOGY FOR MITIGATING THE EFFECTS OF BIOTIC AND ABIOTIC STRESSES?

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Anonang (*Cordia dichotoma* Forst) stem cuttings were rooted in five different soil media to determine survival and rooting performances. Significant differences among four rooting media came out. Treatment 4 (1:1:1 mixture of top soil, fine sand, and partly decomposed rice hull) had the highest mean survival of 47.5%. This was significantly higher than T2 (partly decomposed rice hull), T1 (top soil), and T3 (1:1 mixture of fine river sand and top soil) with a mean survival of 25%, 10%, and 5%, respectively. The results of the number of adventitious roots formed during the rooting period showed that there were no significant differences among the media used for rooting. Although T4 obtained the highest number of roots with a mean of 2.5, this was not significantly higher than the rest of the media used for rooting. As regards rooting, Treatment 4 resulted in longest roots with a mean length of 15.92cm. This was significantly different from the results of T2, T1, and T2, which had a mean length of 5.46 cm, 4.43 cm, and 2.28 cm, respectively. Among the five rooting media used in propagating Anonang cuttings, T4 was found to be the best medium in rooting stem cuttings.

Keywords: Anonang, *Cordia dichotoma*, soil media

AS – 06

CASSAVA YIELD IMPROVEMENT THROUGH SITE SPECIFIC NUTRIENT MANAGEMENT

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Diverse traditional upland rice (TUR) is at risk of genetic erosion due to displacement by modern high-yielding varieties and government restrictions on slash-and-burn farming. Many traditional varieties possess favorable characteristics (e.g., good eating qualities, aroma, and pigment), which necessitate the conservation of their genepool. The Mariano Marcos State University conserved 146 accessions *ex situ*, characterized them morphologically, and evaluated them agronomically. The third and last batch of evaluation was conducted in two consecutive years in 2015 and 2016 wet seasons in rainfed lowland areas of Batac, Ilocos Norte. It aimed to evaluate the agronomic performance and identify high-yielding varieties for cultivation in the rainfed lowlands. Seven accessions were selected based on their growth and yield performances. These include: TUR 123 (Duyduyan), TUR121 (Ginorot), TUR129 (Maliket), TUR116 (Balsamo), TUR111, TUR 134 and TUR 136 (Olandis), with yields ranging from 3.0 to 3.4 tha^{-1} . Selected accessions outyielded the check variety NSIC 146 and surpassed the documented farmers' yield (2.2 tha^{-1}) in the upland areas of Ilocos Norte. Aside from the genetic make-up of these accessions, weather conditions in each evaluation trial contributed to the differences in their growth and yield performance. They were tall, with medium tillering ability, medium panicles, medium to long maturing, and fertile spikelets.

Keywords: traditional upland rice, agronomic evaluation, conservation, rainfed lowland areas

AS – 07

**CO-AMENDMENT OF BAMBOO BIOCHAR,
VERMICOMPOST, AND BIOFERTILIZER IMPROVED
GROWTH, NUTRIENTS STATUS, AND SOIL
BIOLOGICAL COMPONENTS OF CACAO
(*Theobroma cacao* L.)**

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The extensive use of farm soils coupled with heavy usage of chemical fertilizers has led to various deleterious effects on the agricultural system. Soil conditioners such as bamboo biochar (BB), vermicompost, and biofertilizers may help alleviate the stress that can possibly result to successful soil restoration and improved crop productivity. This study determined the influence of BB, vermicompost, and biofertilizers on growth, nutrient status and soil biological components of cacao (*Theobroma cacao* L.). The experiment was conducted inside a screen house following a two factor in Randomized Complete Block Design (RCBD) with five replicates. The arbuscular mycorrhizal fungi (AMF) soil inoculant consisted of 12 species belonging to the genera *Glomus*, *Gigaspora*, *Acaulospora*, and *Entrophospora* while nitrogen-fixing bacteria (NFB) inoculant contained *Azospirillum* spp. Results revealed that cacao amended with 15% BB inoculated with NFB and AMF alone gave the highest total dry weight which could be attributed to a better N and P uptake. Moreover, cacao inoculated with NFB alone at 15% BB gave the highest NFB population. Meanwhile, the highest AMF spore density was observed in cacao seedlings treated with AMF alone at 15% BB. Acetylene reduction assay and 16S rDNA methods verified the NFB colonies in nitrogen free medium. Scanning electron microscopy not only revealed the size of the BB but also the association of BB, AMF and NFB. In conclusion, cacao seedlings amended with 15% concentration of BB showed an overall better outcome in terms of plant dry weight, nutrient status, soil NFB and AMF spore density as compared to the use of 0% and 30% BB.

Keywords: acetylene reduction assay, nitrogen free medium, root infection, scanning electron microscope, 16s rDNA

AS – 08

***Commelina diffusa* BURM. F.: A CERTIFIED WEED OF RICE UNDER SATURATED CONDITION**

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C. diffusa is one of the major weeds in rainfed rice areas. Its negative effect on yield of rice is not yet known under Philippine condition. An experiment was conducted from Aug to Dec 2018 at the Dept. of Crop Protection, CLSU to a) determine the competitive ability of *C. diffusa* against rice under saturated condition, and b) compare its effects on yield of transplanted (TP) versus direct-seeded (DS) rice. A plastic pot, (25 x 20 cm WH) filled w/ 5 kg sterilized soil and planted with either 21-day old or 3-day old pre-germinated rice seed (NSIC Rc222), was the experimental unit of the study. TP or DS rice in each pot was allowed to grow with *C. diffusa* at 1:0, 1:1, 1:3, 1:5, and 1:7 ratios. Each ratio was replicated 5 times arranged in RCBD. Yield and yield components of rice were gathered and analyzed through ANOVA (STAR 2.0.1). Results showed that *C. diffusa* had no significant effects on height, leaves, tillers, and panicles of TP rice. But its presence at increasing population significantly reduced the shoot-dry weight (14.5-55.9%), number and weight of filled grains (7.1-23.7%, 3.4-15.3%) of TP rice. Number of empty grains significantly increased by 53.4 to 90.1%. Yield and all yield components of DS rice were significantly reduced. Reduction on number and weight of filled grains ranged from 6.7 to 60.2% and 4.5 to 25.6%, respectively. Increase in number of empty grains ranged from 71.1 to 92.5%. Mean weights of filled grains between TP rice and DS rice had no significant differences at all population levels of *C. diffusa* except at 1:7 ratio. The results of this study proved that *C. diffusa* is a very competitive weed against rice under saturated condition. Thus, control of this weed is highly recommended.

Keywords: *Commelina diffusa*, COMDI, Commelinaceae,

AS – 09

COMPARATIVE PERFORMANCE OF COMMERCIAL AND FORMULATED PLYWOOD ADHESIVE WITH TOBACCO PARTICLES ADDITIVE

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The study investigated the use of tobacco (*Nicotiana tabacum* L) stalk particles as an additive with extender, filler, formaldehyde scavenger and termite repellent properties in urea formaldehyde (UF) adhesive formulation used to bond *Paraserianthes falcataria* (L) Nielsen veneers into plywood. The effect of varying amount of tobacco stalk particles (4, 8 and 12%) on adhesive working properties, shear strength (SS), wood failure (WF), formaldehyde emission (FE) and termite resistance (TR) of 3-ply plywood was investigated and compared with commercial formulation of UF. Adhesive mix containing UF resin with tobacco stalk particles up to 8% by mass blended very well and remained stable for at least 1 hour. An increase in SS and WF up to 8% tobacco stalk loading was observed compared to plywood that used a commercial glue formulation. Based on SS and WF, panels containing 4-8% tobacco stalk particles would pass the requirements of PNS ISO 12466-2. Examination of adhesive penetration and plywood strength suggest that tobacco particles could function as both filler and extender. The 8% tobacco stalk loading reduced FE up to 11%. TR improved as evidenced by lower weight loss on samples with incorporated tobacco particles. Thus, tobacco stalk particles offer an environmentally friendly, low cost and strong 4-in-1 additive as an alternative to conventional fibers used in plywood production.

Keywords: extender, filler, formaldehyde, termite resistance, nicotine

AS – 10

COMPARING MUSTASA (*Brassica juncea*), PECHAY (*Brassica rapa*), AND HOT PEPPERS (*Capsicum frutescens*) GROWTH ON FOUR HYDROPONICS SETUP

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Researchers probed into the possibility of using sewage water and ‘hugas bigas’ as alternative nutrient sources for plants in a nutrient film technique hydroponics setup. The effects of experimental treatments UV-treated sewage water and ‘hugas bigas’ on the physical growth parameters – plant height, leaf width, leaf area, and number of true leaves – of mustard (*Brassica juncea*), pechay (*Brassica rapa*), and hot pepper (*Capsicum frutescens*) were compared to the effects of control treatments tap water and normal nutrient. Significant differences ($\alpha=0.05$) were determined using T-test of two-independent means and Chi-square test for independence. Through uncommon patterns only observed under tap water and ‘hugas bigas’ growth rates, researchers found out that ‘hugas bigas’ was not suitable for hydroponics setups since its spoilage afflicts samples; and tap water does not sustain plant growth for long. Sewage, however, has comparable performance with the commercially available normal nutrient, as determined by various negligible differences in statistical tests’ results.

Keywords: hydroponics, hugas-bigas, sewage, growth parameters, nutrient film technique

AS – 11

DECADAL LAND USE CHANGE DYNAMICS IN THE CITY OF SANTA ROSA, LAGUNA, PHILIPPINES

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Land use change analysis is an important approach to better understand global environmental changes. Rapid urbanization in rural areas is one of the major drivers of agricultural land conversion. Santa Rosa City in the province of Laguna has shown distinct changes in land use towards a more urbanized environment from being agricultural. In order to understand and quantify these land use changes, a Geographic Information System-based unsupervised classification of three Landsat satellite images taken in 1990, 2000 and 2016 was performed. The study quantified changes in agricultural areas and analyzed their impacts on the agricultural productivity of the city over the last 2 decades. Results show that 78% of agricultural lands have been converted to other uses from being the dominant land use type. Most conversions were towards residential developments. In 1990, residential areas covered only 18% of the city, but later increased to 49% by 2016. This change has resulted in a net decrease in rice production of the city from 34,440MT to 7840MT in a matter of 16 years. Additionally, about 21% of the original agricultural areas that have been allocated for other developments are currently idle. This quantitative data on land use and land use changes can be considered by the city government in planning for a more efficient use of their natural resources, particularly as a guide for land use appraisal, alternative land use plans, and in designing novel policies on optimizing the use of land resources while also moving towards sustainable urban development.

Keywords: Geographic Information System; Remote sensing; Urbanization; Land use change

AS – 12

DESIGN, FABRICATION AND EVALUATION OF A POTATO GRADER FOR VILLAGE OPERATION

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Uniformly graded tubers command a premium price in the market over the ungraded one. Likewise, in the potato processing industry, graded tubers promote ease of handling resulting to an increased efficiency of the processing line.

This study presents the development of a potato grader that uses a rotating helix with increasing gaps as a medium of gradation. Response variables are the grading system efficiency in percent, capacity in kg/hr, percentage of damaged tubers and power consumption. These were evaluated on the speed of the grading unit in RPM and inclination of the grading unit in degrees.

Results of the evaluation showed that the grader had its optimum performance when operated at 15 RPM and inclination of 10 degrees giving a system efficiency of 92.56%, capacity of 441.58 kg/hr, less damaged tubers of 1.83% and a low power consumption of 22.6 W-hr.

The cost of the grader is P31, 000.00 with a break-even quantity of 23 tons of tubers/year. The capacity of the device can be increased by considering a larger diameter of the grading unit.

Keywords: potato, potato grader, potato processing

AS – 13

ECOLOGICAL ENGINEERING FOR A HEALTHY UPLAND RICE ECOSYSTEM

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Researchers are currently facing with the global challenges of increasing food security while at the same time taking climatic uncertainty that requires sustainable and resilient ecosystems, and a need to conserve or restore biodiversity and optimize ecosystem functions. Therefore, new directions in research are needed to create healthy rice ecosystems. Ecologically-based pest management methods like ecological engineering has recently emerged as a paradigm for sustainable and resilient upland rice ecosystems, but still unexplored due to limited on-farm research attention in this field. This paper presents a framework for a holistic approach to ‘rice upland ecosystem health’ in a local level geared at securing food production while protecting farmer and ecosystem health. An assessment was carried out using combined quality and qualitative data collected from a diverse vegetation patches (DVP), focus group discussion with stakeholders including officers of the Department of Agriculture (Philippines) and rice farmers. Results revealed that DVP had significant effects (50%) on the diversity and abundance of natural enemies, but lowers insect pest activity. Positive association was found among insect pests’ species and their natural enemies’ in terms of economic damage. DVP including action threshold, series of pest management evaluations, decision combined with indigenous management practices were remarkably effective in promoting population balance among families of insect pests and natural enemies. Furthermore, socio-economic profile, religious and cultural beliefs directly affect perceptions on ecologically-based pest management methods. Our results suggest that sustainable and resilient upland rice ecosystems could be developed using ecological engineering approaches that employ both vegetation strips and DVPs.

Keywords: Ecological Engineering, Upland Rice Ecosystems, Natural Enemies, Rice insect Pests

AS – 14

EFFECT OF DIFFERENT ROW SPACING AND FUNGICIDE APPLICATION ON THE GROWTH AND YIELD PERFORMANCE OF GENETICALLY MODIFIED CORN

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The study was conducted to evaluate the effect of different row spacing and schedule of fungicide application on the growth and yield performance of genetically modified corn. The experiment was laid out using Split-plot Design with four replications using the following treatment combinations: Mainplot factor (row spacing): a_1 – 70 cm x 20cm, a_2 – 65cm x 20cm, and a_3 – 60cm x 20cm, a_4 – 40cm x 40cm x 100cm (double row); Subplot factor (schedule of fungicide application: b_1 – No application (Control), b_2 – 45 Days After Planting (DAP), b_3 – 65 DAP, and b_4 – 85 DAP. Among the four row spacing tested, crops planted with closer spacing performed better than those that are planted in wider spacing (a_1) as it exhibited significant difference in grain filling, ear weight per plot, grain yield per plot and computed yield per hectare (tons/ha). There was no significant difference on the effect of the four schedules of fungicide application in almost all parameters except in the common corn rust infection rate and bacterial leaf and sheath blight.

Keywords: row spacing, fungicide application, genetically modified corn

AS-15

ENHANCING PEANUT PRODUCTION THROUGH INNOVATIVE WATER MANAGEMENT STRATEGIES

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A study on enhancing peanut production through drip irrigation (DI) technology was conducted to increase the productivity and profitability of peanut production in the Ilocos region. To achieve this goal, irrigation management strategies suitable for peanut were developed. The study was able to generate and develop the best irrigation scheme for peanut (PN 9 variety) using drip irrigation technology through Decision Support System for Agro-technology Transfer (DSSAT) simulation and field validation. Three pilot test farms showcasing the DI technology was established in (1) Brgy. Bago, Vintar, Ilocos Norte, (2) MMSU, Batac, Ilocos Norte, and (3) Brgy. Lanna, Enrile, Cagayan. Using the DI scheme, dry pod yield increased from 1.59 MT ha⁻¹ to 2.09 MT ha⁻¹ (31.45%). This result is a little higher than the target increase in yield of 30%. On the other hand, water productivity was only increased by around 16% due to the limited water application of farmers. In terms of seed quality based on seed size, DI and farmer's practice (FP) were comparable. Based on the results of the economic analysis, the use of DI technology was profitable through yield improvement with a return on investment (ROI) of 0.25. Water savings was not a factor in profitability due to under-irrigation by farmers.

Keywords: drip irrigation, irrigation scheme, water productivity, water savings

AS – 16

**GROWTH PERFORMANCE OF MOLUCCAN SAU
(*Falcataria moluccana* (Miq.) Barnaby & J.W. Grimes) AS
INFLUENCED BY VARYING LIGHT INTENSITIES USING
VARIOUS SPECTRAL FILTERS**

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Plants can respond to their surrounding environment and their growth and development according to the quality of perceived radiation. Only the visible spectrum is useful to plants. The study aims to determine the effect of light intensity filtered with various colored polyethylene on the growth performance of Moluccan sau; to determine the significant differences on the growth of Moluccan sau under various spectral filters; to determine the best spectral filter for the optimum growth of Moluccan sau; and to determine the significant differences on the survival rate of Moluccan sau under various spectral filters. Results of the study revealed that Treatment 1 (White) had the highest light intensity filtered with a mean of 3083 followed by T4 (Yellow) with a mean of 3028, T3 (Blue) with a mean of 2306 and T2 (Black) with a mean of 1378, though there was no significant difference among the different treatments. However, a highly significant difference in the number of leaves with p-value of 0.0007, $p < 0.01$) was observed in the month of October and December. Other significant differences were the diameter of seedlings from the month of December with p-value of 0.0013, $p < 0.01$ and the height of the seedlings for T2 and T4 on the month of December with p-value of 0.0494, $p < 0.05$.

Keywords: Moluccan sau, *Falcataria moluccna*, spectral filters

AS – 17

IMPACT OF CLIMATIC VARIATIONS IN THE PRODUCTIVITY AND YIELD PERFORMANCE OF GARLIC

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Garlic is known to be thermo and photo sensitive and its growth and development are greatly influenced by the growing environment. Different varieties of garlic were evaluated for their growth and yield performance at different dates of planting, to identify varieties suited for specific location and to know the effect and implications of different weather conditions to garlic production. Planting dates and the prevailing weather conditions during the growing period of the plants significantly influenced the growth and yield performance of the different varieties. Yield of garlic varies, and this can be attributed to the time of planting and the weather conditions during the growing period of the plants which affected the bulb development of the plants and desired maturity. Higher yield was obtained during regular planting as compared to early and late planting. Further evaluation of the promising varieties on farmers' field in different locations, also varies in their growth and productivity. Weather conditions like rainfall, temperature, and relative humidity had significant effect on garlic bulb and leaf size. As temperature increased and surpassed the optimum range of 21°C-24°C, bulb and leaf size was smaller, while less rainfall produced larger bulbs. Shorter daylength was necessary to initiate bulb growth and a windspeed of 8 meters per second. Relative humidity of 80% increased yield and beyond 80% favored the development of diseases. With the above observations, climatic variability has an effect on the yield and pest occurrence of garlic when planted at different dates including the desired maturity of the plant, thus affecting the storability of the harvested bulbs. These findings provide added information to researchers and extensionists in making recommendations to farmers on choosing the best time of planting and variety suited for a specific location. It will also help farmers in making decisions in their farm activities or their cropping system.

Keywords: planting dates, location, weather, climatic variability, yield

AS – 18

IMPACT OF SOIL AND CLIMATIC CONDITIONS ON THE PHYTOCHEMICAL PROPERTY OF *Livistona rotundifolia* SHOOT

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Anahaw (*Livistona rotundifolia*) is a non-timber forest species that grows in a wide range of soil and climatic conditions throughout the Philippines. Soil and climatic conditions and other factors can greatly affect the composition of biological active compounds in plants. The aim of this research is to evaluate the impact of soil and climatic conditions on the phytochemical property of *L. rotundifolia* shoot. Shoot samples of *L. rotundifolia* were taken from secondary forests of Pagudpud and Batac, Ilocos Norte with different soil characteristics and climatic condition with Type III and Type I, respectively. Taxonomic classification of soil samples was undertaken using standard procedures. Shoot samples were prepared following the standard protocol for plant extraction and phytochemical screening was done qualitatively. The ethanol extract of *L. rotundifolia* shoot from Batac with soil taxonomic classification of fine, montmorillonitic, acidic isohyperthermic, typic haplustalfs and climate characterized by two pronounced seasons, dry from November to April and wet during the rest of the year, exhibited the highest antioxidant potential. Its flavonoid and alkaloid contents were higher when compared with sample taken from Pagudpud with fine, montmorillonitic, acidic isohyperthermic, typic hapludalfs soil and climate characterized by seasons which were not very pronounced, relatively dry from November to April, and wet during the rest of the year. Results suggested the robust impact of soil and climatic conditions on the phytochemical composition which further affected the antioxidant potential of *L. rotundifolia* shoot.

Keywords: anahaw, soil and climatic conditions, phytochemical screening, taxonomic classification, and antioxidant

AS – 19

INFLUENCE OF SINGLE PLANT *Cyperus rotundus* L. ON GROWTH AND DEVELOPMENT OF RICE UNDER CONTINUOUS FLOODED CONDITION

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C. rotundus (CYPRO) is considered the world's worst weed. When it is not controlled, yield losses on major crops due to competition could reach up to 90%. In earlier times in the country, CYPRO was only a major and minor problem in upland and rainfed lowland areas. Later, reports confirmed that a lowland ecotype of CYPRO existed possessing different physiological mechanisms of survival under flooded condition. Despite the reports, its negative effect on rice under flooded condition is still unknown. An experiment was conducted at two trials at PhilRice CES from Feb. to Nov. 2018 to determine the effects of single plant-lowland ecotype CYPRO on growth and development of transplanted (TP) and direct-seeded (DS) rice under flooded condition (3 cm water level). Clay pots (6 x 5 inches WH) were planted under the following treatments: rice alone (TP/DS rice), rice + CYPRO, and CYPRO alone. The experiment was arranged in RCBD with 3 replications. Height, no. of leaves, tillers, chlorophyll contents, shoot and root weights, and no. of tubers were recorded and analyzed using STAR 201. SE was used to determine the variability within means and TTEST between treatments. Results showed that single plant-lowland ecotype CYPRO had no negative effects on growth and development of TP and DS rice under flooded condition. In reverse, growth and development of lowland ecotype *C. rotundus* were affected when grown with rice. Results suggest that presence and infestation of lowland ecotype CYPRO to rice at 1:1 ratio (weed: rice) had no negative effects on yield of the crop if water management is set at continuous flooding.

Keywords: *Cyperus rotundus*, CYPRO, Cyperaceae, purple nutsedge, rice-weed competition

AS –20

iVEG: A WEB PORTAL FOR INFORMATION ABOUT PHILIPPINE INDIGENOUS VEGETABLES

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The Philippine Indigenous Vegetables Information System (or *iVeg*) is a web-based platform developed for the management and integration of primary data relating to production systems, utilization, conservation, management and diversity of Philippine indigenous vegetables. Pertinent botanical and horticultural information gleaned from various sources are also included in the database. The core of this system consists of a relational database (MySQL) and a hypertext preprocessor-based web framework (Laravel) which jointly execute data storage and management operations. A user-friendly graphical and data browsing interface which allows data query and retrieval, on one hand, was developed using Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS). To ensure referential integrity, responsiveness and efficiency of the database system, additional web development techniques were utilized. Designed to promote underutilized food resources for nutritional well-being and food security, *iVeg* is a fully searchable system which can be easily accessed by researchers, farmers, students and other stakeholders. Presently, the database is populated by 132 indigenous vegetables documented from ten selected provinces all over the country. This number will further be augmented by field expeditions in other provinces not covered during the first phase of the study. With full functionality, *iVeg* will make available a wide range of information about Philippine indigenous vegetables, thereby providing high quality food for the Filipino household.

Keywords: indigenous vegetables, database, information system

AS – 21

MOLECULAR SCREENING ON THE OCCURRENCE OF THE MOST IMPORTANT PATHOGENS IN ORGANIC FERTILIZERS AND LIQUID SUPPLEMENTS FOR A SAFE ORGANIC AND SUSTAINABLE AGRICULTURE

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The application of organic fertilizers and liquid supplements to promote sound state of health in crops is widely used despite the public health issues. The great risk can be attributed to the transmission of pathogens such as bacteria, protozoa and helminths present from biosolids to the local farmers and consumers through improper production. Here, a total of 47 samples consisting of normal organic solid fertilizers, vermicompost solid fertilizers and various types of liquid from different organic farms in Luzon were screened. Application of conventional methods such as microscopy and bacterial culture in parallel with Polymerase Chain Reaction (PCR) revealed the presence of important pathogens: *Escherichia coli* and *Salmonella enterica* subsp. *enterica* serovar *typhimurium*. Successful detection by PCR was confirmed by DNA sequencing, demonstrating the impartiality of PCR over the conventional method. Other target pathogens such as *Entamoeba histolytica* and *Toxoplasma gondii* along with *Trichuris trichiura* were also successfully detected on PCR.

Keywords: organic farming; organic fertilizers; liquid supplements; polymerase chain reaction (PCR)

AS – 22

MUNGBEAN PERFORMANCE AS CASSAVA INTERCROP AND ITS DIFFERENTIAL CONTRIBUTION TO CASSAVA PERFORMANCE

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This study was conducted to evaluate the performance of 15 selected mungbean entries intercropped with the cassava variety, 'Binulak' in terms of yield and morphological characteristics, as well as the effect of mungbean intercropping on cassava. The field trial was laid-out in a split plot design with cropping systems as main plot, and genotypes as sub-plots with 3 replications. Results showed that area wise, mungbean grown as monocrop has higher grain yield compared to mungbean grown as intercrop. Across cropping system, Pag-asa 7 had the highest grain yield among entries (2.8 t ha⁻¹ monocrop; 1.8 t ha⁻¹ intercrop). On the other hand, pod characteristics, leaf area, SPAD values of mungbean did not differ significantly between cropping systems. Plant height differed significantly among entries regardless of the cropping system. Sixty per cent of the cassava intercropped with mungbean showed an increase in root yield. Cassava intercropped with mungbean entry, PHL 152204 had the largest root yield of 31.91 ton/ha whereas the average yield of the monocrop counterpart was 22.15 ton/ha or equivalent to 30.59% increase. On the other hand, cassava intercropped with entry PHL 12782 had the lowest yield of 16.95 ton/ha corresponding to 24.42% reduction when compared to cassava grown as monocrop. All cassava intercropped with mungbean showed an increase in per cent dry matter, with Pag-asa 7 having the highest increase of 47.85%. The trial showed that although all mungbean lines had lower yield when planted as intercrop, the Land Equivalent Ratio (LER) of cassava was increased with mungbean intercropping. The results further showed the differential ability of each mungbean genotype in increasing yield of cassava and that there are genotypes which can compete with cassava for nutrient resources thus reducing root yield.

Keywords: mungbean, cassava, intercropping, yield

AS – 23

NUTRIENT DYNAMICS IN HYDROPONIC PRODUCTION OF LETTUCE (*LACTUCA SATIVA*, L. VAR. *CRISPA*) USING HOUSEHOLD GREENHOUSE MODULE

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Changes in concentration of nutrients in a hydroponic system for lettuce after one week, three weeks and before harvest for a period of 40 days was determined. This was achieved by daily monitoring of the environmental and water quality parameters, nutrient solution analysis and measuring growth, yield and presence of nutrient deficiency. The nutrient solution was maintained by adjusting the electrical conductivity (EC) to 1.80 mS/cm and pH to 6.5. Results showed that the EC of the nutrient solution decreased as it was expended by the plants. The increased in pH affected some of the concentration of nutrients while the total dissolved solids (TDS) fell within the maximum range. The concentration of nutrients between collection points did not vary significantly from each other except for Cl. This result indicated that the hydroponic system used was efficient. On the other hand, changes in concentration of nutrient solution every week varied significantly from each other. The nutrients that increased in concentration were NO₃-N, K, Ca and Cl; increased during the first and third week; total N and NH₃-N; increased until third week but decreased before harvest; P, Mg, SO₄, HCO₃, Na, Cu, Zn, Fe and Mn; and increased only during the first week; B. In terms of growth and yield, and observed deficiency symptoms, plants in sampling point 1 significantly got more leaves and eventually, got the highest leaf area index (LAI) and fresh weight. Only sampling point 1 did not exhibit tipburn and stunted growth. All of the other deficiency symptoms like chlorosis, necrosis and distorted or malformed leaves were observed in all of the sampling points.

Keywords: hydroponics, nutrient dynamics, nutrient deficiency, electrical conductivity

AS – 24

PRISM: A NEAR REAL-TIME MONITORING SYSTEM TO DESCRIBE THE RICE PRODUCTION SITUATION OF WESTERN VISAYAS

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Western Visayas ranked third as the highest rice producing region in the Philippines. Despite of high total rice production, there is a need to increase the yield to sustain rice sufficiency in the region. Reliable, location-specific and timely information on rice production situation is needed by the DA for strategic planning on how to increase rice yield. In 2014, the Philippine Rice Information System (PRISM) was implemented by the PhilRice, DA and IRRI. PRISM is an operational system that generates rice info using remote sensing, crop modeling, crop health survey and smartphone-based data collection. Based on the 2nd semester data of 2018, the total rice area planted in Western Visayas was 245,731 ha with an average yield of 3.62 tons/ha. Crop establishment was widely varied with the peak of planting in August. The preferred varieties of farmers were early to mid-maturing, namely, PSB Rc10, NSIC Rc216 and NSIC Rc222. Majority of the farms exceeded the required nitrogen fertilization (200 kg/ha) which may explain the high disease incidence, namely, brown spot, leaf blast, bacterial leaf blight and sheath blight. Insecticide was the widely used pesticide with stemborer and rice bug as the major insect pests being controlled. Dominant weeds species were composed of sedges and grasses. Specific interventions were started in identified low yielding rice areas through extension services to farmers with focus on proper soil fertilization, and synchronize planting and proper pest management options to control major pests that contribute to yield loss in the region.

Keywords: PRISM, rice information system, Region VI, rice monitoring

AS – 25

**PRODUCTIVITY OF SWEET PEPPER
(*Capsicum annuum L.*) UNDER DIFFERENT BALANCE
FERTILIZATION STRATEGY**

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This study aims to determine the effect of different balance fertilization strategy (combination of inorganic and organic fertilizer at varying rates) on the growth and yield performance of sweet pepper (*Capsicum annuum L.*)

The experiment was setup following the Randomized Complete Block Design in two factors with three replications and with the following treatments: Factor A (Sweet Pepper Variety): a₁- Emperor F1 and a₂- California Wonder and Factor B (Balanced Fertilization Strategy): b₁- 100% inorganic fertilizer, b₂-100% organic fertilizer, b₃-50% inorganic fertilizer and 50% organic fertilizer, b₄-60% inorganic fertilizer and 40% organic fertilizer, b₅-40% inorganic and 60% organic fertilizer.

Analysis of variance revealed that the different combinations of organic and inorganic fertilizer applied did not produce significant effect on the computed yield and growth of the two sweet pepper cultivars tested.

Keywords: productivity, sweet pepper, balance fertilization strategy, organic fertilizer

AS – 26

PROFILE ANALYSIS ON THE PRODUCTIVITY OF COCONUT (*Cocos nucifera* L.) FOR THE FOUR CLIMATE TYPES IN THE PHILIPPINES

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Coconut is considered as one of the main drivers of the Philippine economy due its contribution in terms of export. However, coconut productivity is severely affected by changes in weather and climatic conditions and in the age of climate change and smart agriculture, it is important to understand the effect of varying climate and weather conditions on the productivity of coconut. Hence, this study aimed to compare the profiles of representative farms of the four climate types in terms of potential yield, tennis ball-sized nut, and button-sized nut count. Thirty palms from each selected farm representing the four climate types were selected. Nut production data were collected from 2015-2016 from each of the farm while the climate types were based on the modified Coronas classification. Moreover, profile of the farms representing the four climate types were analyzed in terms of potential yield, tennis ball-sized nut, and button-sized nut count. Test of parallelism, test of levels and test of flatness were performed using STATA version 12. Average potential yield for climate types I to IV are 38.94, 54.61, 73.05 and 46.34, respectively. On the other hand, average number of tennis ball-sized nuts for climate types I to IV are 5.51, 5.09, 7.27 and 4.64, respectively. Moreover, average number of button-sized nuts for climate types I to IV are 7.03, 7.76, 12.08 and 8.14, respectively. Profile analysis at $\alpha=10\%$ showed that the profiles of the four climate types in terms of potential yield, tennis ball-sized nut and button-sized nut are parallel (p -value=0.1165). However, test of levels and flatness was significant at $\alpha=10\%$ (p -value=0.0914 and 0.0000, respectively). Results of this study suggest that nut production profile in terms of potential yield, tennis ball-sized nut and button-sized nut of the four climate types are parallel, not coincident and not flat. Thus, they have different nut production and the differences may be due to the varying weather conditions among four climate types. Findings of this study may serve as preliminary analysis to investigate further and better understand the effect of varying weather conditions on the productivity of coconut.

Keywords: coconut, profile analysis, yield, climate

AS – 27

RESPONSE OF CACAO (*Theobroma cacao* L.) TO BIOCHARS FROM BAMBOO AND SUGARCANE BAGASSE, AND BIOFERTILIZER

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Amendment of biochar, vermicompost and inoculation with biofertilizers constitute a new approach in improving soil chemical properties that definitely result to a better plant growth. This study determined the response of cacao (*Theobroma cacao* L.) to amendment with biochar from bamboo (BB) and sugarcane bagasse (BSB), and biofertilizer MYKORICH® (mycorrhizal inoculant containing *Glomus*, *Gigaspora*, *Entrophospora* and *Acaulospora*). Aseptically germinated cacao seedlings were inoculated with biofertilizer and planted in oven sterilized red acidic soil mixed with vermicompost and applied with increasing (0, 3.75, 7.5 and 15%) concentration of BSB. In previous experiments, 30% BB level reduced growth of cacao. Experimental design was a two factor in RCBD with ten replicates under greenhouse conditions. Results showed that BB promoted better growth of cacao than BSB. Total dry weight of cacao ranged from 21-38 g plant⁻¹ in BB and from 20 to 24 g plant⁻¹ in BSB. Highest dry weight was obtained from those with 15%BB while the highest in BSB was with 7.5% and the lowest was in 15%BSB. Inoculation with MYKORICH in BB doubled plant dry weight with 114 to 399 mycorrhizal spores 10 g⁻¹ sample. On the other hand, spore count in BSB ranged from 42-116 spores 10 g⁻¹ sample and highest in 7.5%BSB and lowest in 15%BSB. Mycorrhizal root colonization was comparable in BB and BSB amended soil ranging from 64 to 88%. The results indicate that cacao seedlings grew better in BB and supported higher mycorrhizal spore production and root colonization than in BSB particularly when inoculated with MYKORICH® biofertilizer. Field trials should be conducted to verify the above results before its recommendation for adaption by farmers.

Keywords: mycorrhiza spore count, root infection, MYKORICH®

AS – 28

SAVING MAMENG: A SCIENTIFIC APPROACH TOWARDS SUSTAINABILITY THRU NDF

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Considered as an endangered species by the Convention on International Trade Species of Wild Flora and Fauna (CITES) Appendix II and IUCN Red List, Napoleon wrasse (*Chelinus undulatus*), locally known as Mameng, is protected under RA 8550 as amended by RA 10654 wherein the law states “the ban on fishing of rare, threatened and regulated species”. With the ban in place for the species, fisherfolks in Tawi-Tawi raised their concern on its effect since their livelihood is also dependent on the species. In order to address the problem, NFRDI, together with other agencies composing the CITES Scientific Authority, decided to conduct a Non-Detrimental Findings (NDF) assessment which could support claims that the existing fishery practices do not impact the fish stocks and consecutively allow the ban to be lifted. The Method includes development of the localized NDF criteria, conduct of review, workshops and consultations, and on-site field validation. The results of the conducted NDF were presented during an organized public consultation with representatives from different groups of stakeholders in the different municipalities of Tawi-Tawi. The results showed a negative NDF, hence, the ban is still in place to protect the species. However, discussions on the results between the stakeholders and the CITES Management and Scientific Authorities were deemed to be positively accepted by the participants. Thus, they decided to create a Technical Working Group (TWG) for Mameng to carry-out activities that will address sustainability issues of the fishery.

Keywords: mameng, NDF, Tawi-Tawi

AS – 29

SELECTION OF WATER BUFFALO BULLS BY SPERM NUCLEAR SHAPE AND RELATIONSHIP TO SPERM IN VITRO FERTILITY AND COMPUTER ASSISTED SPERM ANALYSIS

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Laboratory methods to select high fertility and eliminate low fertility semen are needed in the water buffalo industry. Fourier harmonic analysis (FHA) was used to 31 buffalo bulls with known in vivo fertility to identify the top 32% (conception rates = 28 to 36%) and bottom 16% (conception rates = 19 to 13%) highest and lowest fertility, respectively. The model cutoff points were harmonic amplitude 1 values of $<0.042 \mu\text{m}$ and $>0.051 \mu\text{m}$ for high and low fertility bulls. Using the cutoff values, a new set of 44 bulls was classified and 12 high and 10 low fertility bulls identified. Five bulls from each fertility group were randomly selected and used to evaluate sperm in vitro fertility via fertilization of buffalo oocytes matured in vitro and sperm motility parameters via Computer Assisted Sperm Analysis (CASA). The formation of a male pronucleus was recorded as evidence of fertilization. CASA was evaluated on 201 to 1125 sperm per bull with a Hamilton-Thorne motion analysis. Significant difference in fertilization percentage of 83 ± 4.4 vs 70.0 ± 4.4 for the predicted high vs. low fertility bulls ($p < 0.05$) was observed. The CASA measures of progressive motility (67.2 ± 2.9 vs. $51.9 \pm 2.9\%$), straightness (STR) (85.4 ± 0.7 vs. $81.3 \pm 0.7\%$) and linearity (LIN) (53.3 ± 0.8 vs. $49.8 \pm 0.8\%$) were different for sperm from predicted high vs low fertility bulls ($p < 0.05$). There was no effect on average path velocity, straight-line velocity, curvilinear velocity, lateral head displacement, or beat/cross-frequency in relationship to bull fertility group ($p > 0.05$). The results suggest that buffalo bulls predicted to be of higher fertility have better in vitro fertility and sperm motion characteristics of progressive motility, STR and LIN.

Keywords: FHA, bulls, sperm analysis, sperm quality, CASA

AS – 30

SOIL EROSION AND SOIL CARBON ASSESSMENT OF AN ADLAY-BASED FARMING SYSTEM

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Soil erosion has become rampant in the upland and rolling areas which has led to land degradation, siltation to low lying areas, and pollution to water bodies. A number of communities are continuously cultivating the uplands with a variety of crops for livelihood. Some of these crops require various degree of cultivation to obtain sufficient yield. Crops that require minimal tillage such as adlay crop can be good options for planting in sloping areas. This study was conducted to assess the soil erosion rate and soil carbon stock of an adlay farming system at varying slope gradients. The study was carried for a 10-month period following the completely randomized design. The erosion rate was measured using an improvised erosion bar, the infiltration by an infiltrometer, and soil carbon was analysed through a laboratory facility. Findings revealed that erosion rates in the adlay farming system are far beyond the tolerable limit. The slope, with more than 20%, had an erosion rate of 66.49 tons ha⁻¹ yr⁻¹ while the gentler slope (less than 10%) had only 12.5 tons ha⁻¹ yr⁻¹. Soil carbon stock of the area ranged from 1.684 tons ha⁻¹ to 2.2 tons ha⁻¹ across the slope gradients of the farm. The infiltration rate was also found to be higher in a gentler slope (less than 10%) at 106.67 mm hr⁻¹ as against 91.33 mm hr⁻¹ in steeper slope (more than 20%). Adlay crop may be planted along areas steeper than 10% slope but this requires minimal tillage to regulate soil erosion. The technologies for soil and water conservation measures need to be adopted by the farmers in steeper areas.

Keywords: soil erosion, soil carbon, farming system

AS – 31

UNFOLDING INDIGENOUS FLOWER VEGETABLES IN THE PHILIPPINES

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Flower vegetables, despite their ubiquity in Filipino diets, are not recognized as major food sources. This study was thus undertaken to document flower vegetables cultivated and consumed by rural households in the Philippines. Information on utilization of flower vegetables were obtained from community inventory, ocular, household and local market surveys in 10 provinces in the Philippines. Focus group discussions revealed seven species, namely, Kapas-kapas (*Telosma procumbens*), Alukon (*Broussonetia luzonica*), Katuray (*Sesbania grandiflora*), Sampaloc (*Tamarindus indica*), Kalabasa (*Cucurbita moschata*), Saging (*Musa* spp.), and Ampalaya (*Momordica charantia*). Among the more popular food preparations are *salad, dinengdeng, law-uy, ginataan, kinilaw, ginisa, atsara, paksiw, okoy, inihaw and torta*. It was also revealed that with the exception of *T. indica*, all the above mentioned flower vegetables are prepared as salads. Moreover, unique preparations of the male banana inflorescence as *okoy, inihaw* and *torta* were documented in Quezon while the utilization of *S. grandiflora* and *Musa* spp. as *atsara* and *kinilaw* was recorded in Iloilo and Capiz. Region-specific utilization of flower vegetables was noted for *B. luzonica* and *T. procumbens* which are popular vegetables in the Ilocos Region. Brought by migrating Ilocanos to South Cotabato, *B. luzonica* still remains as a hitherto undiscovered flower vegetable in these areas. Promotion of other indigenous vegetables for their flowers can increase diversity in vegetable preparation and conservation through sustainable use thus maintaining its potential to meet the needs of present and future generations.

Keywords: Flower vegetables, *Telosma procumbens*, *Broussonetia luzonica*, *Sesbania grandiflora*, *Momordica charantia*

AS – 32

UTILIZATION OF NDVI AND THERMAL IMAGING IN DETECTING WATER-DEFICIT STRESS IN TEN HIGH-YIELDING SUGARCANE VARIETIES

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NDVI and Thermal Imaging are two aerial imaging processes that use images taken by specialized cameras attached to a plane or quadcopter. NDVI (Normalized Difference Vegetative Index) utilizes the amount of NIR and visible light reflected by the plant's leaves to estimate the health and density of vegetation while thermal imaging creates images based on the amount of heat reflected by the object being captured. These two processes were used in monitoring an experimental field of sugarcane plants which were subjected to drought stress. Ten HYVs developed by the Sugar Regulatory Administration (SRA) were subjected to drought at 3 months old (tillering stage). Watering was withheld for two months for the drought plots while control plots were regularly irrigated. Throughout the stress imposition, NDVI and canopy temperature, as well as chlorophyll content data were gathered on a weekly basis. At 5 months old, the sugarcane plants were recovered and grown until 12 months for harvesting. Statistical analysis showed significant varietal differences in NDVI values among varieties with Phil 2004-1011 having the highest NDVI value of 0.041667. Canopy temperature and chlorophyll content data significantly differentiated drought and control plots. NDVI data were also highly correlated to cane (TC/Ha) and sugar (LKg/Ha) yield which will be useful in the early assessment of yield. In this study, NDVI and Thermal Imaging have been found useful in differentiating moisture stressed from well-irrigated plants. This technology shows promise in the easy and rapid mass screening of crops grown over a large area, with precise and reliable data.

Keywords: sugarcane, NDVI, thermal imaging, drought

AS – 33

VALIDATION AND COMPARATIVE YIELD TRIAL USING NUTRIENT EXPERT FOR MAIZE IN CORN PRODUCTION IN THE PHILIPPINES

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Nutrient Expert for Maize™ (NEM) is a software decision tool which generates a guideline for fertilizer management to increase yield and profit for traditional, open-pollinated, and hybrid varieties of corn in the Philippines based on the 4R principle: right source, right rate, right time and right place. The algorithm and decision rules of Nutrient Expert for developing fertilizer guides lie upon the use of existing information on related farming practices and site characteristics. Attainable yield goal, on the other hand, is determined by using information on yield responses evaluated through nutrient omission plot technique. In the absence of omission plot trials data, estimates are made by the software based on current yield, climatic environment and soil fertility. Attainable yield is determined by variety type and agro-ecological condition of the crop. Yield of hybrid corn is 8-10 t/ha, open-pollinated varieties, 5 t/ha, and traditional varieties, 3 t/ha. To test the efficacy of the estimates generated by the Nutrient Expert, these were considered as 4R prototypes and then subjected to field validation. A total of 190 farmer-cooperators in 16 regions throughout the country participated in this evaluation. Yields from Nutrient Expert-generated (NE) treatments and from the existing farmer's fertilizer practice in a location (FFP) were compared to determine the extent of efficiency of the software in increasing optimum yield of corn. Result showed that NE treatment gave a greater yield than FFP in 119 out of 124 farms (96%). Moreover, the NE treatments were also able to achieve the attainable yield in 57 out of 68 farms from the 8 regions (83.8 %). The use of NEM increased yield by an average of 1.2 t/ha and profit of Php 12,837 per ha/crop. With these results, the use of Nutrient Expert for Maize proves that yield and profit can be increased.

Keywords: Nutrient Expert, FFP, omission plot, corn variety, 4R

AS – 34

YEAR-ROUND PERFORMANCE OF INBRED AND HYBRID RICE VARIETIES AS AFFECTED BY DIFFERENT LOCATIONS AND PLANTING DATES

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The study was undertaken to evaluate the agro-morphological and identify suitable inbred and hybrid rice varieties under different locations, as well as the best planting time to plant that will give higher yield for each particular location. Four hybrids (Bigante, LP 937, Pioneer, SL8 H) and four inbred (NSIC Rc 130, NSIC Rc 160, NSIC Rc 216 and NSIC Rc 222) were grown from May 2016 to April 2018 in four provinces (Aurora, Nueva Ecija, Tarlac and Zambales) of Central Luzon, Philippines. The varieties were laid-out following the Randomized Complete Block Design (RCBD) were the four provinces or locations were assigned as the blockings/replications.

Results indicate that Aurora and Nueva Ecija provinces obtained longer growing period, taller plants, higher number of productive tillers, higher seed setting as compared to Tarlac and Zambales provinces. With respect to yield, Aurora (3.60-5.04 t/ha) and Nueva Ecija (2.66-4.08 t/ha) showed a better yield performance over the two provinces, Tarlac (2.43-3.56 t/ha) and Zambales (2.83-3.77 t/ha). Higher yield was noted from Bigante hybrid which ranged from 3.42-5.04 t/ha while no significant differences were noted from the inbred varieties. After varietal testing and evaluation on a year round monthly planting, Aurora can produce better yield following the months of planting in December, January and February for hybrid as well as inbred while Nueva Ecija and Tarlac can follow planting during the months of November, December, February, May, June and July for inbred and hybrid. Zambales province can follow months of planting during the months of December, January, June and July for inbred and hybrid.

Keywords: rice (*Oryza sativa L.*), agro-morphological, inbred, hybrid

AS – 35

**A NARRA LEAF ENDOPHYTE, *Bacillus amyloliquefaciens*,
POSSESSES ANTIFUNGAL ACTIVITY AGAINST
PHYTOPATHOGENIC FUNGI *Alternaria* SP., *Diaporthe* SP.,
AND *Fusarium oxysporum***

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Microbial endophytes are microorganisms that live within plant tissues but do not confer disease. Endophytes benefit their host plant by promotion of plant growth, reduction of disease severity, induction of the defense mechanisms of plants, secretion of products that prevent herbivory, fixation of nitrogen and by increasing nutrient uptake. Their relationship with their host plant makes them physiologically different from their soil-dwelling counterparts making them ideal sources of antimicrobial compounds that can be used as biocontrol agents against phytopathogenic fungi. As an initial step to the development of a biofungicide, 259 endophytic bacteria, yeast and fungi were screened. One isolate, N2B2, recovered from the leaves of *Pterocarpus indicus* or Narra, was able to exhibit antifungal activity against three phytopathogenic fungi namely, *Alternaria* sp., *Diaporthe* sp., and *Fusarium oxysporum*. *In vitro* assays showed that the bioactivity was due to multiple mechanisms intrinsic to the isolate. Identification of N2B2 by sequencing of its 16S rDNA revealed it to be *Bacillus amyloliquefaciens*. This is the first mention in literature of the isolation of *Bacillus amyloliquefaciens* from an indigenous tree species and posits the potential of endophytic *B. amyloliquefaciens* to be used as local biocontrol agent against pathogenic fungi of tomato.

Keywords: Biocontrol, *Bacillus amyloliquefaciens*, Antifungal activity, Biofungicides, Phytopathogenic fungi

AS – 36

APPLICATION OF CITRONELLA OIL AND TWO BOTANICAL EXTRACTS AGAINST MAJOR DISEASES ON MUNGBEAN

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Mungbean is a drought-tolerant plant and has the capacity to fix and supply its own nitrogen. However, the plant still suffers from many diseases caused by both biotic and abiotic causes. Hence, a study was conducted to evaluate the effects of plant extracts on major diseases on mungbean as well as to assess the agronomic and yield performance of the crop. The study was laid out in Randomized Complete Block Design. The treatments were the following: T₁ (Control), T₂ (Kocide-Chemical Check), T₃ (Citronella Oil), T₄ (Lemongrass) and T₅ (Lagundi). The foliar application of the plant extracts was done at 14 days after planting (DAP) and at two weeks interval thereafter. An emulsifier was added to citronella oil.

There were four diseases observed and assessed namely: leaf spot, anthracnose, powdery mildew and virus-like disease. Results of the study showed that the application of lagundi extract (T₅) on mungbean plants significantly influenced the percent severity of *Cercospora* leaf spot (*Cercospora canescens*) at 49 DAP with a mean of 29.26% which is comparable to Kocide at 22.59%. On the other hand, application of Citronella (T₃), Lemongrass (T₄) and Lagundi (T₅) did not significantly affect the severity of the other diseases observed and assessed. Furthermore, the application of the different plant extracts significantly influenced plot yield (kg/plot) and the adjusted yield (ton/ha) of mungbean. Plants applied with lemongrass (T₄) had comparable effect with plants sprayed with Kocide obtaining a mean plot yield of 0.20 kg/plot and 0.27 kg/plot, respectively. Similarly, plants treated with Kocide obtained the highest adjusted yield at 0.18 ton/ha but was comparable to lemongrass (T₄) at 0.14 ton/ha and showed the capacity to assist plants in obtaining higher crop yield.

Keywords: plant extracts, diseases, mungbean

AS – 37

APPLICATION OF POTASSIUM ON SWEET CORN FOR THE MANAGEMENT OF MAJOR DISEASES

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With the aim of improving the quality of local sweet corn, this study attempted to identify the optimal level of potassium fertilization on a hybrid sweet corn variety while at the same time assessing its effects on major diseases of sweet corn. Six experimental levels of potassium (65-85-0, 65-85-42.50, 65-85-63.75, 65-85-85 as recommended rate, 65-85-127.50 and 65-85-148.75) were implemented in a Randomized Complete Block Design experiment. Analysis of variance revealed no significant difference among treatment means in terms of percentage disease severity in sweet corn, however, assessments show high severity ratings on leaf spot (*Curvularia* sp.) in T₄ (65-85-85.00) with 61.08%, leaf rust (*Puccinia* sp.) in T₂ (65-85-42.50) with 29.62%, brown spot (*Physoderma* sp.) in T₂ (65-85-42.50) with 45.71% and leaf blight (*Bipolaris* sp.) in T₃ (65-85-63.75) with 55.38% during the last rating period (70 DAP).

Analysis of variance revealed that length of husked ears as well as Total Soluble Solids (TSS) were significantly affected by the application of different levels of potassium. Highest value for ear length was obtained in T₅ (65-85-127.50) with a mean of 28.22 cm while for TSS, the sweetest corn was recorded from T₂ (65-85-42.50) with a mean of 15.20° Brix. Throughout this experiment, the observed non-variability of mean values on most of the parameters can be attributed to the fact that there was one variety used in this experiment.

However, based on these findings, it is recommended that a similar experiment be conducted that will implement more rates of potassium fertilization to really dissect the effects of potassium on TSS as well as on deriving a more conclusive trend that will show the optimum level of potassium fertilization.

Keywords: potassium, Total Soluble Solids, sweet corn, diseases

AS – 38

BACILLUS SUBTILIS FOR THE CONTROL OF DAMPING-OFF ON CAVENDISH BANANA PLANTLETS

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The Cavendish banana is a widely grown commercial cultivar and due to tremendous expansion of new areas for planting bananas, tissue culture laboratories also doubled in number to produce seedlings for massive planting. However, damping-off of plantlets caused increasing mortality to the seedlings. Hence, a study was conducted to assess the effectiveness of varying levels of *Bacillus subtilis* in controlling damping-off organisms on Cavendish plantlets. The experiment was laid out using Completely Randomized Design (CRD) with seven treatments replicated four times. The treatments were: T₁. Untreated, T₂. Thiophanate methyl, T₃ - 1ml/L of *B. subtilis*, T₄ - 2ml/L of *B. subtilis*, T₅ - 3ml/L of *B. subtilis*, T₆ - 4ml/L of *B. subtilis* and T₇ - 5ml/L of *B. subtilis*. The plantlets were dipped into the prepared *B. subtilis* suspensions before planting on sterile coir dust. Subsequent applications were done through drenching on the growing plantlets.

Results showed that the application of *B. subtilis* at higher concentrations of 4 and 5ml/L resulted to lowest percent incidence of damping-off of 2.25% and 1.50%, respectively at 15 DAP. There were four fungal pathogens identified as causal agents, namely: *Fusarium* sp., *Nigrospora* sp., *Aspergillus* sp. and *Penicillium* sp. Plantlets treated with 4ml of *B. subtilis* were the tallest at 6.61 cm. Those treated with 2 ml of *B. subtilis* had the longest roots at 45.20 cm, while those applied with 3 ml of *B. subtilis* had the heaviest roots at 40.15 g.

With these results, it was evident that the application of *Bacillus subtilis* on Cavendish banana positively influenced the growth of the plantlets and had a positive effect on the reduction of damping-off incidence.

Keywords: *Bacillus subtilis*, Cavendish banana, damping-off

AS – 39

**BIOCONTROL ACTIVITY OF FOLIAR ENDOPHYTIC
MICROBIOME FROM BALATINAO BLACK RICE
AGAINST *Xanthomonas oryzae***

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Bacterial leaf streak, caused by *Xanthomonas oryzae* pv. *oryzicola*, is one of the most damaging rice diseases in Asia. Recent studies showed that endophytic bacteria from healthy rice leaves can act as biocontrol agents against *X. oryzae*, but there is little information regarding the biocontrol potential of microbes in Philippine varieties of black rice. This study explored the antagonistic potential of foliar-associated microbiome of the Cordilleran *Balatinao* cultivar. Using dual culture method and volatile organic compounds (VOCs) assay, fungal and bacterial residents from the leaf of the plant sample were tested against *X. oryzae*. Results showed that 10 bacterial isolates and 15 fungal strains have antagonistic potential against *X. oryzae*. Results of dual culture method showed susceptibility of *X. oryzae* to *Bacillus safensis*, and 64.58% and 60.42% growth inhibition by *Penicillium oxalicum* and *Colletotrichum gloeosporioides*, respectively. VOCs assay result revealed 44.00–58.67% induced growth inhibition by *Bacillus indicus*, *Staphylococcus equorum* and *Staphylococcus saprophyticus*, and 58.67-69.33% growth inhibition induced by *Microdochium lycopodium*, and *Leptosphaerulina chartarum*

Keywords: biocontrol activity, bacterial leaf streak, balatinao, dual culture, *Xanthomonas oryzae*

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CLE-PCR: RAPID AND ECONOMICAL DETECTION OF *BANANA BUNCHY TOP VIRUS (BBTV)*

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Banana bunchy top disease (BBTD) caused by *Banana bunchy top virus* (BBTV), is one of the most devastating diseases of banana and plantain. BBTV is an aphid-borne isometric, multi-component, circular single stranded DNA virus belonging to genus *Babuvirus* family *Nanoviridae*. Transport and utilization of asexually produced planting material, including suckers, corm/bits and tissue propagated material from infected plant is the primary means of transmission of BBTV. Hence, detection of BBTV in planting materials prior to distribution and/or planting is necessary. At present, enzyme-linked immunosorbent assay (ELISA) and nucleic-based detection methods, by polymerase chain reaction (PCR) are used to detect BBTV. The latter method is more sensitive and robust. However, PCR assays require DNA extraction that is time consuming and involve the use of reagents that are expensive. In this study, the efficiency of a detection technique involving crude leaf extract of banana as compared with nucleic acids was assessed. Crude leaf extract and DNA from both symptomatic and asymptomatic banana were used in the study. Results showed that BBTV can be detected from both samples with equal sensitivity. The use of crude leaf extract-polymerase chain reaction (CLE-PCR) is now being used in routine BBTV indexing of banana for tissue culture purposes and other resistance studies. With this technique, the laboratory was able to save tremendously in terms of manpower, time and supplies. The technique proved to be rapid, reliable, efficient and economical.

Keywords: *Banana bunchy top virus* (BBTV), polymerase chain reaction, crude leaf extract, detection

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DIFFERENTIATING *Ralstonia pseudosolanacearum* FROM *R. solanacearum* BY COMBINED MORPHO-CULTURAL CHARACTERIZATION AND MICROSCOPY

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Potato bacterial wilt is caused by *Ralstonia pseudosolanacearum* and *R. solanacearum*. These two genomic species can be discriminated by using the Phylotyping scheme and by Biovar analysis. Differentiation of the two species by colony morphology is rarely reported and only by visualization of colony growth. The latter, relative to the first two methods, is simpler, less time-consuming and economical. This study shows that microscopic examination of colony morphology can be also used to discriminate potato isolates of *R. pseudosolanacearum* from *R. solanacearum*. Visual observation of the colony in growth media was not sufficient to separate the two species. By examining individual colonies under 40X microscope magnification, colony characteristics of the two species were found distinct. Color and the ratio of the white and colored portion of the colony proved to be the two discriminating factors. The variations were observed in repeated tests conducted on reference isolates and in representative *Ralstonia* spp. collection. These results demonstrate how colony morphology examination, with microscopy, can still be used to identify species causing bacterial wilt in potato. This test may be used to partially screen large number of isolates, may be used alongside biovar analysis and may substitute the Phylotyping scheme for potato isolates.

Keywords: *bacterial wilt, phylotyping, biovar analysis, microscopy*

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EFFECT OF LONG-TERM STORAGE AND HOST EXPOSURE ON THE AGGRESSIVENESS AND VIRULENCE OF *Colletotrichum* spp. FROM CHILLI

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Anthrachnose is a threat to profitable chilli production in the Philippines. The disease, known to be caused by a number of species of *Colletotrichum*, causes sunken necrotic lesions, with concentric rings of acervuli, both on preharvest and postharvest conditions. In this study, we examined the effect of long term storage and host exposure to the aggressiveness and virulence of select *Colletotrichum* spp. isolated from chilli. Assays were done by using cultures stored for a year and stored for a week and inoculating them to chilli fruits var. Django. For the host exposure, we used reisolated (isolates previously inoculated to chilli) and 7-day old pathogens (from PDA) and inoculated them on the same chilli variety. Results showed that younger cultures (7-day old) are more aggressive and more virulent than the older ones (1-year old). Large to medium sized lesions on wounded and watersoaking symptoms on unwounded chilli fruits inoculated with the seven-day old cultures appeared two days after inoculation (DAI), while minute lesions on wounded chilli fruits inoculated with the 1-year old cultures were apparent only at three DAI. Concurrently, no symptoms on unwounded chilli fruits inoculated with 1-year old cultures were observed. Lesion lengths seven DAI were also significantly higher in fruits inoculated with the seven-day old cultures than those inoculated with one-year old cultures. On the other hand, observations from the experiment suggest that host exposure may not affect aggressiveness but may significantly affect virulence of the pathogen. Necrotic and watersoaked lesions were observed three DAI with both reisolated and 7-day old pathogens. However, lesion measurements seven DAI with the reisolated pathogens were significantly higher than those inoculated with the 7-day old pathogens. This study provides insights into the biology of *Colletotrichum* spp. as influenced by prior and post host-plant recognition.

Keywords: *Colletotrichum*, aggressiveness, virulence

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EFFECT OF POKKAH BOENG INFECTION ON THE YIELD OF LOCAL SUGARCANE VARIETIES

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Pokkah Boeng is caused by various *Fusarium* species and was recently identified as an emerging disease of sugarcane. Several few studies have been conducted in the Philippines on the Pokkah boeng pathosystem, but the extent of damage caused by the disease has not yet been quantified. This study quantified the yield of 10 local sugarcane cultivars grown in the field that were naturally exposed to pokkah boeng. Yield parameters such as stalk height, stalk width, millable weight, sugar content and disease scores were gathered prior to harvesting, at 10 months after transplanting. Millable volume in liters was computed by using a modified equation by Lofton et al. 2012. Results show that infection decreased the volume of canes by at least 20%. ($r=30$). Sugar content in grams was computed using a modified equation from Lingle et al. 2010. Results show that infection decreased the sugar content of the canes by at least 16% ($r=30$). In conclusion, natural infection of pokkah boeng caused significant yield loss and is a possible threat to the sugarcane industry.

Keywords: sugarcane, pokkah boeng, yield loss, *Fusarium* sp.

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EVALUATION OF RICE GERMPLASM AGAINST BROWN PLANTHOPPER (*Nilaparvata lugens* STÅL) AND GREEN LEAFHOPPER (*Nephotettix virescens* DISTANT)

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Rice is an important staple worldwide. High impact on hunger results from rice production constraint cause by various biotic stresses. The use of resistant varieties is still one of the effective major solutions. However, there is scarcity in the source of resistance genes which slows the development of resistant varieties particularly against economically important insect pests that act as vectors for viruses leading up to 100% yield loss such as brown and green leaf hoppers. The vast reservoir of rice accessions in Genebank could be a source of these resistances that could help accelerate the breeding for insect pests-resistant varieties. This study aims to evaluate rice germplasm against brown planthopper (BPH) and green leafhoppers (GLH) and determine possible sources of resistant genes against either or both pest. A total of 2055 traditional rice germplasm were evaluated against BPH and 2049 accessions against GLH. Thirty-two rice accessions showed moderately resistance to GLH while 843 had intermediate reaction while 66 showed resistant reaction and 892 had intermediate reaction to BPH. Notably, three accessions were moderately resistant to both BPH and GLH: “Saigon” (PRRI000039), “Bandera” (PRRI000040) and “Luding-luding” (PRRI000113). The evaluated accessions exhibited resistance to one or more insect pests would be recommended for further validation and could be utilized as source of resistance for the development of new resistant rice varieties.

Keywords: brown planthopper, evaluation, genebank, green leafhopper, resistance, rice

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IDENTIFICATION OF A FUNGAL PATHOGEN CAUSING POSTHARVEST ANTHRACNOSE IN BANANA FRUITS CV. CAVENDISH

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Anthracnose is one of the major pre- and post-harvest diseases of banana. It is caused by multiple species of *Colletotrichum*. Apparently healthy banana cv. fruits harvested from the field showed anthracnose symptoms after several days in a plastic chamber. To identify the causal pathogen(s), samples were collected and subjected to further characterization. Fungi were isolated from anthracnose-infected banana tissues. Fungi were grown in Potato Dextrose Agar (PDA) and conidia were examined by microscopy. DNA was also extracted to amplify the internal transcribed spacer (ITS) region by polymerase chain reaction (PCR). The amplified PCR products were then sent for DNA sequencing. To establish Koch's postulate, the fungi were inoculated to healthy banana fruits in a detached assay. Two fungi were isolated from the anthracnose-infected tissues. Fungi A had falcate-shaped conidia and a white cottony growth in PDA. Fungi B had cylindrical-shaped conidia and a white cottony growth that turns orange with age in PDA. Based on DNA sequencing of the ITS region, Fungi A was *Fusarium* spp. and Fungi B was *Colletotrichum musae*. However, in the detached assay, only Fungi B caused anthracnose in banana fruits. Hence, *C. musae* was the causal pathogen of post-harvest anthracnose in banana cv. Cavendish. The findings provide useful information on the etiology of post-harvest banana anthracnose that would be useful in banana breeding programs.

Keywords: *Colletotrichum musae*, internal transcribed spacer, *Fusarium* spp.

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MOLECULAR PHYLOGENETICS AND THE PREPATENT PERIOD DETECTION OF TOMATO LEAF CURL VIRUS (TOLCV)

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Tomato yellow leaf curl disease is one of the most destructive **tomato diseases** destroying the tomato crops globally. Tomato leaf curl virus (ToLCv) spread of infection have been attributed to its vector, the silverleaf whiteflies (*Bemisia tabaci*). Here, C1RAP gene was targeted for molecular phylogenetics revealing that the Philippine strain formed monophyletic cluster with strains from South Korea, Africa, Israel and USA implicating that it is related to the Tomato Yellow Leaf Curl Virus (TYLCV) ancestor of ToLCV. Ninety-four (94) samples composed of leaves, whiteflies, soil, water samples and commercial seeds were purposively obtained from farms practicing organic farming. The application of PCR, Loop-Mediated Isothermal Amplification (LAMP) and Recombinase Polymerase Amplification (RPA) were investigated. Unexpectedly, ToLCV were detected in seedlings 0 day after inoculation even before the symptoms manifested that later appeared at 12-day post inoculation confirming that the soil and seeds can be probable sources of infection.

Keywords: molecular phylogenetics; tomato leaf curl virus (ToLCV); recombinase polymerase amplification (RPA); polymerase chain reaction (PCR); loop-mediated isothermal amplification (LAMP).

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**MORPHO-CULTURAL AND GENETIC
CHARACTERIZATION OF PHILIPPINE ISOLATES OF
Colletotrichum gloeosporioides CAUSING MANGO
ANTHRACNOSE**

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Anthracnose, caused by *Colletotrichum* spp., has been considered as one of the most destructive postharvest diseases of mango in the Philippines. This study characterized *Colletotrichum gloeosporioides* isolates, causing mango anthracnose, through cultural, morphological and molecular analyses. Isolates were obtained from various areas in the Philippines and subjected to virulence assay. Isolates from Nueva Vizcaya, Guimaras and Davao had the highest mean lesion diameter. Morphological and cultural characterization revealed similar results for most of the isolates. Spores were unicellular, ovoid-shaped with obtuse ends and size ranges from 10.31 to 14.23 µm in length and 3.06 to 4.99 µm in width; while, growth on potato dextrose agar was circular, cottony mycelial growth, milky white colony with production of orange and black fruiting bodies. Fungal pathogens were molecularly identified using species-specific primers CgInt and ITS4 (450 bp). Phylogenetic analysis of the internal transcribed spacer (ITS) 18S rDNA (680 bp) and β-tubulin gene (1500 bp) revealed no distinct genetic relationship among the isolates based on their geographical origins and phenotypic characters. Gene sequences, however, revealed that the test isolates belong to the *Colletotrichum gloeosporioides* species complex. This is the first confirmed report describing the molecular characteristics of *C. gloeosporioides* causing anthracnose of mango in the Philippines. Information can be used in developing effective and durable disease management strategies for mango anthracnose.

Keywords: *anthracnose, Colletotrichum gloeosporioides, morphology, molecular*

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PHENOLOGICAL EVENTS AND PURPLE BLOTCH INCIDENCE OF DIFFERENT VARIETIES OF GARLIC UNDER ILOCOS NORTE CONDITION

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Garlic is one of the most economically important cash crops in the Ilocos region but its productivity however, is hampered by the attack of pests. Phenology may help in predicting the incidence of pests (Nixon, 1998). This research was conducted to determine the phenophases and purple blotch (*Alternaria porri*) incidence of different varieties of garlic in the field under Ilocos Norte condition.

Phenological observation and monitoring of purple blotch incidence were done. Correlation and regression analysis were employed. Results shows that the emergence of each leaf required an average of 5 to 6 days regardless of the weather condition or planting dates except for Batanes cultivar planted in November 14. This cultivar requires an average of 8 days for each leaf to emerge and 7 days for those that were planted in December 5. Results of the analysis revealed that temperature did not significantly affect the rate of phenophases of garlic. It was only the Batanes cultivar that air temperature significantly affected the rate of occurrence of the phenophases of the crop during November 14 planting. Lesions of purple blotch were noticed on older leaves during the development of the 10th leaf or at the later part of bulb formation stage during November 14 planting. Garlic planted on November 22 had purple blotch manifested during the development of the 9th leaf and on November 30 and December 5, during the development of the 8th leaf. Relative humidity significantly affected the occurrence of purple blotch at different planting dates. Air temperature significantly affected the occurrence of purple blotch during the November 30 planting only. The information derived is useful in determining the appropriate time of applying pest management strategies based on weather conditions and phenophases of garlic to minimize the application of pesticides which is toxic to the environment.

Keywords: *garlic, phenophases of garlic, weather, purple blotch*

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VERIFICATION OF THE DEVELOPED PEST MANAGEMENT PRODUCTS FOR VEGETABLE PRODUCTION USING DIFFERENT FERTILIZER MANAGEMENT SCHEMES

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Due to the increasing concern about the risk associated with chemical pesticides, development of alternative control methods for crop production such as the use of biopesticides against major pests of vegetable crops is a necessity. Mariano Marcos State University (MMSU) researchers were able to develop promising biopesticide products for the common insect pests of vegetable like tomato fruitworm, thrips and mites for pepper and epilachna beetles in eggplant. The different products were coded as MMSU Bio-In 3, MMSU Bio-In 6 and MMSU Bio-In 8. Using the formulated biopesticide products, the effectiveness was comparable to chemical pesticides in an organic farm. The effectiveness of the products was verified also in an inorganic and in combination of organic and inorganic farm. Results show that the effectiveness of the developed MMSU Biopesticide products was comparable with chemical pesticide regardless of different fertilizer management scheme. Lower pest incidence was noted and comparable to the chemical pesticide. Further, effectiveness of the biopesticide was enhanced when used as an alternate to chemical pesticide as indicated by the higher yield obtained in all the crops evaluated. Cost and return analysis also shows that the developed MMSU Biopesticide was comparable to chemical pesticide especially when used as an alternate to chemical pesticide. Based on the findings, the use of biopesticide presents a promising future for safer and lesser if not pesticide-free vegetables and less dependence of farmers on the use chemical pesticide.

Keywords: Biopesticide, efficacy, pest and diseases, organic, inorganic, combination

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**ADVANCES IN THE DEVELOPMENT OF MALIPUTO
(*Caranx ignobilis*) SEED PRODUCTION TECHNOLOGY
IN THE PHILIPPINES: LARVAL DIET
AND STOCKING DENSITY**

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The National Fisheries Research and Development Institute-Freshwater Fisheries Research and Development Center (NFRDI-FFRDC) has continuously conducted researches geared towards the development of Maliputo, *Caranx ignobilis* (Forsskål, 1775), seed production technology. The present study summarizes the recent advances in larval rearing of *C. ignobilis*. Larval experiments were conducted in two rearing trials to determine the effects of three feeding regimes and three stocking densities on growth and survival of larvae. Larvae fed with rotifer and/or in combination with copepod showed significantly higher survival rates ($23.47 \pm 5.50\%$ and $14.37 \pm 6.71\%$ in rotifer+copepod and rotifer+copepod+*Artemia*, respectively) than those fed with rotifer+*Artemia* ($11.67 \pm 3.29\%$). Growth was highest in larvae fed with rotifer+copepod+*Artemia* at 10.28 ± 1.51 mm. Larval survival was also higher in lower stocking density (5 larvae per liter) with 9.6% SR compared to two other treatments (5.8% and 1.2% in 10 and 30 larvae per liter, respectively). These improvements in larval rearing protocol as a result of these experiments helped improved larval survival from 0.01-1.6% in previous years to up to 29% in 2018. Further investigation on larval behavior and nutrition is needed to attain consistency of larval survival. Nevertheless, the development of this technology signifies the importance of research in addressing the gaps that hinder the successful aquaculture of *C. ignobilis*.

Keywords: *Caranx ignobilis*, induced breeding, larval rearing, seed production technology

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ANALYSIS OF TRADED MARINE ORNAMENTAL FISH IN THE PHILIPPINES: OCCURRENCE AND SUSTAINABILITY

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This study assessed the traded marine ornamental fish in the country through survey interview and focus group discussions to identify species gathered, major collection sites, volume of catch per species per area and assess conservation measures in the areas. All of the traded fishes were gathered from the wild and comprised 1,200 species belonging to 144 families and 67 fish groups. The largest groups were: Labridae (hogfishes, 73 species), Pomacentridae (clownfishes, chromis, damselfishes, 44 species), Chaetodontidae (butterflyfishes, 36 species), Pomacentridae (angelfishes, 26 species), Gobiidae (gobies, 22 species), Acanthuridae (tang, 20 species), Serranidae (anthias, groupers, 19 species) and Serpulidai (anemones, 13 species). Top species were green chromis, false percula clownfish, firefish goby, damselfish, pacific neon goby and three-stripe damselfish. Of these fishes, 426 species from 71 families, 43 groups (35 fish and 8 invertebrate groups) were validated in the survey interview and FGDs. The fishes occurred in twelve provinces in nine regions in the country with Region 4A-Calabarzon (Quezon and Batangas), Region 3-Central Luzon (Zambales) and Region 7-Cebu (Cebu) as the major sources. Coral reef system in these areas had been categorized as fair to poor. There is no local IUCN assessment of marine ornamental fish but based on global IUCN status, 165 species were categorized as not yet assessed, 210 species as least concern, 39 species as uncategorized, 10 species were data deficient, 1 species as vulnerable, 2 species as near threatened and 1 species as endangered. Presently, there is a pressing concern with the sustainability of resources over the continued gathering of these fishes from the wild. Existing national and local policies needs to be reviewed to enact appropriate policy regulations on conservation.

Keywords: marine ornamental fish, ornamental trade, resource sustainability

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**BREEDING AND LARVAL REARING OF ASIAN MOON
SCALLOP *Amusium pleuronectes* IN GUIUAN,
EASTERN SAMAR, PHILIPPINES**

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The study investigated the conditioning method, spawning and larval development of *Amusium pleuronectes* in Guiuan, Eastern Samar. Conditioning of *A. pleuronectes* in the hatchery yielded high survival rate (48.06±5.95%) in flow-through system without substrate and water temperature maintained at 28°C-29°C. *Isochrysis galbana* and *Chaetoceros calcitrans* were suitable microalgae diets for *A. pleuronectes* consumed at 7,388,888 cells·min⁻¹. Significant results were applied in scallops with 18-23 mm shell length. Results showed high survival rate of 96.57±2.04%, Average Daily Growth Rate (ADGR) of 0.13±0.04 mm day⁻¹ and Specific Growth Rate (SPR) of 3.92±1.31% d⁻¹. Natural spawning was successful under controlled condition while induced spawning trial through thermal stimulation, food shock, sexual stimulation and serotonin injection resulted in unsuccessful release of sperm and eggs. The estimated number of fertilized eggs per spawning ranged from 220,000-1.4 million. Fertilized eggs appeared spherical and darkly colored with 54.2-62.57 µm in diameter. After 9 hours the larvae developed into trochophore with 59.08-84.4 µm in length. D-veliger with 120.37-157.07 µm shell length developed within 24 hours. At seventh day the umbo had become well developed with shell length 135.45-73.36 µm. By the ninth day, pedi-veligers were seen in the culture. Then, spat grew to 312.41-509.48 µm at day 16 and survived until four months with shell length 4-10 mm. For the larval rearing, stocking density of *Amusium pleuronectes* larvae observed high survival rate (0.04±0.03%) at 200 larvae/L while 0.00±0.00% at 800 larvae/L due to contamination of protozoans in culture medium.

Keywords: scallop, conditioning method, spawning, larval development

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CIGUATERA IN THE PHILIPPINES: EXAMINING REEF FISH VECTORS AND ITS CAUSATIVE BENTHIC DINOFLAGELLATES IN VISAYAN AND SIBUYAN SEAS

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Ciguatera Fish Poisoning (CFP) is primarily caused by ingesting reef fishes contaminated with Ciguatoxins (CTX) produced by benthic dinoflagellates, particularly the *Gambierdiscus* species. The unpredictability of this type of food poisoning poses risk to the fish trade industry and public health. This study aimed to provide useful information on Ciguatera in the country. Different reef fish species and host-macroalgae were collected in the Visayan and Sibuyan Seas. Ciguatoxins were extracted from the reef fish samples following the method described by Oshiro *et al.* (2010) and toxicity was determined qualitatively using mouse bioassay. Furthermore, cell density estimation of causative benthic dinoflagellates isolated from the host-macroalgae was done through microscopy. It was observed that 4.46% of the total reef fish samples collected were positive with ciguatoxin. Spatially, Carles, Iloilo has the highest number of toxic specimens belonging to *Epinephelus* spp., *Lethrinus* spp., *Lutjanus* spp., *Scarus* spp., *Siganus* spp., and *Sphyraena* sp. followed by Daanbantayan, Cebu and Cajidiocan, Romblon. Based on the gathered data from three sampling sites, fish toxin is dependent on area. Moreover, fish size has no direct relationship to fish toxicity. For the causative benthic dinoflagellates, higher cell density counts were observed during dry season. Causative organisms of CFP, *Gambrierdiscus* spp., *Ostreopsis* spp. and *Prorocentrum* spp., were all present in sampling sites. *Ostreopsis* spp. dominated the other two causative organisms by allelopathy. High frequency of toxic reef fish samples is correlated to the observed high cell density counts of the causative organisms during dry season.

Keywords: Ciguatera, *Gambierdiscus*, marine biotoxins, food safety, food contaminants

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DEVELOPMENT OF DATABASE SYSTEM FOR FISHERIES VULNERABILITY ASSESSMENT TOOL (FISHVOOL)

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The country through the Climate Change Act of 2009, recognizes the potential dangerous consequences of climate change that could damage the ecosystems and biodiversity which in return can result to the country's loss in environment and economy. In response to the emerging detrimental effects and impacts of climate change to the fisheries sector, the National Fisheries Research and Development Institute (NFRDI) has developed the Fisheries Vulnerability Assessment Tool (FishVool) that measures the sensitivity, exposure and adaptive capacity using interview survey metrics and analytics. FishVool has already been piloted in selected municipalities of all regions in the Philippines by BFAR Regional AMIA Focal Persons. Here we describe the design and development of database to store and analyze data from the regions. It is consistent with the questionnaire and rubrics for scoring i.e. survey data input is divided into three (3) different assessment factors, namely sensitivity, exposure, and adaptive capacity. One of the outputs of FishVool is the creation of color-coded vulnerability maps. Areas marked with red have high vulnerability, orange with medium vulnerability, and yellow with low vulnerability. FishVool will be able to aid in identifying areas that are highly vulnerable to climate change, which will be important support in instituting an adaptive and mitigation measures and an important platform and tool for Climate Change-related information and planning in the Philippines.

Keywords: climate change, sensitivity, exposure, adaptive capacity, vulnerability

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DISTRIBUTION AND ABUNDANCE OF ICHTHYOPLANKTON IN LAGONOY GULF IN RELATION TO OCEANOGRAPHIC CONDITIONS

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Lagonoy Gulf is one of the country's major fishing grounds and considered as one of the largest and most important fishing ground for tuna, tuna-like, and elasmobranches species in the Bicol region. It is situated in Southern Luzon and is bordered by the three provinces of Camarines Sur, Albay, and Catanduanes. Investigation on the distribution and abundance of phytoplankton and ichthyoplankton in Lagonoy Gulf were carried out onboard on wet and dry season basis. A total of 23 pre-determined sampling stations were established in Lagonoy Gulf with an average distance of 7-9 nautical miles apart from each other. Results showed that highest concentration of phytoplankton communities for the month of May 2013 was observed in the southwestern part of the Gulf with an average density of 560 cell/100m³. For November 2013, phytoplankton amassed in the northwestern and southeastern part of the gulf predominantly in stations near the coastal areas. For the succeeding year, high abundance was again observed during May (2014) survey in the southwestern and southern part of the gulf with a density of 730 cell/100m³ while much lower density was observed in November survey with only 430 cell/100m³. Both surveys were dominated by filamentous cyanobacteria *Tricodesmium erythraeum* accounting to 92% of the total phytoplankton densities. Fish eggs were more abundant during the May 2014 and May 2013 survey with 580 ind/100 m³ and 380 ind/100 m³ with centroid of egg distribution tends to be found in the middle moving towards the mouth of the gulf which showed a clear offshore transport. This is in contrast with the November 2014 and 2013 surveys during which the density observed was lower with only 280 ind/100 m³ and 200 ind/100 m³.

Keywords: Phytoplankton, ichthyoplankton and Lagonoy Gulf.

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EFFICACY OF DIFFERENT HORMONES IN INDUCING SPAWNING OF MUDFISH, *Channa striata*

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Mudfish (*Channa striata*), locally known as dalag, is an important indigenous fish for aquaculture. The aquaculture of this species in the Philippines has not yet been fully developed despite its potential for culture due to its high market price and tolerance to adverse environmental conditions. Induced breeding of indigenous species is one of the options to increase seed stocks and production. This study determines the efficacy of commercially available hormones to induce spawning of *C. striata*. A total of eighteen mature male and female *C. striata* weighing 200-300 grams were used in this study. Each spawner was injected intramuscularly using human chorionic gonadotropin (HCG), leuteinizing hormone releasing hormone analogue (LHRHa+), and salmon gonadotropin releasing hormone (S-GnHRHa) (Ovupin). After injection, each spawning pair (1 female: 1 male) was placed in hapa net. Latency period and incubation period observed in all treatments ranged from 21-23 hours and 20-26 hours at 26-28°C, respectively. Highest mean values of relative spawning fecundity of 39.07 ± 0.77 gram of body weight, fertilization rate of $97.31 \pm 0.06\%$ hatching rate of $89.70 \pm 0.04\%$ were obtained using 0.5 ml/kg of Ovupin. Thus, *C. striata* can be successfully induced in captivity using commercially available natural and synthetic hormones with higher spawning success rate using Ovupin.

Keywords: mudfish, *Channa striata*, induce spawning, hormones

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FACTORS AFFECTING COMPOSITION, DISTRIBUTION AND ABUNDANCE OF ICHTHYOPLANKTON IN MANILA BAY

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Manila Bay is a semi-enclosed body of water and was once considered as one of the major fishing grounds in the Philippines. The continuous changing environment, human activities such as destructive fishing practices, reclamation, and domestic waste influx lead to the decline of fish population in the bay. Fish larvae collection was carried out to determine the ichthyoplankton assemblages in the bay, CTD multi parameter was also lowered to obtain environmental data that might affect the distribution and assemblages of fish eggs and larvae in the area. Eight established sampling stations were placed throughout the bay with an average distance of 5-6 nautical miles and sampled every other month from January 2017 to November 2018. Horizontal towing of bongo net with attached calibrated flowmeter was used in collecting fish larvae. A total of 1,240 fish larvae were collected which belongs to 36 families. The results show that more fish eggs and fish larvae were observed during March 2018 survey, a representative of northeast monsoon with 711 ind/100 m³ fish eggs and 268 ind/100 m³ fish larvae and followed by March 2017 survey, also a representative of northeast monsoon with 688 ind/100 m³ fish eggs and 255 ind/100 m³ fish larvae, respectively. Since fish eggs were drifters and move along the surface currents, they can be found throughout the bay. The concentration of fish larvae were mostly found in the northern and eastern part of the bay. Small pelagics dominate the total composition of fish larvae family in Manila bay such as sardines, slipmouths, anchovies, and mullets. The most dominant fish families were Clupeidae, followed by Leiognathidae and Nemipteridae. Other families that complete the top five were Mugilidae and Gobiidae.

Keywords: Ichthyoplankton, Manila Bay

AS – 58

GROWTH RESPONSE OF GLASS EELS, *Anguilla* sp. FED WITH DIFFERENT DIETS IN CAPTIVITY

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Glass eels, *Anguilla* sp. are intensively traded internationally due to escalating demand for intensive culture resulting to a progressive decline of captures. Information on the captive culture process is scarce and limited success in the culture period was mainly due to inaccurate feeding and unsuitability of the diet. Thus, a feeding experiment was conducted to evaluate the potential of three different diets (*Tubifex* sp., paste formulated diet and granulated commercial feed) on the growth and survival of glass eels reared in tanks. Glass eels with initial body weight and length of 0.1310 ± 0.03 g and 4.88 ± 0.20 cm, respectively were kept in 0.63 cubic meter circular tanks and fed with experimental diets over a period of 90 days. At the end of the feeding trial, the final body weight of 2.216 ± 0.19 g, total length of 10.28 ± 0.49 cm and survival rate of 94.44 ± 3.03 was obtained from the treatment fed with *Tubifex* sp. which is significantly higher than the rest of feeding treatments. Feed conversion ratio (FCR) was lower and specific growth rate (SGR) was significantly higher for fish fed with *Tubifex* sp. with value $3.39 \pm 0.12\%$ /day than fish fed with formulated and commercial feeds with values $1.96 \pm 0.17\%$ /day and $1.35 \pm 0.55\%$ /day, respectively. Therefore, *Tubifex* sp. is the most suitable feed for glass eels in captivity to achieve high survival rate and to attain maximum growth in shortest possible time.

Keywords: Glass eels, *Anguilla* sp. culture, feeding

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MOLECULAR IDENTIFICATION OF NEMATODES IN RABBITFISH (*Siganus guttatus*) FROM SELECTED CAGE CULTURED AREAS IN THE PHILIPPINES

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The rabbitfish, *Siganus guttatus*, popularly known as samaral or kitong, is widely cultured in brackishwater ponds, pens and cages as well as in sea pens and cages in several regions in the country. It is also been considered as a good mariculture species in terms of its desirable production traits and an excellent food fish that commands a high market price hence a greater profit margin. However, massive mortality was observed in some areas in the Philippines which was caused by parasitic infestation. A total of 55 individuals of *S. guttatus* were collected and samples were transported to the laboratory for parasitological analysis. Three (3) species of parasites were isolated in the study namely: *Anisakis pegreffii*, *Contracaecum ogmorhini* and *Spirocamallanus philippinensis*. DNA sequence and phylogenetic analysis confirmed the 99%, 82% and 99% similarity of the parasite DNA isolates to *A. pegreffii*, *C.ogmorhini* and *S. philippinensis*, respectively. The identified parasites were different species of nematodes with 25.45% prevalence and mean intensity of 3-5 parasite individuals per host.

Keywords: rabbitfish, nematode, molecular identification, prevalence

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**NATIONAL STOCK ASSESSMENT PROGRAM (NSAP):
INTERACTIVE ATLAS OF PHILIPPINE MARINE CAPTURE
FISHERIES USING A WEB-BASED GEOGRAPHIC
INFORMATION SYSTEM (GIS)**

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The National Stock Assessment Program (NSAP), which has been implemented since the late 1990s, aims to provide standardized, specific, and time-series information on the landed catch and effort of the marine capture fisheries sector for the sustainable management of the country's aquatic resources. In 2017, NSAP published the first Philippine Capture Fisheries Atlas. However, the information presented in this publication is limited due to its hardcopy format. Hence, the NSAP Interactive Atlas of Philippine Marine Capture Fisheries was developed. The Interactive Atlas is a web-based portal that utilizes information from the existing NSAP Database and can be openly explored by stakeholders, fisherfolk, and the general public. Its maps run with an open-source mapping platform provided by a third-party web-based Geographic Information System (GIS) software, which allows it to be viewed in geo-formats. The Interactive Atlas provides real-time monitoring maps concerning the status of fisheries, general information on catch, effort, and Catch per Unit Effort (CPUE) at the national, regional and local scales among others. In addition, the software is not restricted only to NSAP database, but it is also designed to receive multiple open-source information for further enhancement. Taken together, the Interactive Atlas can be used as a source of awareness for the public and provides an easy access to data-rich information regarding the status of marine fishery resources in the Philippines.

Keywords: Capture fisheries, Marine fishery resources, NSAP

AS – 61

**NATIONAL STOCK ASSESSMENT PROGRAM:
EXPLOITATION RATES OF SELECTED FISH SPECIES IN
VARIOUS FISHING GROUNDS IN THE PHILIPPINES
USING 2016 BASELINES AND AVERAGE CATCH PER
UNIT EFFORT 2015-2016**

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The National Stock Assessment Program (NSAP) primarily aims to develop standardized, specific and time-series information on capture fisheries for the management of the country's marine resources in major fishing grounds. Among the possible Reference Points (RP), NSAP selected the Exploitation Rate (E) and Catch per Unit Effort (CPUE) as the RPs to be used in assessing the status of fish stocks in the country. NSAP set the Limit Reference Point (LRP) for demersal and neritic tunas at $E = 0.50$. For small pelagic, the LRP value was decided to be at 0.60 based on its high fecundity and relatively short life cycle of about 3 years and $E = 0.40$ for oceanic tunas, which are long lived with a life cycle of about 10-12 yrs. For 2016, the dominant species for small pelagic, demersal, neritic and oceanic tuna has an average of 0.65, 0.65, 0.70 and 0.72 E rates, respectively. These E rates are higher than the LRP set by NSAP, suggesting unsustainable harvest of the fish stocks in major fishing grounds monitored. Meanwhile, the 2014-2016 average CPUEs for the major fishing gear in the country namely, ring net, trawl, gill net, push net, hook and line, and Danish seine, culled out from and computed using NSAP database system is also decreasing. The decreasing three year CPUE trend indicates overexploitation of the stocks. The overall view presented by these E rates 2016 and CPUE 2014-2016 trend suggests that most of the Philippine traditional fishing grounds continue to be subjected to unsustainable fishing activities.

Keywords: stock assessment, exploitation rate, CPUE

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REPRODUCTIVE BIOLOGY OF JAPANESE THREAD FIN BREAM, *Nemipterus japonicus* (BLOCH, 1791) IN MANILA BAY, PHILIPPINES

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Information on the reproductive biology of *Nemipterus japonicus* (Bloch, 1791) in Manila Bay was investigated from 2017-2018. Monthly collection was conducted from selected sites of the bay. Collected samples came from various fishing gears such as bottom gillnet, bottom set long line, motorized dredge, multiple hook and line, and trawl. A total of 1,463 samples were collected with total length ranging from 6.5 cm to 23.2 cm for the female and 10.9 cm to 27.3 cm for the male. The weight ranged from 16.95 g to 168.52 g and 21.88 g to 276.04 g, respectively. Female species was the most abundant in the collected samples, particularly during the month of June. Overall mean sex ratio was 2:1 (F: M) which departed from the expected ratio of 1:1. This species showed a continuous reproduction with peak of spawning during the last quarter, particularly during November and December. This coincides with the result of the Gonadosomatic Index (GSI). The estimated length at first maturity (Lm50) was at midlength of 16.25 cm for the female and 18.75 cm for the male. Fecundity ranges from 14,285 to 298,080 with size ranges 13.6 cm to 22.5 cm.

Keywords: *Nemipterus japonicus*, sex ratio, spawning season, Gonadosomatic Index (GSI), Length at first maturity (Lm50).

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SEED PRODUCTION AND GROW-OUT CULTURE OF THE BLUE SWIMMING CRAB *Portunus pelagicus*

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This study conducted four experiments that aimed to develop systems for crab grow out culture and evaluate the possibility of using hatchery-reared crabs for soft-shell production. The first experiment evaluated feed types in terms of survival of *P. Pelagicus* from megalopa to crab instar stage. The highest survival rates were observed in *Artemia* in the two trials conducted (31.0 ± 3.0 and 40.0 ± 3.8 %). This study also evaluated and compared the survival and growth of day 20 crab juveniles in wooden tanks and in hapa net cages at three stocking densities. The highest survival rate was observed in wooden tanks at 75 ind.m^{-2} (20.7 ± 3.8 %), while the highest growth rate was observed in hapa net cages at 100 ind m^{-2} (20.6 ± 2.7 %). However, in terms of the different stocking densities in both the rearing mediums, no differences in survival, growth and carapace width were found, except at 50 ind m^{-2} stocking density in wooden tanks where there was significantly faster growth of crabs compared to the two other stocking densities. For the survival and growth of ~5 g crab juveniles reared in B-net cages, three stocking densities were tested. As of the 30th day of the experiment, the crab juveniles stocked at 15 ind m^{-2} had the highest survival (46.7 ± 0.0 %), while the crab juveniles stocked at 5 ind m^{-2} had the fastest growth (26.83 ± 10.83 %). This study also used hatchery-reared *P. pelagicus* crabs to produce soft-shell and evaluate its economics and profitability. Out of the 30 crabs placed individually in perforated boxes, 11 crabs with a total weight of 1.05 kg were harvested. Although only 37.0% of the crabs had achieved good quality soft-shell, the projected profit would still be 41% of the total investment after 10 harvests per year.

Keywords: *Portunus pelagicus*, megalopa, stocking density, soft-shell

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SEA CUCUMBER AQUACULTURE: SEED PRODUCTION AND PRELIMINARY TRIAL ON GROW-OUT CULTURE OF THE SEA CUCUMBER *Holothuria scabra* IN EASTERN SAMAR, PHILIPPINES

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Experiments involving spatio-seasonality (sites in Guiuan and Salcedo during April, July and September 2018), stocking density (300, 500 and 1000 ind/cage) and rearing media (floating hapa net and rearing tank) was conducted to optimize methods for nursery rearing of *Holothuria scabra* in Eastern Samar. Preliminary grow-out culture and release-size experiment were done in 2018 and some predators, parasites and diseases of sea cucumber seeds were also studied since 2017. Growth performance of juveniles was significantly better in Guiuan ($0.11 \text{ g}\cdot\text{d}^{-1}$), compared to Salcedo ($0.06 \text{ g}\cdot\text{d}^{-1}$). However, survival rates were higher in Salcedo (75.67%) compared to that of Guiuan (66.89%) ($p>0.05$). Rearing during April 2018 had the highest growth ($0.08 \text{ g}\cdot\text{d}^{-1}$) and survival rate (71.39%) but were lowest during October 2018 (growth rate of $0.06 \text{ g}\cdot\text{d}^{-1}$; survival rate of 70.89%) ($p>0.05$). Significant interaction was found between the effect of spatio-seasonality of rearing on the growth performance ($p>0.05$) but not on survivorship of *H. scabra* juveniles ($F=0.497$, $p=0.621$). Juveniles grew best at 300 ind/cage stocking density ($0.12 \text{ g}\cdot\text{d}^{-1}$) and lowest in 1000 ind/cage ($0.03 \text{ g}\cdot\text{day}^{-1}$). Survival rates of the juveniles in 300 ind/cage were also highest (80.3%) ($p < 0.05$). Growth performance was better in floating hapa net cages compared to rearing tanks. However, rearing tanks yielded higher survival rate (67.83%) than floating hapa nets (56.11%) ($p > 0.05$). In grow-out, the juveniles grew up to 62.75 g ($0.95 \text{ g}\cdot\text{d}^{-1}$) in August 2018 but the survival rate dropped to 15.67% due to the effects of natural disturbances. Small-sized juveniles (1-3g) were more vulnerable (3.5%) while larger juveniles (8-10g) had better survivorship (10.5%). Autolysis also lowered survivorship of larvae while crabs and isopods (*Cymodoce* sp.) were found to be culprits to sea cucumber nursery rearing.

Keywords: *Holothuria scabra*, sea cucumber, sandfish aquaculture

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SEMI-NESTED RT-PCR DETECTION OF TILAPIA LAKE VIRUS (TiLV) IN HATCHERY REARED TILAPIA (*Oreochromis niloticus*) FINGERLINGS WITH NO CLINICAL SIGNS

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Tilapia lake virus (TiLV), an emerging infectious pathogen that has been identified in diseased tilapia, threatens the worldwide tilapia industry. This study aims to detect and profile the prevalence of TiLV in the country using molecular diagnostics. TiLV detection was done using a semi-nested RT-PCR to detect the segment 3 (250 bp and/or 415 bp) of TiLV genome. Detection of one band of 250 bp indicates light infection and presence of double bands indicates heavy infection. Results showed that 2 samples tested positive in 250 bp out of ten fingerling samples collected from a private hatchery. Fingerlings collected that tested positive showed no symptoms of infection. However, they were reared in high stocking densities which likely triggered stress and resulted in high mortalities. There is an immediate need for further research on the molecular epidemiology of TiLV, monitoring and surveillance to understand and monitor the occurrence of TiLV in the country.

Keywords: tilapia lake virus, TiLV, tilapia, *Oreochromis niloticus*

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SPATIAL AND TEMPORAL VARIATIONS OF EUTROPHICATION IN MANILA BAY FROM 2017 TO 2018

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Eutrophication or the excessive nutrient enrichment of water bodies is a growing problem around the world. For the past years, it has become a serious environmental problem in Manila Bay and has continuously degraded its ecological integrity. In this study, the current state of eutrophication in the bay was documented to determine its spatial and temporal variations. Thus, 16 stations were sampled every two months from January 2017-November 2018. Based on the results, Manila Bay was still extremely contaminated with high nitrogen species, particularly nitrate (41.38 μM), in the near-bottom waters. Other inorganic nutrients, such as nitrite (11.13 μM), phosphate (0.62 μM) and silicate (208 μM), reached their highest concentrations near tributaries and coastal areas of the bay. Meanwhile, chlorophyll *a*-enriched areas were more noticeable in the northern part. This was in agreement with previous observation that eutrophication intensifies through time, especially during wet season (July to September). This resulted from the influx of elevated freshwater from rivers and surrounding coastal areas, mostly in the northern half of the bay, and was aggravated by contaminated wastewater effluent from anthropogenic activities. It also formed stratification in the water column, resulting in nutrient-enriched but dissolved oxygen-depleted near-bottom waters. Thus, this study proposed a closer attention to the areas identified to be the main contributor of excessive nutrient fluxes and develop effective mechanisms that will reduce the inputs of nutrients in the coastal waters, thereby preventing further undesirable changes in the ecosystem of Manila Bay.

Keywords: eutrophication, inorganic nutrients, Manila Bay, nitrate

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SPATIO-TEMPORAL DISTRIBUTION OF HEAVY METALS (Pb, Cd, AND Hg) AND HYDROGEN SULFIDE (H₂S) IN MANILA BAY FROM 2017-2018

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To appraise the extent of pollution in Manila Bay, heavy metal and hydrogen sulfide concentrations in 16 pre-established sampling stations were determined from 2017-2018, representing the different seasonal winds (Southwest and Northeast monsoons and Tradewinds or Easterlies). Trace amounts of these two physical parameters are naturally occurring in the marine environment. However, at high concentrations they can pose a significant risk to both the aquatic biota and man. Surface water and sediment samples collected from the bay were analyzed for heavy metals (Pb, Cd, and Hg) using atomic absorption spectroscopy (AAS) while H₂S concentrations were determined by 4500-D Methylene Blue Method. Results revealed that Cd concentration in March 2017 reached a peak of 3010 µg/L, 301 times the critical value recommended by the DENR and ASEAN (10 µg/L). This dramatic spike was recorded on northern half of the bay, suggestive of irregular inputs from anthropogenic sources in the area. Very high Pb (196.9±105.6 µg) and Hg (0.14±14.54 mg/kg) levels were also reported to exceed their respective permissible limits, marking the bay as moderately heavy to heavy polluted with these metals. H₂S concentration ranged from <0.49 mg/kg to 2.757 mg/kg all throughout the sampling months and stations, showing a sharp decline from the 2015-2016 data. The presented findings form the basis for future monitoring since alarmingly high heavy metal levels in Manila Bay were reported in 2017 and 2018.

Keywords: *heavy metals, hydrogen sulfide, Manila Bay, sediment*

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STATUS OF TAAL LAKE CAPTURE FISHERIES WITH EMPHASIS ON *SARDINELLA TAWILIS* (HERRE, 1927)

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Taal Lake, the third largest lake in the Philippines, is a home to a diverse community of species, which serves as a major fishing ground for 2,283 fisherfolks. The study aims to provide information on the status of the fishery resources, especially, *Sardinella tawilis*, in Taal Lake to recommend appropriate policy for the lake's conservation and management. *S. tawilis* is the only freshwater *Sardinella* and is endemic and found only in Taal Lake. Fish landed catch survey was conducted in 13 landing centers surrounding the lake. Total capture fisheries of 2,202.53 mt was recorded from January – November 2018. A slight improvement was observed in the harvest since 2014, but this can be attributed to the proliferation of introduced species which contributed 52.81% of the total harvest. Also, the number of introduced species recorded increased from 6 species in 2009 to 13 species in 2017. A total of 40 finfishes, comprised of 4 native, 13 introduced and 23 migratory species were recorded in the monitored landing sites. *Chanos chanos* was the dominant species in the lake. The population parameters of the top species were estimated using the FISAT software. The exploitation rate (E) of *tawilis* decreased from 0.62 in 2014 to 0.53 in 2017, but it still exceeded the reference point of 0.5, which is attributed to high fishing pressure as revealed by high fishing mortality. The dominant gear being used in the lake is gillnet, with a catch per unit effort (CPUE) of 4.72 kg/day. The highest and lowest CPUE were recorded from fish pot/pahigop (115 kg/day) and bamboo fish trap (0.50 kg/day), respectively. The lake's ecosystem is in poor condition, thus strict implementation of conservation and management measures should be continuous.

Keywords: Taal Lake, *Sardinella tawilis*, introduced species

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VULNERABILITY ASSESSMENT OF SELECTED FISHERY SECTORS IN THE PHILIPPINES USING FISHVOOL

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Climate change (CC) is one of the major threats to the Philippine fisheries. Studies have shown a decreased volume in the total fish production. In response to this, the National Fisheries Research and Development Institute (NFRDI) developed a sector-based Fisheries Vulnerability Assessment Tool (FishVool) for capture fisheries and aquaculture sectors. The collection of data was done through key informant interviews to assess the vulnerability score whether low, medium, or high by identifying three parameters namely sensitivity, exposure, and adaptive capacity. This study showed the assessments of these parameters of three capture fisheries sub-sectors namely: tuna, sardines and round scad fisheries and three aquaculture sub-sectors namely: tilapia, milkfish, and seaweeds. The assessed data of tuna sub-sector are medium for sensitivity, medium for exposure, medium for adaptive capacity and medium for vulnerability. The assessed data of sardine sub-sector are medium for sensitivity, medium for exposure, medium for adaptive capacity and medium for vulnerability. The assessed data of round scad sub-sector are medium for sensitivity, medium for exposure, medium for adaptive capacity and medium for vulnerability. The assessed data of milkfish sub-sector is medium for sensitivity; low for exposure, medium for adaptive capacity and low for vulnerability. The assessed data of seaweeds sub-sector are medium for sensitivity, medium for exposure, medium for adaptive capacity and medium for vulnerability. The assessed data of tilapia are medium for sensitivity, low for exposure, medium for adaptive capacity and low for vulnerability. These assessments were done to analyze the areas that need improvement based on the identified “weaknesses” of commodities. Such weaknesses can be improved by conducting training on adaptation strategies to decrease the vulnerability scores.

Keywords: climate change, sensitivity, exposure, adaptive capacity, fisheries

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A COMPARATIVE STUDY ON THE NUTRITIVE CONTENT OF BANANA FLESH AND BANANA PEEL ICE CREAM

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The primary purpose of the study was to assess the acceptability of banana peel ice cream in terms of its appearance, aroma, flavor and texture. The study chose a total of 50 respondents, represented by 50 Asian Cuisine Students. The data gathered were analyzed and the overall all average determined by using Tukey-HSD. The results showed that banana peel ice cream is extremely acceptable in terms of aroma, texture, appearance and flavor. Significant differences in their qualities were observed among the three ice cream samples. Among the samples, banana peel ice cream was the most acceptable to the respondents as a form of dessert. Most particularly, the pureed banana peel ice cream gained the highest interest from the respondents as based on its quality. The pureed inner banana peel ice cream with one cup pureed inner banana peel had the highest amount of potassium, dietary fiber and protein, with a percent increase of 21.43%, 94% and 208.59% respectively. Further, it had 38.54% lower carbohydrate content than the banana flesh ice cream.

Keywords: banana, potassium, nutritive content, banana peel, ice cream

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A STUDY ON THE MARKET POTENTIAL OF PROCESSED GOAT MEAT (CHEVON) PRODUCTS

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Increased goat production is mainly driven by the sustained demand for chevon or goat meat. Parallel to the gaining popularity of chevon, there is a need to determine the market potential of processed chevon products that will cater to a wide variety of uses as well as satisfy demand for innovative local delicacies. The objectives of this study were to determine the market potential of the chevon products developed at the Central Luzon State University (instant papaitan, chevon jerky and chevon caldereta with rice “binalot”), to define the market, to determine the market strategy to reach the intended market. A descriptive survey was conducted (n=679) in 10 towns and cities in Nueva Ecija through self-administered questionnaires. Results showed that in terms of socio-economic status, 61.3% of the consumers were classified as the highest spending household (cluster 5-9) while 4.50% were under least spending household (cluster 1-4). Most consumers (81.6%) have tried tasting chevon. The processed chevon products have clear market potential since 61% of the consumers would probably buy the product. Less than half (41.4%) of the consumers were aware that the goat meat has lower cholesterol level compared to other meats while only 26.8% know that chevon was high in iron. Majority of consumers (78.6%) will eat more chevon after knowing its nutritional benefits. To encourage consumer patronage, goat meat should be positioned as a healthier choice compared to other type of meats.

Keywords: chevon, descriptive survey, instant papaitan, chevon jerky, binalot

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ACETIC ACID FERMENTATION OF ACACIA (*Samanea saman*) PODS: CONVENTIONAL VS. AERATED

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Pods from acacia (*Samanea saman*) plant have been reported to contain sugars and have been commonly used as natural sweetener. In this study, water infused with ground acacia pods were utilized as substrate for alcoholic fermentation and then for vinegar production. Method comparison was done during acetic acid fermentation. Treatments were designed based on factorial design, with three ratios of acacia:water (T1-3:1, T2-1:1, T3-1:3) and two methods of acetic acid fermentation (conventional (CF) and aerated (AF)). During the first phase of the study, the three treatments were subjected to alcoholic fermentation under anaerobic condition with commercial active dry yeast (*Saccharomyces cerevisiae*) as starter culture. After alcoholic fermentation, the samples were subjected to CF and AF for phase 2, with unpasteurized vinegar as starter culture. Initial total soluble solids (TSS) were T1-25.16°Brix, T2-20.06°Bx, and T3-15.66°Bx. After alcoholic fermentation, the resulting TSS were 11.10°Bx, 9.23°Bx, and 6.97°Bx, respectively. Consequently, the % alcohol contents were 8.31%, 5.62%, and 4.06%, for T1, T2, and T3, respectively. After acetic acid fermentation, TSS, pH, and total titratable acidity values were only significant within different ratios. The physico-chemical properties of the vinegar were not affected by the method used in acetic acid fermentation. The only difference was in the length of fermentation time: CF takes 4 weeks whereas AF takes only about 16 hours. Results of this study can be used as basis in the application of aerated method for vinegar production. Further study on the sensory properties of the vinegar made from acacia pods is recommended.

Keywords: liqueur, coffee beans, infusion, infused liqueur, liquor

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BIODEGRADABLE FILM FROM WILD TARO (*Colocasia esculenta* (L.) Schott) STARCH

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This study aimed to produce and characterize the biodegradable film from (*Colocasia esculenta* (L.) Schott) starch. Starch was extracted from wild taro by manual peeling, chopping, grinding, filtering, settling and sun drying. Biodegradable films were produced from factorial combinations of 5 g and 10 g of taro starch with 2%, 3%, and 4% of glycerol. Results showed that taro films prepared with high level of starch and high level of glycerol (10g starch with 4% glycerol) had highest maximum stress (MPa) which is 9.51 MPa while lower level of starch and lower level of glycerol (5 g starch with 2% glycerol) had highest percent elongation. At high level of plasticizer, the films elongation capacity increased while tensile strength decreased. The two factors (level of starch and level of glycerol) had significant effect ($p < 0.05$) on density, water absorption and thickness swelling. One of the treatments (T6) was examined positive after one week for biodegradability in the soil with *Trichoderma harzianum*.

Keywords: biodegradable film, taro starch, glycerol, elongation, density, water absorption, thickness swelling

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BULK STORAGE SYSTEM OF ILOCOS GARLIC

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The bulk storage of garlic grown in the Ilocos has been always a problem because it cannot last long compared to the imported varieties that are grown in temperate countries. Technologies that have been developed have been for small applications of 50 to 100 kg in storage and these have been found to be very impractical.

A postharvest system has been developed for storing large volume of Ilocos garlic in bulk without the use of pesticides in relation to its photoperiodism characteristics. The technology developed start with the harvesting of the mature garlic from the field as indicated by the browning of the flag leaf. The garlic are then sun dried for not more than three (3 days). These are afterwards placed in a garlic curing barn of shed until the stalk reaches a moisture content of 14 to 15% (dry-basis).

The garlic was bundled by the hundreds and each bunch contained 10 bundles. Dried leaves of kakawate [*Gliricidia sepium* (Jacq. Kunth ex Walper)] and lagundi [*Vitex negundo* L.] of equal proportion at a rate of 30 to 35 kg per ton of garlic placed in the bulk storage repelled the insects and mites during storage. In the storage shed, a temperature of not more than 25°C and relative humidity of not more than 75% were maintained. These resulted to a garlic bulb deterioration of more than 10%. Ten months after the start of storage, the garlic bulbs started to germinate and then to deteriorate. A storage temperature of 10°C and below was observed to induce the pre-germination of the garlic cloves.

Keywords: garlic, bulk storage, temperature, relative humidity

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CASSAVA: NOT JUST YOUR ORDINARY SOURCE OF CARBOHYDRATES

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Cassava (*Manihot esculenta* Crantz) is one of the major crops in the Philippines. The roots are the most commonly consumed plant part while the leaves are mostly considered as by-product. However, cassava has potential nutritional benefits. A quantitative approach to evaluate some of the nutritive and anti-nutritive components in the leaves and roots were done using sixteen cassava entries. The trial was laid out in a randomized complete block design (RCBD) during the 2017-2018 cropping season. Results showed significant differences in all parameters measured except crude protein and starch in roots at $\alpha=0.05$. Root yield was between 18.55–39.78 t/ha while starch was around 79.80–84.39%. Higher crude protein was observed in the leaves with values ranging 22.34 to 37.54% than in the roots with 0.66–2.56%. Fresh cassava leaves had higher range of hydrocyanic acid (57.52–572.22 mg/kg) than fresh roots (26.93–255.81 mg/kg). CG02-05r-05 had the highest root yield and lowest HCN in the leaves with 26.22% and 1.2% protein content in the leaves and roots, respectively. Cassava-dependent regions face a form of malnutrition caused by a lack of protein in the diet. Although cassava roots are high in starch and good source of carbohydrates, it is poor in terms of protein composition; cassava leaves with high protein content and low HCN can be a good cheap alternative source of protein.

Keywords: cassava, leaves, roots, yield, nutrition

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DEVELOPMENT OF LINEAR OPTIMIZED FIBER RICH BISCUITS USING CORN HUSK POWDER

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Corn is widely consumed and the husk is commonly regarded as waste. The study aimed to utilize corn husk as a material for the development of fiber-enriched biscuits that will provide one-third of the recommended dietary fiber for adults. Corn husk powder (CSP) and the corn husk biscuit (CHB) were analysed for proximate composition using AOAC Official Methods. CHB was formulated using linear optimization to obtain proportion of the raw materials. Proximate components of the CSP include moisture (6.67%), ash (1.91%), protein (1.55%), fat (<0.10%), total carbohydrates (89.87%). CSP has total dietary fiber (89.67 %) of which insoluble fiber (87.44 %) was considerably higher than Soluble Fiber (2.23%). Microbiological testing done on CSP showed salmonella was absent in 25g, TPC of 70CFU/g, yeast and mold count was <10 CFU/g, of which the levels are considered acceptable in Philippine FDA standards. The nutrient of content of CHB from the results of laboratory testing expressed as g/100g are 12.72 g of moisture, 2.31 g of ash, 6.81 g of protein, 20.70 g of fat, 57.46 g of carbohydrates, and 12.55 g of dietary fiber. CHB contains 34.5 g of carbohydrates, 4.1 g of protein, 12.4 g of fat and calorie content of 266 kcal per 60 grams. CHB was also subjected to sensory evaluation using 7-point Hedonic Rating Scale. CHB were generally liked in terms of appearance 5.03 ± 1.11 , aroma 5.36 ± 1.12 , flavor 5.01 ± 1.36 , aftertaste 4.70 ± 1.39 , and general acceptability 5.11 ± 1.23 but was neither liked nor disliked for its texture 5.10 ± 1.23 . It is recommended that the CHP and CHB be further studied for its digestibility and be further optimized for pilot scale production.

Keywords: linear optimization, dietary fiber, corn husk powder, corn husk biscuit

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DEVELOPMENT OF LOW-CALORIE DARK CHOCOLATE BARS FROM PHILIPPINE COCOA (*Theobroma cacao* L.) BEANS

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This study was conducted to produce low calorie dark chocolate bars using Philippine cacao beans with stevia as sugar replacer. Sensory evaluation using consumer acceptance testing (n=50) determined the acceptability of the produced dark chocolate bards with stevia at different concentrations (3%, 4.5%, and 6%) in comparison with the locally available dark chocolate in the market (Valor and Hershey's). Bioassay was conducted to determine the glycemic index and effect on blood sugar level of the most acceptable treatment from the consumer test with commercial samples. Results showed that among the treatments with stevia, dark chocolate bar with 4.5% stevia was the most acceptable sample but with significantly lower ($p<0.05$) than commercial chocolates. Chocolate bar with 4.5% stevia had the lowest glycemic index compared with the commercial chocolates and the control with sucrose based on the blood glucose level of laboratory mice. This proves the low caloric value of the chocolate sample with stevia. Penalty analysis revealed that smoothness and flavor need to be improved in the product to further increase acceptability in a 9-point hedonic scale. Nonetheless, consumer testing showed that the product has a high market potential and can be one of the pioneering products to fully harness the Philippine cacao and will pave the way for quality, healthy, and truly Filipino chocolate products.

Keywords: chocolate, Philippine cacao, stevia, sensory evaluation, penalty analysis

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EFFECT OF FOOD ADDITIVES ON THE QUALITY OF YACON (*Smallanthus sonchifolus*) SYRUP

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Effects of different food additives combination on the quality of vacuum evaporated yacon syrup were evaluated in this study. The treatments applied were: Control: pure yacon syrup; T1, direct addition of 0.5% citric acid + 0.5% ascorbic acid solution to the extracted juice of yacon; T2, blanched and peeled yacon was soaked to 0.5% citric acid + 0.5% ascorbic acid + 0.1% calcium chloride solution; T3, blanched and peeled yacon was soaked to 0.5% citric acid + 0.5% ascorbic acid + 0.2% potassium sorbate solution; T4, direct addition of 0.1% sodium metabisulfite solution to the extracted juice of yacon. Findings showed that yacon syrups treated with food additives were insignificantly ($p > 0.05$) different with the control in terms of water activity and pH, but positively ($p < 0.05$) influenced its total soluble solids and viscosity. Yeast and molds count exhibited satisfactory result implying microbiological safety and stability of the produced yacon syrup. Sensory evaluation using consumer acceptance testing ($n=50$) determined the acceptability of yacon syrup. The produced yacon syrup was evaluated in terms of its sensory attributes (taste, color, aroma, mouthfeel, and aftertaste). Pure yacon syrup (control) was the most liked ($p < 0.05$) by the panelists in all its attributes. To further increase the acceptability and marketability of T3, color, sweetness and aftertaste should be improved based on the result of penalty analysis.

Keywords: yacon syrup, blanch, overall acceptability, vacuum evaporation

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**POTENTIAL HYPOGLYCEMIC EFFECT OF
FRUCTOOLIGOSACCHARIDES FROM YACON (*Smallanthus
sonchifolus*) ON BALB/C MICE**

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One of the biggest health problems arising in the society is the increasing number of people suffering from diabetes due to obesity. This study was conducted to test the effectivity of yacon syrup in lowering the blood sugar, lipid profile, creatinine and serum glutamic-pyruvic transaminase (SGPT) of BALB/c mice. Mice were divided into six experimental groups (n=8) having their specified diet given every day for 46 days: group A (normal basal diet), group B (high fat diet), group C (high sugar diet), group D (yacon syrup diet), group E (yacon syrup with high fat diet) and group F (yacon syrup with sugar diet). Groups A, C, D and F were given normal feeds. In terms of blood glucose level (BGL), no significant ($p>0.05$) differences were observed between initial and different time intervals but yacon syrup-fed mice had higher percentage on the reduction of BGL from zero-minute observation as compared with those fed with sugar. In addition, bioassay results revealed that yacon syrup positively increased the level of High-density Lipoprotein (good cholesterol) and reduced the level of Low-density Lipoprotein (bad cholesterol). The best treatment which exhibited good results was the combination of 5% yacon syrup and 5% sugar solution. Reduction of BGL, total cholesterol and triglyceride on mice was influenced by the presence of fructooligosaccharides (FOS) in the vacuum evaporated yacon syrup.

Keywords: yacon syrup, glycemic index, bioassay, vacuum evaporation, cholesterol

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EVALUATION AND CHARACTERIZATION OF PROPERTIES OF PALM (*Corypha elata Roxb.*) SUGAR

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Most people want to live a long and healthy life, so they focus more on health and wellness. Thus, low glycemic index (GI) foods are now in demand. This work is concerned with the evaluation of sap from palm tree such as buri palm (*Corypha elata Roxb.*) which has a big potential to be used as healthy alternative sugar. Initial studies done suggested that Buri palm sugar from Verde Island, Batangas has a medium glycemic index but its other properties are not yet explored. The sugar content and phytochemical properties analyzed using high performance liquid chromatography (HPLC) and gas chromatography mass spectrophotometry (GCMS). The sugar properties of Buri Palm sugar were also compared with brown sugar and coco sugar. The results showed that Buri palm sugar had neutral to basic pH and showed variances in color properties. It exhibited no phytochemical content such as phenolics and anthocyanin using HPLC. Sucrose content of brown sugar was 92.35 µg/100 µg, coco sugar 84.94 µg/100 µg, and Buri palm sugar 82.50 µg/100 g. For glucose content, Buri palm sugar had 2.01 µg/100g, brown sugar has the lowest content of 1.32 µg/100 µg and coconut sap sugar has the highest with 2.61 µg/100 µg. The results indicate that samples contain mostly sucrose with a minimal content of glucose and fructose and is comparable to that of the coconut sap sugar. Buri palm sugar contains minerals which are essential to health and is comparable to the mineral contents of coconut sap sugar (PCA 2015) with emphasis to sodium, iron and zinc and no heavy metals are present. This research provides baseline information for further processing and value adding of the Buri palm sugar which can also help in the livelihood of the people of Batangas.

Keywords: Buri palm sugar, food processing, sucrose, glycemic index

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EVALUATION OF POSTHARVEST PHYSIOLOGICAL DETERIORATION AND YIELD OF DIFFERENT CASSAVA (*Manihot esculenta* Crantz) GENOTYPES

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Cassava (*Manihot esculenta* Crantz) is an important root crop that is widely grown in tropical countries for food, feed, biofuel and industrial uses. Postharvest physiological deterioration (PPD) is an endogenous phenomenon in fresh cassava roots that shortens its shelf-life and causes significant loss. The study aimed to evaluate 59 cassava germplasm collection from the Institute of Plant Breeding in UP Los Baños. The trial was conducted during the 2017-2018 cropping season and laid out in a randomized complete block design (RCBD) with 2 replications. At harvest (10 MAP), roots were assessed for yield and PPD using the protocol of Fukuda et al. (2010). Yield showed significant variation at $\alpha=0.05$. Each plant produced 0.55 to 4.15 kg of roots or 5.50 to 41.50 t/ha of fresh root. Twenty-nine out of 59 accessions had yield greater than or equal to 20 t/ha. Moreover, results revealed that PPD of the genotypes assessed ranged from 0 to 97%. Davao City 3, Malate Ubeh and PR-C312 showed no sign of PPD while 48 out of 59 genotypes showed less than 50% PPD level. The identification of cassava genotypes with high-yielding trait and tolerance to PPD suggests availability of breeding materials for yield and resistance to the postharvest problem of cassava.

Keywords: PPD, yield, cassava, germplasm, postharvest

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FRUIT RIPENING BEHAVIOUR OF THREE PRSV-TOLERANT PAPAYA VARIETIES REVEALED BY DIGITAL PHOTOMETRY AND PHYSICO-CHEMICAL ANALYSES

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The fruit ripening behavior of PRSV-tolerant papaya (*Carica papaya* L.) varieties ‘Pineras’, ‘Cavite Special’ and ‘Cariflora’ was observed by determining the interaction of digital photometric and physico-chemical analyses. Papaya peel colors at different stages of maturity obtained from the digital camera were quantified using the Byers (2006) RGB analysis of Colors Software. The RGB (Red, Green, Blue) values are correlated with the physico-chemical parameters such as pulp firmness, total soluble solids (TSS), titratable acidity (TA) and total carbohydrates to determine if the changes in color are associated with fruit ripening. Statistical analysis showed that the R and G values of the fruit samples increased at increasing stages of maturity, confirming that RGB values of the papaya peel color can be used to predict the ripening of papaya harvested at the mature green stage, i.e. stage 1, without going through destructive analysis. Upon maturity, RGB values of mature and immature green fruits were compared to determine whether there is a difference in color. The RGB values are converted into Hue Saturation Lightness (HSL) to give more information on color based on another color space; the HSL. Results showed that R and G values of the RGB color space and the S and L of the HSL color space are significantly different for the mature and immature green fruits. Thus, it is confirmed that the RGB and HSL color spaces that correlated physico-chemical parameters such as pulp firmness, TSS, TA and total carbohydrates can be used to predict ripening behavior of papaya fruits harvested while they still at the mature green stage. This basic information are important in the postharvest of papaya to avoid rapid ripening and softening especially if they are intended for long distance transport.

Keywords: *Carica papaya* L., HSL value, physico-chemical, postharvest, RGB values

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**INFLUENCE OF DRYING TEMPERATURE ON THE
ANTIOXIDANT ACTIVITY, BIOACTIVE COMPOUNDS
AND FUNCTIONAL PROPERTIES OF PILI
(*Canarium ovatum* Engl.) POMACE**

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Pili (*Canarium ovatum*, Engl) pomace, a by-product recovered after pulp oil extraction is a potential functional food due to its high dietary fiber and polyphenol contents. The impact of convective oven-drying temperatures (55, 60, 65 and 70°C) on antioxidant activity, polyphenol content, functional and physicochemical properties was examined and compared to a freeze-dried control sample following standard published methods. Extractable polyphenols (EPP) make up a large proportion of about 56.27–78.47% of total phenolics and contributed to about 45.84–95.72% of total antioxidant activity in pili pomace. EPP content in pili pomace and its corresponding antioxidant activity after convective drying was lower than freeze drying while the reverse was observed for non-extractable polyphenols (NEPP). Functional and physicochemical properties significantly varied with temperature. Among the hot air drying temperatures tested, data suggest 60°C to be the closest alternative method for freeze-drying in terms of EPP content and antioxidant activity retention.

Keywords: pili, *Canarium ovatum*, antioxidant, phenolics

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SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES AS A POTENTIAL SENSOR FOR VOLATILE ORGANOSULFIDES

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Garlic, one of the most popular spices used in manufacturing many food products, is subjected to fungal and bacterial diseases resulting to substantial losses in quantity and quality. Specific detection tools for garlic spoilage will be an asset in relieving these losses during postharvest storage. In this study, garlic spoilage was monitored by detecting the release of volatile organosulfides evolved during spoilage via the stable yellow-colored silver nanoparticle colloidal solution. The nanosilver particles were synthesized by the chemical reduction method where silver nitrate is taken as the metal precursor and sodium borohydride as the reducing agent. These silver nanoparticles were characterized by UV-Vis spectroscopy and Scanning Electron Microscope. The spectral analysis shows that the absorption peak of the silver nanoparticles solution was around 390 nm and the SEM images indicated that the silver nanoparticles had spherical shape with size ranging from 3 to 4 nm. The visual changes during the spoilage was monitored for ten days during which time the yellow color of the nanosilver solution changed to orange, pink and finally turned transparent.

Keywords: postharvest, silver nanoparticle, volatile organosulfide

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OPTIMIZATION OF ALL-IN-ONE SEASONING USING NATURAL HERBS AND SPICES

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Commercially available all-in-one seasonings in the market consist of chemical preservatives which may have an adverse effect into one's health. All-in-one natural seasoning would be a great substitute considering the health of consumers. Herbs and spices promote health effect due to their general nutritional profile but also to nonnutrient bioactives and phytochemicals such as flavonoids and other phenolics-control cancer and other diseases. The purpose of this study is to formulate all-in-one natural seasoning made with natural ingredients. The treatments were the levels of mushroom and pepper, for these ingredients mainly contribute to the taste of this seasoning. Fifty panelists (n=50) were asked to do sensory evaluation using a consumer type on a 9-point hedonic scale. Statistical analyses showed that there was no significant difference ($p>0.05$) among the attributes of the treatments except aroma and overall flavor. No significant difference was also found among the overall acceptability. Most of panelists indicated that the attributes were just about right. Among the three treatments, treatment 3 was selected which has the highest level of mushroom and pepper. Nonetheless, consumer testing showed that the product has a high market potential and can be one of the healthy Filipino All-in-one seasonings in the market.

Keywords: flavonoid, phenolic, sensory evaluation

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OPTIMIZATION OF TARO (*Colocasia esculenta*) AND RICE (*Oryza sativa L.*) AS FLOUR IN THE PRODUCTION OF PREMIX BY D-OPTIMAL MIXTURE DESIGN

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This study aimed to utilize the taro tubers as flour in the production of a chocolate crinkle premix with standardized formulation using D-optimal mixture design. In addition, this study evaluated the influence of flour blends and their interactive effects, to obtain an optimal formulation with desirable characteristics, and assess the acceptability and formulation cost of optimized product produced. Dried taro and rice (NSIC Rc222) were collected and pulverized. Ten (10) formulations of different concentrations of taro flour (30-50%, TF), rice flour (10-20%, RF) and all-purpose flour (30-50%, APF) were used to produce chocolate crinkle premix. Responses observed in determining the effect of the varying percentage of flour blends are as follows: bulk density, water activity, moisture content, amylose content, water holding capacity and oil holding capacities were analyzed using the D-optimal mixture design. Results showed that the TF had positive effects in all responses. RF had minimum effect in all responses because of its concentration (10-20%). APF had positive effects in bulk density, water and oil holding capacity but negative effect on water activity, moisture content and amylose content. The optimum formulation obtained was 49.5% of taro flour, 16.99% of rice flour and 33.51% of all-purpose flour with 0.32 g/ml bulk density, 0.41 water activity, 9.59% moisture content, 22.60% amylose content, 62.04% water holding capacity and 107.18% oil holding capacity.

Keywords: taro flour, rice flour, d-optimal mixture design, optimization, premix

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PROCESSING OF INSTANT ARROZ CALDO FROM ORGANIC AROMATIC RICE (*Oryza sativa L.*)

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The study which has three phases aimed to produce an acceptable instant arroz caldo using organic aromatic rice. Firstly, it determined the best processing method, then the ratio of organic aromatic rice and organic glutinous rice, and finally, the fortification level using soy bean, based on physical and chemical characteristics such as bulk density, color, rehydration characteristic, viscosity, water activity and proximate composition; microbial stability and sensory evaluation (paired preference, ranking preference, and consumer tests). Cost analysis of the best treatment combination was also done. In producing instant arroz caldo, the best treatment was the use of conventional method with the rice ratio of 70:30 (organic aromatic rice and organic glutinous rice) and with 20% soy beans. Method of cooking affected the color, water activity and moisture content of instant arroz caldo. Conventional method was better than separate boiling and sautéing method because of lower water activity (>0.60) and moisture content (8.89%) of the final product. Addition of 20% soybeans to organic glutinous rice increased the ash (8.51%) and protein content (13.92%) of the samples. It was also found that addition of organic glutinous rice increased the total carbohydrates content of the samples (70.92%). The best treatment combination was subjected to cost analysis and it was calculated that the instant arroz caldo with 20% soy beans has a production cost of Php13.61 and can be sold at a Php20.00 per 50 g pack.

Key Words: instant arroz caldo, soybeans, organic, aromatic, glutinous

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QUALITY EVALUATION OF GLUTEN-FREE LOAF BREAD MADE WITH SWEET POTATO FLOUR, CORN MEAL, AND RICE FLOUR

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The lack of gluten in bread forms a structure that does not hold carbon dioxide produced by the yeast during fermentation. This results in a harder, drier, crumbling texture of the bread. This study aimed to characterize the physical, proximate and microbiological properties of the gluten-free loaf bread made with the combination of sweet potato flour, rice flour, and corn meal. There are evidences that show the possibility of sweet potato flour to be used in loaf baking. Rice flour and corn flours are commonly used because of their taste, texture, starch present, and other factors. Results show that according to the sensory evaluation, the best formulated gluten free loaf bread (F8) is made from 50% rice flour, 30% sweet potato flour, and 20% corn meal. The panelists preferred samples with light yellow color, slightly to moderately recognizable bread-like smell, slightly to moderately soft texture, barely to slightly coarse texture, and barely to slightly buttery flavor. F8 had a rather high specific volume with small air cells. Protein, fat, carbohydrate, starch, dietary fiber, moisture, and ash content of F8 based on the proximate analysis are 3.15 g/100 g, 4.07 g/100 g, 59.94 g/100 g, 43.43 g/100 g, 2.09 g/100 g, 31.70 g/100 g, and 1.14 g/100 g, respectively. F8 had acceptable yeast and mold count, while APC was classified as acceptable but in marginal class. Marginal classification does not mean that F8 contains pathogens and that the bread is unacceptable. It is recommended to incorporate substances that may prolong shelf life. Moreover, amount of hydrocolloids should be greatly considered in GF bread making. In comparison with gluten-free loaf breads available in the supermarket, the experimental gluten loaf bread made with sweet potato, rice, and corn meal is significantly cheaper and more affordable than the commercial.

Keywords: gluten-free, rice flour, sweet potato flour, corn meal, quality evaluation.

AS – 89

ROASTED LOCAL FRUITS SEEDS AS COFFEE ALTERNATIVE

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This descriptive-experimental study aimed to identify the fruit seeds that can be utilized as alternative coffee bean and to determine the level of acceptability of the roasted local fruits seeds drink using the validated researcher-made checklist. The respondents were the 80 coffee drinkers- students of La Salle University and 3 baristas of the 2 coffee shops. The selected local fruit seeds had undergone sun-drying and the number of days differs according to the size of the seed. Autoclaving and boiling processes were done to eliminate the toxins of some seeds before roasting. Grinding of the seeds followed until it had coarse and fine texture. Laboratory study was done to identify its nutritive value and caffeine content of the drink. Drink tasting was then conducted. It was found that among the sensory characteristics, the appearance got the highest weighted mean and verbally interpreted as highly acceptable while the aroma got the least mean but still rated as highly acceptable. The roasted local fruit seeds drink contained high in potassium, calories, protein, sodium, and carbohydrates and had no sugar content. The researchers concluded that the appearance plays an important factor in accepting the roasted drink. The drink had no caffeine content. Through food/drink innovation, waste fruit seeds can be made as an alternative to the coffee drink.

Keywords: coffee, roasted seeds, alternative, local seeds

AS – 90

SENSORY EVALUATION OF CALABASH ICE CREAM FORTIFIED WITH NATURAL PREBIOTICS

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The purpose of this study is to formulate a French style ice cream flavoured with Calabash and fortified with prebiotics, coming from Yacon and Jicama. Sensory evaluation is conducted to determine the level of acceptability of the formulated Calabash ice cream. An experimental and descriptive method of research is used to quantitatively analyze the amount of nutrients present in the Calabash ice cream and the significant differences between the three samples conducted. The first sample with one cup of Calabash and one cup of prebiotic extracts has 10.59% fat, 3.27% protein and 14.83% carbohydrates. The second sample, with one-half cup of Calabash and one-half cup of prebiotic extract has 12.50% fat, 2.09% protein, and 17.92% carbohydrates. The third sample which contains one-fourth cup Calabash and one-fourth cup prebiotic extract has 13.54% fat, 1.57% protein and 20.03% carbohydrate. Based from sensory evaluation among 70 respondents, it shows that the most acceptable fortified Calabash ice cream must contain the highest amount of fat and carbohydrate. This is implied to the highest acceptability and satisfaction of the respondents to Sample 3. Analysis of variance (ANOVA) shows that there are significant differences to the means of the three Samples being analyzed. The amount of Calabash extract is inversely proportional to its level of acceptability. It is also noteworthy to stress-out that respondents aged 22-30 years old would prefer samples with highest calabash volume. It is then recommended that the stakeholders will take part in the formulation of this new and healthy Calabash ice cream fortified with prebiotics.

Keywords: calabash ice cream, yacon and jicama, calabash extract, prebiotic formulated ice cream

AS – 91

UTILIZATION OF MANGO PECTIN IN PROCESSING OF FRUIT-FLAVORED SOYMILK AND SOY-BASED YOGURT

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Consuming soy food products such as soy milk and soy yogurt provided many health benefits. However, innovations must be continuous to have soy-based products with optimum quality. The study focused on the utilization of mango pectin blend in processing fruit-flavoured soymilk and soy-based yogurt. Addition of pectin was done to stabilize the products and improve the texture. Blended mango pectin was also utilized as fat replacer to mimic the mouthfeel of lipids in these low calorie foods. Low cost maltodextrin was blended with pure mango pectin to reduce the cost of the stabilizer and to improve the characteristics and acceptability of the two products. Effects of fresh and canned pineapple juice and two levels of sugar on the sensory qualities of soymilk were determined after pasteurization. Physical and chemical properties of soy-based yogurt as affected by the type (citrus pectin and blended mango pectin) and levels of stabilizers (0.1% and 0.05%) were evaluated. Pineapple-flavoured soymilk has total soluble solids of 12-14%, pH of 7.0 and total titratable acidity of 0.30-0.36. The product also has a protein content of 2.44-2.84%. Soy-based yogurt has total soluble solids of 7.57-8.13, pH of 4.17-4.30 and titratable acidity of 0.35-0.44. Protein content of the yogurt ranged from 2.26-3.09%. Soymilk with 10% sugar is more acceptable to consumers. Fruit-flavoured soymilk samples with fresh pineapple juice were more acceptable in all the sensory parameters evaluated. Soy-based yogurt with 0.05% mango pectin blend has the highest mean overall acceptability. Sensory evaluation also revealed that this treatment was preferred by most consumers in all the evaluated attributes.

Key Words: mango pectin, fruit-flavoured soymilk, soy-based yogurt

AS – 92

DEVELOPMENT OF INSTANT SINIGANG POWDER FROM KATMON FRUIT (*Dillenia philippinensis*)

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This study was conducted to develop an instant *sinigang* mix using katmon fruit (*Dillenia philippinensis*), shiitake mushrooms, garlic, iodized salt, and sugar. Katmon, shiitake mushrooms, and garlic were dehydrated using the multi-commodity heat pump dryer for 13 hours. These were then ground and mixed with iodized salt and sugar. One sachet of the instant sinigang powder (45g) contains 191 kcal, 2.9 g of protein, 1g of fat, 42.2 g of carbohydrates, 141 mg of calcium, 47 mg of phosphorus, 1.1 mg of iron, 18 µg of vitamin A, 0.12 mg of thiamine, 0.07 mg of riboflavin, 1.4 mg of niacin, and 19 mg of vitamin C. The product was evaluated by 30 individuals from three age groups. The evaluation showed that the product was *liked very much* by evaluators ages 19 and above (color 53%, texture 53%, taste 33%, aroma 40%, and appearance 46%). The instant *sinigang* powder is stored in an 8.5x14cm polyethylene metallized zip lock packaging, and in the two months of observation, the quality of the product remained unchanged at room temperature. The cost of the product per 45g pack is PhP37.50. The instant *sinigang* powder from katmon fruit was found to be cheaper and more nutritious compared to similar products in the market.

Keywords: sinigang powder, katmon fruit, shiitake mushrooms

AS – 93

DEVELOPMENT OF POWER VEGAN CUPCAKE

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The objective of this study was to develop a nutrient-dense product, the Power Vegan Cupcake, using local plant-based ingredients. Brown rice flour, all-purpose flour, muscovado sugar, salt, and baking powder were sifted and mixed. Saluyot and pandan leaves were boiled for 15 minutes and then cooled, blended, and strained. The saluyot puree and pandan juice were then mixed with the dry ingredients, soy milk, and vanilla. The batter was mixed, and raisins and banana were added. The batter was baked in an oven for 25 minutes at 200°C. Each Power Vegan Cupcake (70 g) contains 41.7 g of carbohydrates, 4.7 g of protein, and 3.12 g of fat, for a total calorie content of 198.4 cal. It also contains 28.75 µg of Vitamin A, 2.4 mg of Vitamin C, 50.6 mg of calcium, 1.5 mg of iron, 0.17 mg of thiamin, 0.19 mg of riboflavin, 2.93 mg of niacin, and 98.7 g of phosphorus. The product was found to contain a higher amount of carbohydrates, protein, and micronutrients compared to regular cupcakes on the market. Its shelf-life was one day in room temperature and eight days in the refrigerator. The selling price is ₱10.50 per piece and ₱88.50 per box of eight pieces. Thirty respondents ages 18-29 evaluated the product. The results show a rating of *like very much* from 63%, 53%, and 50% of the evaluators in terms of appearance, texture, and taste, respectively.

Keywords: vegan, cupcake, product development

AS – 94

RICE-BASED COMPLEMENTARY FOOD: PROVIDING NUTRITION FROM 9-11 MONTH OF LIFE

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In developing countries, most of the complementary foods consumed by growing infants are deficient in essential nutrients and inaccessible to vulnerable families, leading to undernutrition. The use of simple processing technology and nutrient-rich local crops are one of the effective approaches of improving its nutrient adequacy. The study was designed to develop an instant rice-based complementary food for 9-11 month old children. Ten combinations of complementary flours were prepared using D-optimal mixture design ranging from 50-55% for rice, 30-35% for soybean, and 15-20% for yellow sweet potato to optimize the nutrient and sensory acceptability (n=30). These were further evaluated for hydration and water activity properties. Three optimum combinations of complementary flours were generated and subjected to consumer sensory evaluation (n=50). Nutritional composition of the product was also assessed. Results showed that the optimal complementary food blending ratio with high nutrient and consumer acceptance was 50% rice, 35% soybean and 15% yellow sweet potato flours that contained 1.36% moisture, 17.72% protein, 6.75% fat, 1.38% minerals, 73.85 g carbohydrates and 423.04 kcal which met the daily intake recommendations of WHO/FAO (2004) except fat. The complementary flour blends exhibited high water absorption index (3.66-4.67 g/g), low water solubility (0.24-0.39%), and low swelling power (0.02-0.03 g/g). Water activity of 0.052-0.123 signified a shelf-stable product. A 100-g serving of the product can supply 409 calories, 4 mg iron, 3 mg zinc, 63 mg calcium, 62 mg magnesium, and 508 mg potassium. Hence, the nutritive complementary food can be a key contributor in improving the daily diet and alleviating the deleterious effect of malnutrition among 9-11 month old children in low-income community.

Keywords: rice-based, complementary foods, d-optimal mixture design, nutrition

AS – 95

AGRONOMIC AND GRAIN QUALITY ANALYSIS OF GAMMA IRRADIATED RICE (Var ‘Azucena’) AT M₄

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‘Azucena’ is an aromatic traditional rice variety with good eating quality, but has several undesirable traits for farmers, such as low tillering, tall plant height and low yield. Mutation breeding was conducted to improve the agronomic and yield traits of ‘Azucena’ while maintaining its outstanding grain characteristics. ‘Azucena’ seeds were irradiated using Cobalt60 at several radiation doses (150-350 Gy) at the Philippine Nuclear Research Institute. The mutated seeds (M₁) were planted in the field at the Central Experiment Station-UPLB for agronomic evaluation and generation advance. Based on phenotypic acceptability, 50 out of 134 M₄ lines were considered promising lines. These lines were subsequently characterized in terms of agronomic traits, yield, yield-related characteristics and physico-chemical grain qualities. The promising M₄ lines generally had 32.78% shorter culm length, 31.62% shorter plant height, 38.96% more tillers, and 42.38% more productive tillers compared to the non-irradiated ‘Azucena’. The M₄ lines also had better yield characteristics than the original variety, having a mean of 89.67% more panicles per plant, 10.94% more spikelets per panicle, and 184.17% higher plot yield. The promising M₄ lines maintained several of the grain characteristics of the original ‘Azucena’ variety, including its slender shape and soft texture of cooked grains, except for five lines with intermediate texture. However, only 44.68% of the lines had low amylose content (AC) and 36.17% had high gelatinization temperature (GT), similar to ‘Azucena’ grain quality. Moreover, 48.94% and 53.19% of the lines had intermediate AC and GT, respectively. Fifteen M₄ lines exhibited improved agronomic and yield characteristics while retaining the grain quality of the original ‘Azucena’, indicating that mutation can be effective in improving traits of traditional rice varieties.

Keywords: rice, Azucena, gamma irradiation, mutation, grain quality

AS – 96

ASSESSMENT OF YIELD AND HYDROCYANIC ACID OF CASSAVA (*Manihot esculenta* Crantz) HYBRIDS

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Cassava is one of the major staple foods in the tropical world and one of the main agricultural crops in the Philippines. However, the presence of hydrocyanic acid limits its consumption for both man and animal. The study aimed to assess yield and hydrocyanic acid of cassava hybrids. Data from three different yield trials of 14 varieties and 2 checks were used in this study. The data includes weight of marketable roots and hydrocyanic content. Results revealed yield ranging from 18.55–39.78, 12.4–31.85 t ha⁻¹ and 7.6–28.75 t ha⁻¹ for general yield trial (GYT), preliminary yield trial set 1 (PYT1) and set 2 (PYT2), respectively. HCN values in all trials showed significant differences. GYT, PYT1 and PYT2 had 33.45–292.76 mg/kg, 27.45–209.05 mg/kg and 44.64–146.79 mg/kg HCN, respectively. No significant correlation between yield and HCN was observed. High yielding varieties are always the main interest to further improve cassava production but assessing the HCN level is pivotal to give cassava producers a broader choice of planting materials to suit their needs.

Keywords: yield, cassava, hydrocyanic acid, field trial

AS – 97

EFFECT OF POLLINATION METHOD ON SEED SETTING OF ‘BATANES’ SHALLOT

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‘Batanes’ is a large-bulb sized shallot variety with can be propagated either through bulbs or seeds. Unlike any other shallot variety, ‘Batanes’ shallot was observed to flower regularly at natural growing condition. However, limited research on efficiency on natural pollination has been made. Hence, this study aims to assess the effects of different pollination methods on quantity and qualities of seed produced and determine the most effective method for higher seed yield. Flower umbels were selected and subjected to different pollination treatments: manual self-pollination (T1), open pollination (T2), and pollination by blow flies enclosed in net cage (T3) and evaluated for several parameters (no. of flower/umbel, % flower set/umbel, no. of seeds harvested and germination rate). Results showed highest percentage of seed set in T3 at 76.57% followed by T1 with 50.07% and lastly, T2 with 22.30%. Pollination with blowflies had highest quantity and quality of seed produced than manual and open pollination methods. This study provided significant information on efficiency of insect pollinator in onion/shallot breeding which can be useful in further studies on varietal development and improvement in *Allium*.

Keywords: Batanes, blowflies, pollination, seed setting, shallot

AS – 98

EVALUATION OF MUNGBEAN GENOTYPES WITH TOLERANCE TO POST-EMERGENCE WATELOGGING

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A series of evaluation of mungbean *Vigna radiata* (L.) Wilczek for post-emergence water flooding tolerance was conducted in the greenhouse of the Institute of Plant Breeding. Initially, 44 mungbean entries were subjected to flooding treatment at three weeks after sowing in styroboxes. The trial was laid out in a split-plot design with well-drained and flooded treatments as main plots and genotypes as subplots with 2 replications. During flooding, styroboxes were placed inside concrete tanks filled with water up to 5 cm above the soil surface. Water treatment was maintained for 1 week and allowed to drain for the recovery period. Plant survival, number of plants with aboveground roots and adventitious roots and SPAD chlorophyll measurement were evaluated at one week after the recovery period. Percent survival ranged from 28 to 90%, the highest survival rate was observed in PHL 12930. Not all entries formed adventitious roots, a unique response of plants subjected to flooded condition. Only PHL 14477 and PHL 6522 showed 100% of its plants with copious amount of root above the soil surface. SPAD-502 chlorophyll meter measurement showed significant interaction between water treatment and genotype. Twenty entries were selected for confirmatory screening with three replications and arranged in split-plot design. The selected entries varied significantly in terms of survival and percentage of plants within accession with roots formed above the soil surface. Survival rate ranged from 72 to 100%, with 9 germplasm accessions exhibiting 100% survival. Preliminary data on seed yield, showed an average yield reduction of 15%. The evaluation showed genotypic variability of mungbean grown under flooded condition which can be utilized in varietal development for flooding tolerance.

Keywords: mungbean, flooding tolerance, chlorophyll meter, survival, adventitious roots

AS – 99

SCREENING OF SSR MARKERS FOR MARKER-ASSISTED SELECTION OF MUNGBEAN FOR DROUGHT-TOLERANCE

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Mungbean (*Vigna radiata* (L.) Wilczek) is the top pulse crop grown in the tropics. However, drought has many morphological and physiological effects in mungbean that result in reduced yield. Marker-assisted selection makes it easier to select for and develop drought-tolerant mungbean varieties. This study aimed to screen mungbean-specific simple sequence repeats (SSR) markers for polymorphism in Philippine mungbean varieties. One hundred fifty-eight (158) SSR markers and corresponding primers were selected from the published literature and screened on the genomic DNA of ten mungbean genotypes. The Polymerase Chain Reaction (PCR) conditions were optimized for the SSR primers, and the PCR products were resolved on polyacrylamide gel electrophoresis. One hundred thirty-three (133) primer pairs amplified only one band of similar size (monomorphic), 15 primer pairs amplified two bands, and two primer pairs have amplified three bands per primer while one primer pair has amplified four bands. A total of 40 polymorphic bands were shown from 18 primer pairs. These 18 primers could be used in genetic diversity analysis, and in identifying genetically diverse mungbean genotypes. Identification of polymorphic markers is recommended to improve the selection process.

Keywords: mungbean, marker-assisted selection, SSR, drought

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DIFFERENCES IN ROOT CHARACTERISTICS IN MUNGBEAN (*Vigna radiata* L. Wilczek) SUBJECTED TO WATER DEFICIT

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A screenhouse study was conducted to identify root characteristics of mungbean under water deficit conditions that complement if not, form basis for drought tolerance. Seven mungbean drought tolerant genotypes consisting of 3 IPB Pag-asa varieties, 4 elite mungbean breeding lines, and susceptible check Pag-asa 19 were grown in PVC pipes (0.8 m height x 0.2 m diameter) filled with 20 kg soil. The experiment was laid out following a randomized complete block design with split-plot with 3 replications. The main plot was water regime, with the genotypes as subplot. The water deficit stress was imposed before flowering, 30 days after planting (DAP), by stopping irrigation for a week. One week after rewatering, whole plants were harvested. Roots were scanned and images analysed using root image analysis software, WinRHIZO™. Seed yield, SPAD and dry matter were also recorded.

Variation in the growth and development of the mungbean lines were observed under well-watered and water deficit treatments. Pag-asa 5, positive control variety, was observed to have highest total root length and root surface area with 4% and 7% significant increase respectively compared to the susceptible check Pag-asa 19. Similarly, Line15-5 and 16-37 were able to perform well over the other mungbean genotypes. In terms of root volume, significant differences were observed only between Pag-asa 19 and Pag-asa 3 with approximately 57% difference. A Pearson's correlation coefficient analysis correlated root parameters and different agronomic traits i.e. SPAD value, dry matter, leaf area and seed yield. Positive correlation between seed yield was observed with total root length ($r = 0.643$), total root surface area ($r = 0.419$), root dry matter ($r = 0.626$), suggesting an important role that root growth and development have on drought tolerance in mungbean. Also, variation in these root characteristics can point to possible mechanisms that govern complex responses of crops to drought conditions.

Keywords: drought, mungbean, root imaging, root

AS – 101

EVALUATION OF RICE GERMPLASM AGAINST MAJOR DISEASES

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Genebank is the national repository of diverse pool of rice germplasm collected from different parts of the country, particularly from the upland areas. These germplasms possess useful genes that serve as building blocks for the improvement of new rice varieties. Thus, this study was carried out to evaluate the PhilRice germplasm for resistance to four major rice diseases such as blast disease, rice tungro disease (RTD), bacterial leaf blight (BLB) and sheath blight (ShB). A total of 6,895 rice germplasm from the PhilRice Genebank were evaluated against major rice diseases in screen house and field at the Philippine Rice Research Institute, in wet seasons of 2012 to 2017 following the protocol and evaluation scale of Standard Evaluation System (SES). Results showed 23.81% recorded resistant reactions in terms of blast disease, 8.48% showed the resistance to BLB, 1% of rice germplasm showed resistance to RTD and one of the genotypes was resistant to Shb. Based on the results of the study, germplasms that were evaluated to be resistant against major rice diseases can be considered in the selection of donor or parent materials for breeding, as well as in the production of varieties that provide suitable performance in rice productivity. Validation of the results of the phenotypic data is highly recommended particularly on the aid of gene-specific markers and high-throughput phenotyping. Data from these evaluations would be incorporated in the database that could be available to interested researchers and breeders in the future.

Keywords: bacterial leaf blight, rice blast, sheath blight, tungro disease, viruliferous

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EXTRACTS OF MAKABIYA AND LANTANA: EFFECTIVE AGAINST BACTERIAL LEAF BLIGHT DISEASE OF RICE

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Bacterial leaf blight, caused by *Xanthomonas oryzae* pv. *oryzae*, is one of the major diseases of rice in the Philippines. Severe infections by the causal bacterium in susceptible rice plants, particularly at tillering stage, can lead to wilting and dying of young plants, which eventually result to yield reduction to more than 60%. The use of botanical plants has been long considered an alternative control against many diseases of rice. The use of makahiya (*Mimosa pudica* L.) and Lantana (*Lantana camara* L.) extracts against the bacterium causing bacterial leaf blight of rice, however, has never been known. A study was conducted at the screenhouse of the Crop Protection Division of Philippine Rice Research Institute Central Experiment Station, Maligaya, Science City of Muñoz, Nueva Ecija from June to July 2017 to determine the efficacy of ethanolic extracts of makahiya and lantana plants against bacterial leaf blight disease of rice. Treatments used were makahiya and lantana at 100 and 75% ethanolic extracts, respectively. Each test plant had positive control (Copper oxychloride) and negative control (Ethanol alone). Each treatment was sprayed after the symptoms appeared on previously-inoculated leaves of rice plants (Taichung Native 1). The experiment was arranged in Completely Randomized Design with five replications. Severity of bacterial leaf blight infections on leaves were measured using a grid method. All the data were subjected to one-way Analysis of Variance while treatment means were compared using the Least Significant Difference at 5% level of significance. Statistical analysis revealed that extracts of makahiya and lantana at 100 and 75% solutions effectively reduced the severity of bacterial leaf blight disease. Rice plants sprayed with the extracts had less area under disease progress curve (AUDPC) values than the negative control. Results suggest that extracts of makahiya and lantana have potentials as biopesticides against bacterial leaf blight disease of rice.

Keywords: bacterial leaf blight, mimosa, lantana, *Xanthomonas oryzae*, Xoo

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**GENETIC DIVERSITY ASSESSMENT OF FIFTY
PIGMENTED PHILIPPINE TRADITIONAL RICE (*Oryza
sativa* L.) VARIETIES USING AGROMORPHOLOGICAL
TRAITS**

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Philippine traditional rice varieties offer potential novel genes for rice genetic improvement. Characterization and the subsequent genetic diversity assessment could identify important traits unique to Philippine geographical conditions. Fifty pigmented rice varieties from Region X, XII and XIII were characterized using Bioversity-IRRI rice descriptor list. Insect pests and diseases, and grain chemical properties were also evaluated. Standardized Shannon-Weaver diversity index for phenotypic diversity averaged at 0.30 for qualitative and 0.88 for quantitative traits. Desirable traits observed include erect flag leaf, pubescent leaf blade, and strong culm lodging resistance. Nine pigmented TRVs, namely ‘Kabuyok’ (Coll. No. 1091), ‘Kabuyog’, ‘Dinorado’ (Coll. No. 12786), ‘Lubang (Red)’, ‘Manganahaw’, ‘Palawenyo’, ‘Boringan’, ‘Mixture from Kabuyok’ and ‘Mimis’ have intermediate resistance to whiteheads while ‘Malagkit’, ‘Dinorado’ (Coll. No. 11071), and ‘Canayo’ showed resistance to blast. ‘Tapul’, on the other hand, was identified to have blast resistance with desirable grain chemical properties: intermediate AC, low GT and medium cooked rice (intermediate AC-low GT combination). The 50 pigmented traditional rice varieties can be tapped for pests/diseases resistance, and grain quality utilized for specific breeding purposes.

Keywords: agromorphological; grain chemical properties; pigmented; traditional rice varieties, Shannon-Weaver diversity

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GENETIC DIVERSITY OF *Oryza* SPECIES IN THE PHILIPPINES

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Philippines is home of four wild rice species, namely: *Oryza officinalis*, *Oryza minuta*, *Oryza meyeriana* and *Oryza rufipogon*. Rice breeders used these wild rice relatives to draw genes needed to develop varieties that are resistant to pests and diseases and can adapt to adverse environments. This study was conducted to evaluate the genetic diversity of the three wild rice relatives (*O. minuta*, *O. meyeriana* and *O. rufipogon*) and 23 selected *Oryza sativa* species from the Philippines. Genetic diversity was determined using 14 highly polymorphic microsatellite SSR markers. Overall diversity among the entries observed was 42%. Polymorphism information content (PIC) values ranged from 0.33 (RM24843) to 0.73 (RM19754) with an average of 0.51. The UPGMA cluster analysis grouped the 37 entries into three distinct clusters at 0.55 similarity coefficient. *O. minuta* and *O. meyeriana* were grouped in Cluster 1 showing that they are more closely related wild rice relatives in the Philippines. Moreover, 100% similarity was observed in *O. minuta* 8 and *O. minuta* 9. Cluster 2 composed of 16 *O. sativa* species wherein 100% similarity was observed between variety Ampipit (PhilC1) and Dacula (Phil4). Cluster 3 includes the other species of wild rice relatives specifically *Oryza rufipogon* together with the 7 other *O. sativa* species. The study showed variability of the 37 entries comprising wild rice relatives and *O. sativa* species that would be useful for varietal improvement. Information on the genetic variability at molecular level is suitable to identify, develop and acquire genetically unique germplasm. This study will benefit the plant breeders especially in breeding rice varieties that can combat biotic and abiotic stresses.

Keywords: diversity, genetic diversity, rice, wild rice relatives

AS – 105

GENETIC DIVERSITY OF SELECTED PHILIPPINE WHITE CORN GERMPLASM

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To evaluate the genetic diversity of the germplasm, 143 Philippine white corn accessions collected across different regions of the country, which were obtained from the Institute of Plant Breeding- University of the Philippines Los Baños and East West Seed Company, were characterized for 11 morpho-agronomic traits. All traits except shelling percentage and grain moisture differed among accessions as per ANOVA. The hybrid check variety, P30W40 had the highest yield and had no significant difference from the ten accessions. Correlation analysis showed 37 significant associations. Days to anthesis and days to silking had the highest correlation ($r=0.878$). Cluster analysis based on morpho-agronomic traits showed the grouping of all accessions collected from Mindanao which were tall and low yielding; high yielding accessions including the three commercial check varieties (P30W40, IPB Var 6 and IPB Var 8); and all the early-maturing glutinous accessions including USM Var 8. Maize is one of the most highly genetically and phenotypically diverse crops. These results can be utilized to identify genetic sources for further maize improvement.

Keywords: genetic diversity, phenotypic evaluation, morpho-agronomic traits, Philippine white corn germplasm

AS – 106

GREENHOUSE SCREENING OF HIGH YIELDING SUGARCANE VARIETIES FOR WATERLOGGING TOLERANCE AND EFFECT OF NODAL POSITION IN GERMINATION RESPONSE

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Sugarcane is susceptible to waterlogging during the germination stage, leading to lower plant stand. To test variable cane points' germination potential, 10 High-Yielding Varieties (HYV) were tested for germination response after waterlogging. Cane points were selected based on their nodal position from the cane, with the cane point from the topmost node assigned as cane position 1, going down until cane position 6. Each cane point was pre-germinated before being planted on styrofoam trays and submerged underwater at 5 cm above the soil surface inside concrete tanks. Cane points were divided into three waterlogging treatments; 5 and 7-days waterlogging, and control (well-drained). A week of recovery period was allotted before the germination count and plant height were measured weekly for 6 weeks. Results show waterlogging leads to 75% mortality rate overall, going as far as 97%. Plant height loss due to waterlogging averages at 81%, with some varieties losing 93-99% plant height. In general, extending waterlogging from 5 days to 7 days after planting has no added effect on germination and plant height. In terms of the effect of nodal position, the optimal range of cane position for germination and plant growth are positions 3-5. No apparent difference in rate of growth and germination among the 10 HYVs was observed over 6 weeks, however, results show that Phil 2155, Phil 00-2569, and Phil 2000-0791 had the highest mean plant growth and germination across treatments. Phil 2006-2289 and Phil 00-1419 had the lowest mean plant height and germination rates.

Keywords: sugarcane, waterlogging, waterlogging tolerance, greenhouse screening

AS – 107

HETEROSIS ESTIMATION FOR YIELD AND YIELD COMPONENTS IN AROMATIC RICE

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Exploitation of heterosis has been one of the strategies to achieve targets in crop improvement. It serves as a guide in making sound decisions in selecting the best hybrids that could be used in selecting desirable recombinants in the succeeding generations to develop new lines. The study was carried out to measure the magnitude of heterosis on the yield and the component characters in eight genotypes and their F_1 's which aim to identify best cross combinations and parents

Twenty cross combinations were made following the line x tester mating fashion. The mid parent (MP) and best parent (BP) heterosis were estimated. CL 1/G 10, CL 2/G 12 and Pandan/P 20 had highly significant and positive MP (138.55%, 88.90% and 81.23%) and BP heterosis (66.00%, 125.36%, and 48.60%) for yield per se performance. CL 1/P 20, CL 1/G 12, CL 1/G 28 and CL 1/G 10 showed highly significant negative MP heterosis value for maturity of -6.2%, -6.85%, -7.41% and -9.01%, respectively, and BP heterosis with -8.01%, -7.41%, -10.06% and -9.97% respectively. Heterosis towards dwarfness was noted in Jasmine x P20 over its BP (-8.83%). CL 1/G 10, CL 2/G 12 and Pandan/P 20 were forwarded to the next generation for identification and selection of transgressive segregants CL 1/P 20, CL 1/G 12, CL 1/G 28 and CL 1/G 10 for earliness; and Jasmine x P20 for dwarfness or shortness.

Keyword: Heterosis, yield, aromatic rice

AS – 108

IMPROVING THE BIOTIC RESISTANCE OF NSIC RC 160 RICE VARIETY THROUGH GENE STACKING

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The development and improvement of rice varieties with tolerance to biotic stresses is very important and is possible through marker-assisted selection (MAS). This study aims to improve the tolerance to bacterial leaf blight (BLB) and tungro diseases by incorporating two *Xa* genes (*xa13+Xa21*) and BLB+ tungro QTL each into NSIC Rc160 released variety. Molecular marker genotyping using SSR and SNP markers, induced screening against the diseases and yield trial evaluation were simultaneously done to evaluate the best performing entries. Five populations of advanced lines were evaluated in replicated yield trial in 2018DS. The recorded mean yield ranged from 5.7 to 7.5 t/ha while NSIC Rc160 yielded 6.9t/ha. Presence of introgressed two *Xa* genes (*xa13+Xa21*) were confirmed through SNP genotyping. For BLB+tungro, three advanced lines designated as PR40843-B002 yielded 6.8 to 7.3 t/ha with intermediate to resistant reaction to BLB as compared to BLB susceptible NSIC Rc 160 with 7.0 t/ha yield. PR40843-B002-148-3-1-1-3-1-1 with yield of 7.3t/ha was nominated to multi-environment trial I (MET I). The stacking of genes for biotic tolerance contributed to the high yielding performance of selected entries without affecting the yield. These advanced lines will be nominated to MET and National Cooperative Test (NCT) to be used as released varieties by farmers and as donors for biotic tolerance by breeders and researchers.

Keywords: Bacterial leaf blight, tungro, marker-assisted selection, NSIC Rc 160, gene stacking

AS – 109

MORPHO-PHYSIOLOGICAL CHARACTERIZATION AND FLORAL BIOLOGY OF DIFFERENT HOT PEPPER (*Capsicum* spp.) GENOTYPES

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Characterization and diversity of hot pepper as one of the most important spice crops in the world have not been fully documented. A study was conducted to characterize the plant, floral and fruit morphology and physiology of 17 hot pepper genotypes from local and foreign collections, estimate the amount of diversity and relationships among genotypes, determine the degree of association between quantitative traits, and identify hot pepper genotypes that are adapted to Musuan condition. A functional ANOVA in Randomized Complete Block Design was constructed partitioning the genotypes into meaningful groups. Orthogonal comparison revealed that *C. annuum* genotypes had higher pollen viability (41.26%), longer fruits (7.45 cm) and outyielded the *C. frutescens* and *C. chinense* genotypes by 98.49% at 69.53 g/plant. Standardized Shannon-Weaver Mean Diversity Index was $H' = 0.80$ (high variability) for quantitative characters and $H' = 0.29$ (low variability) for qualitative characters. Strong positive association was found on days to 50% flowering and days to 50% fruiting ($r = 0.98^{**}$), and petal length and fruit length ($r = 0.71^{**}$). Cluster analysis divided the genotypes into three clusters, Cluster 1 for *C. frutescens*, Cluster 2 for *C. annuum*, and Cluster 3 for *C. chinense* genotypes including Cabai from *C. frutescens*. Recommended local genotypes are Django, Musuan ecotype, and Siling Demonyo, while Red Mini Bell and Space Chili After Glow are the foreign genotypes adapted to Musuan condition. These genotypes could be source of valuable genes for hot pepper breeding.

Keywords: hot pepper, diversity, physiological characterization, adaptation, floral biology

AS – 110

NEGLECTED AND UNDERUTILIZED FRUIT, VEGETABLE, SPICE AND ROOT CROP SPECIES OF BUKIDNON

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The increasing trend in the prices of food commodities pushes the consumers to opt for canned and processed foods since these are readily available and much cheaper. This leads to malnutrition among Filipinos. Although the country is very rich with a wide variety of food sources, some of these are neglected and/or underutilized. The study aimed to determine and document the NUS of Bukidnon and their uses. A mixed survey-interview was conducted from September 2017 to October 2018 in collaboration with the City and Municipal Agriculture Offices. A total of 174 respondents from 22 LGUs of Bukidnon were interviewed: 59.77% were women whereas 40.23% were men, 76% of the respondents were senior citizens, and 61% lived in the locality for 31-60 years. Data revealed that some respondents identified and used the NUS primarily for food (87), with 34 species of fruits, 27 vegetables, 13 spices, and 9 root crops. These NUS can be prepared in various ways: soups/stews (46%), fresh or raw salads (19%), sautéed (16%), and cooked or boiled (14%), among others. As to the plant part used, leaves are usually utilized (132 species), followed by roots/rhizomes (92), and stem/bark/vine (66). Filipinos are relatively generous since 43% of the respondents acquired the planting materials by sharing. They also perform conservation practices through replanting (35%), continuous planting (33%), seed storage (22%). Whereas 10% of these NUS were obtained from the wild or by merely allowing them to grow naturally. The study can be used as reference to policy makers in addressing the issues of food security in the country.

Keywords: Bukidnon, fruits, neglected and underutilized species, spices, vegetables

AS – 111

**PHILRICE DEVELOPED NSIC RC 440 (TUBIGAN 39)
RICE VARIETY RECOMMENDED NATIONALLY FOR
IRRIGATED LOWLAND ECOSYSTEM**

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Irrigated rice areas in the Philippines contributed to 69% of the harvested area and 76% (14.56 million metric tons) of the total rice production with mean yield of 4.42 tha. The Philippine Rice Research Institute (PhilRice) continues to develop new varieties with improved grain yield, resistant to major pests and diseases, has good grain quality, with value-added traits, and wide adaptability across environments to fulfill its vision of “A Rice Secure Philippines”. NSIC Rc 440 is one of recently released variety bred by PhilRice for irrigated lowland rice ecosystem. It was derived from a cross between PJ27 and C8088-13-2-1-3-1 in 2004 wet season and designated as PR36720. After selections and yield trials, the breeding line PR36720-17-1-2-1 was nominated to National Cooperative Test (NCT) during 2012 and recommended for varietal release in 2016. It is a semi-dwarf, early maturing variety, with 3.41% to 9.18% yield advantage over PSB Rc 82, mean yield ranged from 5.5 t/ha to 6.9 t/ha, and potential yield from 7.1 t/ha to 10.8 t/ha across sites during the Multi-Location Adaptation Trial (MAT) in 2014 to 2015. It has intermediate reaction to diseases such as blast and bacterial leaf blight, and intermediate resistance to yellow stem borer, white stem borer, brown plant hopper, and green leaf hopper. Its grain is long and intermediate shaped, has good grain quality, good milling potential, and excellent acceptability when cooked and raw. NSIC Rc 440 was recommended for national cultivation in irrigated lowland ecosystem for both transplanted and direct wet-seeded rice system.

Keywords: irrigated lowland, PhilRice, NCT, MAT

AS – 112

PHYSICO-CHEMICAL CHARACTERIZATION AND TRANSCRIPTOME ANALYSIS OF 5-METHYLTRYPTOPHAN RESISTANT LINES AT DIFFERENT DEVELOPING STAGES OF RICE

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Mutation breeding has brought significant contributions in the development of high value crops. It steered the first studies in generating plants with desired mutations in genes encoding key enzymes involved in important metabolic pathways. Molecular characterization of 5-methyl tryptophan resistant plants revealed the different base changes in OsASA that led to sensitivity to feedback inhibition in anthranilate synthase enzyme. In silico analysis of microarray data from different time points during grain filling was also performed in this study. Results showed the differentially expressed genes (DEGs) and the enrichment of these genes revealed their roles in amino acid transportation during grain filling. Surprisingly, among all DEGs, only LOC_Os06g42560, a tryptophan synthase beta chain was found to be the only gene related directly to tryptophan biosynthesis, which may have affected the amino acid content during grain filling. For physico-chemical analysis, grain and eating qualities of the mutant rice lines were elucidated. The evaluation showed that 5MT-4 and 5MT-5, despite having 20 times higher tryptophan contents, measured in $\mu\text{g}/100 \text{ mg}$ seeds, showed approximately 60% chalkiness after milling. The taste quality in general was not affected significantly, however, other parameters like peak time of viscosity and gelatinization temperature showed different results relative to wildtype. Agronomic traits of the 5MT R-lines showed relatively poor performance compared to wildtype. 5-methyl tryptophan resistant plants, 5MT-4 and 5MT-5 having 20 times higher tryptophan contents, could be useful to develop new high nutrient rice varieties.

Keywords: microarray analysis, high nutrient, gene regulation, tryptophan content, rice

AS – 113

QTL BY ENVIRONMENT INTERACTION ANALYSIS FOR GRAIN ZINC CONCENTRATION IN TWO RECOMBINANT INBRED POPULATIONS OF RICE (*Oryza sativa* L.)

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Identification of environment-specific QTL and stable QTL having consistent genetic effects across a wide range of environments is of great importance in plant breeding. QTL by Environment Interaction (QEI) contributes to the effective use of marker-assisted selection (MAS) in breeding, and better understanding of the genetic architecture of important quantitative traits. In this study, QEI affecting grain zinc (Zn) concentrations in three seasons (2017 dry and wet season; 2018 dry season) were dissected using two recombinant inbred line population derived from IR14M141 x Jamir cross (P1) and IR14M141 x Kaliboro cross (P2) and SNP genotypic data. By using inclusive composite interval mapping, a total of 16 additive QEI effects QTLs for grain Zn were detected, which were distributed on chromosome 2, 3, 5, 6, 8, 10, 11 and 12. Most QTLs were relatively stable, whose LOD_A ranged from 1.68 to 44.33, and LOD_{AE} ranged from 0.04 to 3.45. Among QTLs, 10 (63%) QTLs were detected in both single and multiple environments. $qZn_{5.2}$ were commonly identified in both populations. It is also the highest main-effect QTL underlying grain Zn with additive effects of 2.21 ppm in P1 and 1.25 ppm in P2 and explained phenotypic variance of 36.11 in P1 and 11.42 in P2. This region can be targeted in rice breeding for high grain Zn in rice through MAS.

Keywords: Rice, QTL × environment interaction, quantitative trait loci, grain zinc, SNP markers

AS – 114

**REDISCOVERING THE INDIGENOUS VEGETABLE
Broussonetia luzonica (ALOKON) TOWARDS ENHANCING
ITS POTENTIAL FOR FOOD AND NUTRITION**

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Broussonetia luzonica, Family Moraceae, locally called alokon (Ilk.), himbabao (Tag.) or alibabag (Itawis), is a popular indigenous vegetable in the Ilocos Region as well as in Cagayan and Apayao. It is a wild and seasonal vegetable, commanding high price of P200 to P500 per kilogram of inflorescence depending on the month of availability. Initial studies done on its components and biological activities proved its potential on health and nutrition. Literature on the crop is still limiting, and no variety has been identified nor formal production technology has been developed. Thus, this research documented the species' growth and developmental stages, and determined climatic/weathers factors that affect growth and development. These information will serve as bases for possible interventions to induce/promote flowering, especially before and after the regular flowering period. Additionally, accessions/'varieties' with decided consumer appeal and acceptability and good flowering and flower characteristics were identified. To enhance its domestication and commercial production, propagation of planting materials and establishment of duplicate mother trees of selected 'varieties' at MMSU, and development of management technologies are recommended.

Keywords: *Broussonetia luzonica*, growth and development, phenology, promising varieties, good eating qualities

AS – 115

SEED MORPHOLOGICAL CHARACTERISTICS, DESICCATION TOLERANCE AND SEEDLING DEVELOPMENT OF PILI (*Canarium ovatum* Engl.)

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Pili (*Canarium ovatum* Engl.), an endemic genetic resource of the Philippines with great economic potential, is primarily cultivated through seeds. The study characterized the morphological characteristics, desiccation tolerance and germination pattern of pili seeds towards effective germplasm conservation and management. Seventy-two pili accessions from the National Plant Genetic Resources Laboratory-University of the Philippines Los Baños were used. Per accession, one hundred seeds at two replicates were morphologically characterized, germinated and observed for growth and developmental changes using the extended Biologische Bundesanstalt, Bundessortenamt and CHEmical industry (BBCH) scale. One hundred seeds at three replicates were used to identify initial viability. Subsequently, the seeds were slow-dried to approximately 5% moisture content and retested for viability. At ~5% moisture content, pili seeds were characterized to have a hundred seed weight of 889 ± 162 g, length of 4.50 ± 2.15 g, width of 1.97 ± 0.86 g and thickness of 1.6 ± 0.76 g. Kernels had 146 ± 58 g hundred-kernel weight, 30.73 ± 3.60 mm length, 12.87 ± 1.35 mm width and 9.43 ± 1.11 mm thickness. Seven germination stages were documented and illustrated following the extended BBCH scale. Phanerocotylar epigeal with storage cotyledons type of germination was observed with characteristic radicle emergence at the stylar end. Initial viability of the seeds was 100% and seeds retained its viability at 95% after drying that indicates potential desiccation tolerance.

Keywords: *Canarium ovatum* Engl., seed, morphological characters, seedling development, desiccation tolerance

AS – 116

SPORE PRODUCTION AND GROWTH RATE OF TEN *Azolla* HYBRIDS

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Several studies had supported the effectiveness of *Azolla* as alternative or supplementary fertilizer in flooded rice cropping system. The vegetative means of multiplying *Azolla*, which was the main basis for selection of *Azolla* poses a great problem to farmers whenever they need to reinoculate. The hydrological condition in the paddies may change abruptly to the extent that it may threaten the survival of *Azolla* as hydrophyte. Evaluation and selection parameters to be regarded in order to make *Azolla* sp. coincide with the growth and development of irrigated lowland rice in two cropping cycles with dry fallow period between the two cropping cycles should include *Azolla* varieties that produce spores for at least 50% of the time within one year with sporulation index (SI) \geq 50% during the period of maximum spore production. When the SI value is below 50%, the megaspore (MGS) and microspore (MCS) count can be considered. The desired peak of sporulation is at least one month before the withdrawal of floodwater in rice paddies, i.e. two months before harvest date. Among the 10 *Azolla* UPLB hybrids evaluated, *Azolla microphylla* 4099, *Azolla microphylla* 4113, *Azolla microphylla* 4098, *Azolla mexicana* 2033 and *Azolla mexicana* 2030 are the varieties recommended with these parameters.

Keywords: azolla, biofertilizer, rice-azolla, azolla spore, azolla spore technology

AS – 117

VARIETAL DIFFERENCES OF INBRED LOWLAND IRRIGATED MODERN RICE CULTIVAR “*TUBIGAN*”

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The present study aims to investigate the varying characteristics of inbred lowland irrigated rice variety “*Tubigan*” developed by the International Rice Research Institute (IRRI) and released commercially through the National Seed Industry Council, in an effort to determine sub-varietal differences between and among different “*Tubigan*” variants. Forty variants of the “*Tubigan*” variety were compared in terms of yield, planting method, maturity dates, and plant height. Results show the maturity and yield of “*Tubigan*” variants are inversely correlated in terms of planting methods – transplanted rice (TPR) vis-à-vis direct wet-seeded rice (DWSR) for most “*Tubigan*” rice variants. This finding could guide farmers about their choices in their field operations. Data also showed that inbred breeding program is an indirect biological engineering method in improving crops like rice using trials of different rice pedigree to come up with the best rice variant with the best physical traits, and eating and cooking qualities (ECQs).

Keywords: *Tubigan* rice variety, direct wet-seeded rice, inbred lowland irrigated rice, transplanted rice, varietal differences

VARIETAL IMPROVEMENT OF EGGPLANT

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A study was conducted to improve the productivity of eggplant through the development of hybrids which can outperform the parental lines for wet season planting. It aimed to identify plant genotype with good superior, high yielding and eating quality specifically for culinary purposes after which pureline selection was done to produce stable lines from one generation to another. Results showed that based on farmer preference, acceptability rating, reaction to pest and yield components, three promising F₁ Hybrid eggplant were of good potential for wet season planting. These three promising F₁ eggplant hybrids were coded as: MMSU Eg-08, MMSU Eg-06 and MMSU Eg-02. The different MMSU F₁ eggplant hybrids outyielded the check varieties especially during wet season planting. Through series of selection from the F₂ progeny plants up to F₅ generations, eight promising lines potential for wet season planting were also identified and were coded as follows: MMSU Eg-08 GP, MMSU Eg-08 MP, MMSU Eg-02 LV, MMSU Eg-08 LS, MMSU Eg-06 LT, MMSU Eg-02 V, MMSU Eg-02 GV and MMSU Eg-02 G. When evaluated in farmers' field, the performance of the different varieties at different locations varies in terms of yield and reaction to pest using different fertilizer management scheme. The promising MMSU eggplant varieties gave a considerable yield and comparable to the check varieties, although, yield obtained was higher when planted in an inorganic farm as compared to farmers using organic and good agricultural practices. Cost and return analysis also shows that almost MMSU eggplant varieties obtained lowest unit cost of production as compared to the check varieties.

Keywords: hybrid eggplant, wet season planting, improved productivity, pureline selection, farmers' field.

BIOLOGICAL SCIENCES

BS – 01

***Begonia balangcodiae* sp. nov. FROM NORTHERN LUZON,
THE PHILIPPINES AND ITS NATURAL HYBRID WITH
B. crispipila, *B. × kapangan nothosp.* nov., THE FIRST
REPORT OF NATURAL HYBRIDIZATION IN SECT.
*Petermannia***

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The pantropically distributed *Begonia* (Begoniaceae) is one of the most species-rich genera. Philippines is one of the diversity centers of Southeast Asian *Begonia*. In our 2012 field survey, three species of *Begonia* section *Petermannia* were collected in Barangay Sagubo, Municipality of Kapangan, Province of Benguet in the northern Luzon Island, Philippines. Our study on literatures and herbarium specimens suggests that these collections consist of *B. crispipila*, an unknown new species hereby we named *B. balangcodiae*, and the natural hybrid between them. Molecular analyses confirm that the former contributed the maternal genome while the latter provided the paternal genome. We named the natural hybrid *B. × kapangan*, which is the first natural hybrid reported in sect. *Petermannia*. Our studies of *Begonia* biodiversity help bring attention to the Philippine flora that need immediate preservation, conservation and protection.

Keywords: biodiversity, conservation, ITS, *trnL-trnF*, natural hybrid

BS – 02

DIVERSITY OF EPIPHYTIC MACROLICHENS OF THE THREE MONTANE FORESTS OF MINDANAO, PHILIPPINES

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Floristic studies of macrolichen flora of the three montane forests of Mindanao namely: Mt. Kitanglad, Mt. Lumot and Mt. Malambo. Transect walk was employed by recording all the species within the montane sites. Six sample plots with a 20x20 m quadrat was also established and ecological habitats was used for further species identification.

Floristic data revealed a total lichen taxa of 294 species belonging to 27 genera, 16 families and 86 species in Mt. Lumot; A total of 111 species belonging to 31 genera, and 14 families in Mt. Kitanglad; and a total of 97 species belonging to 30 genera, 13 families and 97 species in Mt. Malambo. The most lichen species distribution was represented by Parmeliaceae family and the least belongs to family Malmidiaceae. Mt. Lumot obtained the highest diversity index. While species richness was noted in Mt. Malambo. Cladogram analysis on lichen species indicate that Mt. Malambo and Mt. Kitanglad appeared species similarity. The combination of systematics with floristics studies reflect an increased understanding of the dynamics of lichens species.

Keywords: cladogram analysis, floristic, montane, species richness

BS – 03

TREE SPECIES DIVERSITY AND STAND STRUCTURE OF THE FOREST PATCH IN BAGANIHAN, MARILOG FOREST RESERVE, SOUTHERN PHILIPPINES

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Tree diversity, stand structure and composition were conducted in the forest patch of Barangay Baganihan, Marilog forest reserve, Davao City. Sixteen 20 x 20 m plots (at 1,224-1,240 m asl) were established in the area. A total of 215 individuals of 25 families, 24 genera, and 32 tree species were recorded. Analyses of the data showed that the forest in the area can be categorized as montane forest based on forest structure (average diameter, height, canopy cover) and species composition. *Palaquium philippense*, *Syzygium tula*, and *Astronia ferruginea* has the highest species importance values. Shannon-Weiner index (H') is relatively high when compared to the other mountain ecosystems in Mindanao with H= 1.38. Three threatened species were noted viz., *Agathis philippinensis*, *Palaquium philippinense* as vulnerable, while *Cinnamomum mercadoi* as other threatened species. Eight (8) endemic species were documented, viz., *Alstonia parvifolia*, *Dillenia megalantha*, *Lithocarpus submonticolus*, *Cinnamomum mercadoi*, *Litsea segregata*, *Syzygium tula*, *Aidia pulcherrima* and *Palaquium philippense*. At present, the biodiversity in the area is under threat due to the different disturbances. The present study has helped the indigenous peoples of Marilog District in deciding the tree species for the Assisted Natural Regeneration (ANR) activity in Marilog forest reserve.

Keywords: species richness, forest structure, tree profile, Mindanao

BS – 04

**SPECIES DIVERSITY AND ENDEMICITY OF
HERPETOFAUNA IN BASILISA AND LORETO NEAR
MINE SITES, PROVINCE OF DINAGAT ISLANDS,
CARAGA REGION, PHILIPPINES**

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Herpetofauna is ecologically significant in maintaining the balance of many ecosystems in the Province of Dinagat Islands, Mindanao, Philippines. With the aim to contribute to the very few scientific studies on the assessment and monitoring studies in the diversity, abundance, distribution, and endemism of herpetofauna in the selected sites of the Province of the Dinagat Islands, this study was conducted. The actual assessment was done in the selected sites of Loreto and Basilisa in the months of November 2017, April and June 2018 using the transect method, pitfall traps, and extensive opportunistic sampling. A total of 38 significant herpetofaunal species belonging to 15 families and 33 genera were identified and recorded with high endemism of 76%. The most abundant species observed in the sampling sites were *Limnonectes magnus* (N=246, 36%) and *Pulchrana grandocula* (N=234, 34%). Basilisa had the highest species diversity with $H'=2.27$ and 25 Philippine endemic species (66%). The presence of endemic, near threatened, vulnerable, and endangered species indicates that the sampling sites are essential habitats for reptilian fauna. However, some of the habitats were observed to be disturbed by some anthropogenic activities that will cause the decline of the reptilian population in the area, which requires immediate attention and conservation.

Keywords: species richness, abundance, mining, endemism, vulnerable, anthropogenic activities

BS – 05

**PHYTOPLANKTON DIVERSITY AND ABUNDANCE
DURING A PYRODINIUM BLOOM IN IRONG-IRONG
BAY, WESTERN SAMAR, PHILIPPINES
(SEPTEMBER-DECEMBER 2017)**

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One of the most persistent red tide event caused by the dinoflagellate *Pyrodinium bahamense* happened in Irong-Irong Bay. This started in 2015 and lasted for more than two years as of this writing (2018). Irong-Irong Bay, despite having mariculture sites has very few data with regards to this point of concern. Field sampling was done monthly from September to December 2017. Physico-chemical parameters such as temperature, pH, salinity, depth, turbidity, current velocity, light intensity, and total suspended solids as well as nitrate, phosphate, and chlorophyll-*a* were recorded. A 20 μm mesh size plankton net with 30 cm diameter and 1 m length, and a bucket yielded 65 phytoplankton species. Lowest and highest cell density was recorded during the month of November (3.1×10^4 cells/L) and December (37×10^4 cells/L), respectively. *Pyrodinium bahamense* dominated during the months of September (3.1×10^4 cells/L) and November (0.43×10^4 cells/L) while *Skeletonema* dominated during the months of October (9.9×10^4 cells/L) and December (29×10^4 cells/L) *P. bahamense* was present in all sampling months with a total average cell density of 0.080×10^4 cells/L. It is lower compared to the 2016 study with a total average cell density of 0.77×10^4 cells/L. *Noctiluca scintillans*, which is a potential predator of *P. bahamense*, was also present in all sampling months. This species might have largely affected the abundance of *P. bahamense* in the area. It reached its peak during the month of November with an average cell density of 0.32×10^4 cells/L.

Keywords: *Pyrodinium bahamense*, *Noctiluca scintillans*, *Skeletonema*, Irong-Irong Bay, Philippines

BS – 06

**THE LIZARDS (SQUAMATA: SCINCIDAE:
GEKKONIDAE: AGAMIDAE) IN SELECTED AREAS OF
ANDANAN WATERSHED FOREST RESERVE, BAYUGAN
CITY, PHILIPPINES**

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Lizards are highly diverse with high percentage of endemism in the Philippines particularly in the island of Mindanao. However, there is few existing account documenting the lizard communities of this unique forest reserve area. The study aimed to assess the distribution of Lizards (Squamata: Scincidae: Gekkonidae: Agamidae) in selected areas of Andanan Watershed Forest Reserve using line transect and intensive opportunistic sampling method. Specimens were identified *in situ* and were recorded by photographic documentation. Ten species of lizards belonging to one order and three families were captured and recorded in the sampling sites. Five were categorized as Philippine endemic, two Mindanao Faunal Region endemic and three of least concern lizards. Endemicity in lower elevations reached 80% for lizards communities. Two lizard species have been considered as socio-economically important species by the local villagers. On-going threats (conversion to agricultural land, wildlife hunting, slash and burn, and increasing population) were observed in the area. Finally, the Andanan watershed forest reserve is home to five Philippine endemic and two Mindanao faunal region endemic lizard species. Thus, it is important that this reserve should have better management and protection.

Keywords: Andanan watershed, endemism, reptiles, squamates
***Biological Sciences**

BS – 07

**PREDICTING POTENTIAL DISTRIBUTION OF
ZOOPLANKTON SPECIES IN PHILIPPINE
FRESHWATER ECOSYSTEMS UTILIZING SPECIES
DISTRIBUTION MODELING**

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Species distribution modeling (SDM) is a widely used method to predict possible species distribution range by using known occurrence data with environmental conditions in a certain geographic region. This method has been comprehensively used in terrestrial organisms but rarely utilized for aquatic species. In this study, SDM for seven Philippine freshwater zooplankton species, including the invasive species, *Arctodiaptomus dorsalis* were constructed in MaxEnt to define species distribution, and for non-invasive species, facilitate conservation and protection of their habitats. The models were then evaluated using three methods: AUC, Cohen's Kappa, and True Skill Statistics (TSS). Of the species tested, all models achieved acceptable evaluation results (AUC > 0.70; Kappa and TSS > 0.50), except for *Moina micrura* and *Mesocyclops varicans*. Moreover, flow regime, topographic slope, and soil organic content around aquatic bodies have a significant contribution to the constructed SDM for most species. This study shows the potential use of SDM methods like MaxEnt in predicting the possible distribution of zooplankton species across river and lake networks in the Philippines, especially in determining the extent of distribution of some invasive taxa. This inferential capacity of SDM in freshwater zooplankton opens doors to different predictive analyses that can be used in drafting sound conservation and management policies.

Keywords: *species distribution modeling, zooplankton, Copepoda, Cladocera, and freshwater ecosystem.*

BS – 08

ESTIMATION OF BIOMASS AND CARBON SEQUESTRATION BY FOREST TREE SPECIES IN RESPONSE TO MICROBIAL BIOFERTILIZERS IN A MINED-OUT AREA IN MOGPOG, MARINDUQUE

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Climate change is presently the most important issue facing our generation. Estimation of plant biomass is one of the developed methods to determine the amount of carbon stored and carbon dioxide (CO₂) that can be released into the atmosphere, which can help reduce environmental degradation and mitigate climate change. This study assessed the carbon sequestration and storage by three reforestation species: *Pterocarpus indicus*, *Acacia mangium*, and *Eucalyptus urophylla*, as influenced by microbial biofertilizers [mycorrhiza with or without nitrogen fixing bacteria (NFB)]. Inoculation was done during pricking while lime and compost were applied to all seedlings during field planting. Allometric equation developed by Martines-Yrizar et al. (1992) was used to determine biomass density using diameter at breast height (dbh) and total height of the tree. Representative trees were excavated 27 months after field planting. Results showed that *A. mangium* inoculated with mycorrhiza+NFB gave a 73.54% increase of accumulated biomass and CO₂ compared with its control counterpart. In *E. urophylla*, 70% biomass increase was observed by those inoculated with mycorrhiza alone. In *P. indicus*, mycorrhiza+NFB inoculated plants gave a 19.10% increase relative to the uninoculated ones. The results suggest that plant biomass and CO₂ sequestration due to microbial inoculation and other soil amendments vary depending on tree species. In conclusion, *A. mangium* generated higher plant biomass, that likewise, gave higher amount of stored or sequestered CO₂ than *E. urophylla* and the lowest was *P. indicus*. Studies should be conducted in other mined- out areas in the country to verify the results.

Keywords: climate change, inoculation, allometry, mycorrhiza

BS – 09

**EFFECTS OF MYCORRHIZAL INOCULATION AND
OTHER SOIL AMENDMENTS ON GROWTH, NUTRIENT
STATUS, AND RHIZOSPHERE MICROBES OF
Acacia mangium AND *Eucalyptus urophylla***

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Acacia mangium and *Eucalyptus urophylla* are popular species for forest plantation and both known for their rehabilitation capability on heavy metal sites. These species can survive in such environment due to their association with beneficial microbes like arbuscular mycorrhizal fungi (AMF) and nitrogen fixing bacteria (NFB). The experiment was conducted to determine the growth, nutrient status, and microbial population due to AMF and/or NFB and other soil amendments. Treated seedlings were raised at the screenhouse and planted in mine tailing site of Mogpog, Marinduque. The seedlings were inoculated with AMF from Surigao, Mindanao mine tailing (coded as Sur) and from marginal site (*Glomus macrocarpum*, coded as *Gmacro*), with or without NFB. After one year, both species grew very well in the area with 96% survival. Mycorrhiza inoculated *A. mangium* grew healthy with green leaves and a meter taller than the control. On the other hand, stem diameter of *E. urophylla* increased by two times when inoculated with *Gmacro* alone. P concentration in the youngest fully expanded leaves of *A. mangium* was highest (1,504 ppm) when inoculated *Gmacro* alone, while N concentration was 2.5% in NFB inoculated plants. Lastly, the rhizosphere soil population of culturable fungi in *A. mangium* was highest in NFB+Surigao inoculated seedlings while the highest NFB and AMF spore count was observed in NFB and Sur inoculated counterpart, respectively. The lowest microbial count was observed in the control counterpart. The results can be used to encourage adoption of the technology for both species in mined-out areas. Microbial biofertilizers inoculated species can also be recommended in the rehabilitation of other mine tailing sites.

Keywords: biofertilizer, *Glomus macrocarpum*, nutrient accumulation, mixed inoculant

BS -10

HEAVY METALS ABSORPTION BY THREE REFORESTATION SPECIES INOCULATED WITH MICROBIAL BIOFERTILIZERS IN A MINED-OUT AREA IN MOGPOG, MARINDUQUE

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Heavy metals are defined as metallic elements with relatively high density and are toxic at low concentrations. Such substances, although naturally present in soil, in mined-out areas, concentrations are harmful to all living organisms including human. The use of both microorganisms and plants as a bioremediation method to treat heavy metal contaminated soils is of high interest since it is cost effective. The experiment was conducted to demonstrate the effect of microbial inoculation on the absorption of heavy metals by narra (*Pterocarpus indicus*), *Acacia mangium* and *Eucalyptus urophylla*. Four month old treated seedlings were outplanted in June 2016 in a mine tailing in Barangay Capayang, Mogpog, Marinduque following RCBD with ten seedlings in a row per block per treatment. All data were subjected to ANOVA of RCBD and treatment means were compared using Tukey's. Twenty-seven months after field planting, the accumulation of elements in the tissues of all three forest species has been in the following order: Cu>Pb>Cd. In all three species, roots contained the highest amount of Cd and Cu while the stem highly accrued Pb. Narra inoculated with mycorrhizal fungi and nitrogen fixing bacteria (NFB) absorbed significantly higher amounts of Cd and Cu (3.34 ppm and 2,799 ppm, respectively) among the three species. *E. urophylla* inoculated with mycorrhiza alone accumulated greater amount of Pb than *A. mangium* (9.66 ppm and 12.49 ppm, respectively). In conclusion, the amount of heavy metals absorbed by plants varied depending on the tree species and microbes used. Mycorrhiza+NFB inoculated narra absorbed the highest Cu and Cd while *E. urophylla* inoculated with mycorrhiza alone absorbed the highest Pb. Tree species studied can be used to clean up Cd, Cu and Pb laden soils.

Keywords: *Acacia mangium*, *Eucalyptus urophylla*, narra, *Pterocarpus indicus*

BS – 11

BIOREMEDIATION OF IRRIGATION WATER AND GENERATION OF BIO-ENERGY USING ENRICHED CONSORTIA IN A DUAL-CHAMBERED MICROBIAL FUEL CELL

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Microbial Fuel Cells (MFCs) are gaining research interests due to bioenergy generation and wastewater remediation capacity at the same time. The present study developed a low-cost, eco-friendly and simplified dual-chamber MFC set-up mainly using recycled materials. The bio-electricity generation capacity of the constructed MFC template using irrigation water with naturally-inhabiting microbial consortia enriched with *Citrobacter koseri*, *Bacillus flexus*, *Shimwella blattae* and *Kosakonia sacchari* was investigated. Generated voltage (millivolts) and current (milliamperes) every 3 days in its 30-day operation were recorded using a digital multimeter. Power (watts), power density (W/m^2) and current density (A/m^2) were computed. Water pre/post analysis and phytotoxicity assay were also carried out. The profile generated by the MFC set-up enriched with *Citrobacter koseri* (Ck-MFC) clearly demonstrates its potential for stable and reliable voltage, current and power production at an average of 336 mV, 64 mA and 31 W in its 30-day operation which are within the MFC output thresholds (300-500 mV, 2 mA and 25 W). Ck-MFC also generated higher power and current densities at 130.15 W/m^2 and 0.27 A/m^2 , respectively, than *Shewanella putrefaciens* (positive control) while exhibiting 87% lead biosorption and no phytotoxicity. Overall, this study has shown that the constructed MFC set-up can serve as a potential bio-electricity generation system which could benefit electricity-deprived remote areas and financially-challenged households.

Keywords: Bio-electricity, microbial fuel cell, *Citrobacter koseri*

BS – 12

PHENOLOGICAL ASSESSMENT OF SELECTED INDIGENOUS TIMBER SPECIES IN ILOCOS NORTE

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Seed shortage is oftentimes the limiting factors in scaling-up the rehabilitation of denuded areas. This is due to the unpredictable fruiting seasons of most trees and short viability of recalcitrant seeds. Hence, this study was conducted to provide information on the phenology of superior mother trees of selected indigenous timber species (ITS) to develop a seed calendar that could facilitate seed collection and planning of nursery operation and timely production of quantity planting stocks. The study was carried out in selected areas in Ilocos Norte where the superior mother trees of premium ITS are found. Six indigenous timber species namely: *Anisoptera thurifera*, *Vitex parviflora*, *Sindora supa*, *Dracontomelon dao*, *Intsia bijuga*, and *Wrightia pubescens* were evaluated. The vegetation profile, soil variables and agroclimatic factors were determined. Individual trees with diameter breast height greater than 20 cm were considered. Leafing, flowering, fruit development and maturation were observed once a month for 3 years. Results revealed that peak of flower bud inception of *V. parviflora*, *D. dao*, *W. pubescens* and *A. thurifera* starts after leaf flush during the first rain in May while flowering activity of *S. supa* and *I. bijuga* comes earlier during mid-summer. However, the flowering activity of *V. parviflora* continuously occurs towards the early dry months in January followed by fruit development and maturation. Fruit development and maturation had the longest phenophase of 8-9 months in *A. thurifera* and *W. pubescens*, 3-4 months in *V. parviflora*, 4-5 months in *I. bijuga* and 2-3 months in *D. dao* and *S. supa*. Timing of flowering and fruiting remains unchanged in almost all the timber species. Thus, the ideal time of collecting seed or fruit of *D. dao* is August – September, *V. parviflora* is September- October, *S. supa* is May – June, *I. bijuga* is October-November, and *A. thurifera* is April – May.

Keywords: phenology, indigenous timber species, seed shortage, phenophase, seed calendar

BS – 13

**ANTI-ANGIOGENIC ACTIVITY OF CORAL PLANT
(*Jatropha multifida* Linn.) CRUDE LEAF EXTRACT ON
DUCK (*Anas platyrhynchos*) EGGS USING
CHORIOALLANTOIC MEMBRANE (CAM) ASSAY**

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The aimed to investigate the anti-angiogenic activity of the leaf crude extract of Coral plant (*J. multifida*) using Chorioallantoic Membrane (CAM) Assay of duck eggs (*A. platyrhynchos*). A group of experimental ducks treated with 10 ug/ml, 50 ug/ml, and 100 ug/ml of *J. multifida* extracts, dexamethasone (positive control), PBS (negative control) and an untreated control were considered. Data gathered focused on the number of branching points, diameter of blood vessels, angular spectrum, and 3D image analysis. Results showed that in the 100 µg/ml treatment, 62.67% blood vessel inhibition was observed on the first day observation while 91.42% on the second day of observation. Image analysis using 3-D view of the CAM and angular spectrum revealed a parallel result with the % inhibition of blood vessels. Diameter of the blood vessels was directly proportional on the concentrations of the plant extract. Significant differences in the percent inhibition in the 50 µg/ml and 100 µg/ml treatments were observed compared to the negative and untreated controls. No significant differences were shown among the treatments in terms of diameter of the blood vessel. It can be concluded that *J. multifida* leaf crude extract has anti-angiogenic potential which can be further explored for medicinal purposes like in the inhibition of tumor metastasis.

Keywords: chorioallantoic membrane, antiangiogenesis, vascularization, inhibition, blood vessel diameter

BS – 14

**TOXICITY AND ANTI –DIABETIC ACTIVITY OF
SERPENTINA (*Androgaphis paniculata* Burm F.) LEAF
CRUDE EXTRACT IN INDUCED – HYPERGLYCEMIC
SWISS MICE (*Mus musculus* L.)**

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One of the leading causes of mortality in the Philippines is diabetes mellitus (DM) because most diabetic patients rely on “out-of-pocket” expenses for a daily medication. Thus, this study aimed to evaluate the potential of serpentina (*Androgaphis paniculata* Burm F.) in lowering blood glucose of induced diabetic swiss mice (*Mus musculus* L.). Specifically, it aimed to (1) assess the level of toxicity of serpentina leaf crude extract (SCLE) using Brine Shrimp Test; (2) determine the blood glucose level of white mice before and after treatment application; and (3) determine the effect of SLCE in lowering the blood glucose as compared to commercially available anti diabetic drugs. The protocols used in the study were reviewed and approved by Institutional Animal Care Facility Unit (IACUC) and Bureau of Animal Industry. The effects of the SLCE on the lethality of brine shrimps were reported in terms of LD₅₀ and results showed that SLCE is toxic to the brine shrimp at a concentration of 1,000 µg/ml and could be taken at 188.41 mg/kg of body weight. After a week of inducing diabetes and two weeks of treating the mice, the potential of SLE in lowering the blood glucose level at a dose of 200 mg/kg was observed. The weight of the mice dramatically increased after induction and after three days of treatment. The study revealed that serpentina leaf crude extract possesses anti diabetic activity.

Keywords: toxicity, anti-diabetic, brine-shrimp, hyperglycemic

BS – 15

LARVICIDAL ACTIVITY OF *Calophyllum inophyllum* (BITAOG) LEAF EXTRACT AGAINST DENGUE VECTOR *Aedes aegypti*

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Insecticides of botanical origin have been reported as useful for control of mosquitoes since synthetic insecticides have caused adverse environmental effects and high operational cost. This study aimed to determine the larvicidal activity of *Calophyllum inophyllum* (Bitao) leaf extract against dengue vector *Aedes aegypti*.

The Bitao plant extract was subjected to phytochemical analysis and results indicated the presence of alkaloids, tannins, saponins, terpenoids, flavonoids, phenols and sterols. For the larvicidal bioassay, the 3rd instar larvae were tested by different concentrations (0.25%, 0.5%, 1%, 2%, 3%, 4% and 5%). The mean percentage of larval mortality was 68% for 0.25% v/v and 97% after 24 h. After 48 hours of treatment, the lowest concentration was 85.2% and the highest shows 100% mortality. Positive control (mosquito pellets) showed 35.56% and 74.07% mortality percentage after 24 hours and 48 hours respectively. The negative control (methanol) showed 0% mortality both after 24 and 48 hours. The LC 50 and LC 90 after 24 hours were 0.1407 and 1.8387, while after 48 hours, LC 50 and LC 90 were 0.0055 and 0.4232. Results showed that Bitao leaf extract was found effective in controlling *Aedes aegypti* larvae under laboratory conditions.

Keywords: Larvicidal activity, Bitao plant, phytochemical analysis, LC 50, LC 90.

BS – 16

MORPHOLOGICAL CHARACTERIZATION, MEIOTIC BEHAVIOR AND POLLEN FERTILITY OF *Canna* (*Canna x generalis* LH Bailey and EZ Bailey)

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The morphology, meiotic behavior and pollen fertility of selected ‘Bandera Española’ or *Canna* (*Canna x generalis* LH Bailey & EZ Bailey) were characterized. *Canna* ‘Percy Lancaster’ is a medium sized cultivar with branching habit, green and oval-shaped foliage with white margin and the stem is round and green. The panicles of flowers are open, yellow and heavily spotted with red, while the staminodes are large, edges are ruffled, and petals are yellow. *Canna* ‘Yellow King Humbert’ is also medium sized, has upright growth habit, and tillering is prolific with green and oblong shaped foliage. The flowers are cupped, yellow and the throat has red spots on yellow. *Canna* ‘Wintzer’s Colossal’ is tall, tillering is average with branching habit, has green, ovoid shaped foliage. The flowers are open, red, staminodes are large, and rhizomes are thick, up to 3cm in diameter and purple. On the other hand, the meiotic behavior of hybrid 3 (light yellow x red orange) ($2n=18$) in metaphase I and metaphase II showed that some chromosomes aligned normally at the equatorial plate but laggards which are the bivalents that arrived late at the equatorial plate were also observed. The meiotic behavior of ‘Percy Lancaster’ ($2n=18$), in metaphase I showed that their chromosomes behaved mostly as univalent resulting from reduced chiasmata formation and abnormal behavior like laggards formation during metaphase I. Pairings observed were quadrivalents, trivalents and bivalents. Among the hybrids characterized, hybrid 3 (H3R1) has the highest percentage of fertile pollen grains at 96% while hybrid 4 (H4R2) has the lowest pollen fertility at 67%.

Keywords: *Canna*, chromosome number, meiosis, morphology, pollen fertility

BS – 17

THE BIOGEOCHEMICAL CYCLING OF METHANE (CH₄) IN LAKES CALIBATO, PANDIN AND YAMBO: IMPLICATIONS ON THE LAKES' CARRYING CAPACITY

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Lakes, aside from providing sustenance and livelihood, can play an important but relatively unrecognized ecological role. They can either store or release methane (CH₄), a greenhouse gas that is 25 times more effective in warming the atmosphere compared to carbon dioxide. In Philippine lakes, where strong impacts brought by unmanaged anthropogenic activities were usually experienced, baseline information about CH₄ stored in the water column and methane-oxidizing bacteria (MOB) is still lacking. In this research, CH₄ concentrations in the water column and one of its key drivers, methanotrophs, were explored. Interesting amounts of CH₄ in $\mu\text{mol.L}^{-1}$ (Yambo with 0.43 ± 0.25 from surface to 15 m depth, 169.40 ± 188.18 at 20 m depth to bottom; Pandin with 4.32 ± 10.12 from surface to 15 m depth, 819.65 ± 915.09 at 30 m depth to bottom; Calibato with 49.53 ± 84.69 from surface to 15 m depth, 796.88 ± 129.69 at 40 m depth to bottom), and MOB profiles (from Types 1, 2 and NC10) were detected from each of the lakes. Along with these results, vertical profiles of selected limnological parameters (i.e. temperature, dissolved oxygen, pH, conductivity and salinity) and climate data were analyzed to detect trends related to the lakes' stratification and mixing regime, and monsoon-driven changes. These findings lead to significant points for lake protection and rehabilitation, since eutrophication and the increasing global temperatures were previously described to have intensive effects on the CH₄ production and its possible emission. As we now realize the occurring impacts of the changing climate, this research displays the indirect consequences on the carrying capacity of the lakes as they function both as "CH₄ sinks and sources."

Keywords: climate change, lake management, limnology, methane

BS – 18

PREDICTING MANGROVE SUITABLE AREAS USING GIS WEIGHTED SUITABILITY ANALYSIS IN ORIENTAL MINDORO, PHILIPPINES: A DECISION SUPPORT TOOL IN MANAGEMENT OF CRITICAL RESOURCE

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A weighted suitability analysis was conducted in predicting suitable areas for mangrove rehabilitation in Oriental Mindoro, Philippines. There were six thematic maps used, projected in PCS zone 51N, rasterized and reclassified. Weighted overlay technique was implemented using a straightforward score class ranging from 1-3. Weight influences were assigned to mangrove areas (30%), land cover (20%), rivers (15%), roads (15%), soil types (10%) and slope (10%). The workflow was made to run in ModelBuilder feature of the ArcMap. Mangrove suitability map was generated in three suitability classes. The area covered by each suitability class was extracted using the zonal geometry tool of the spatial analyst extension. There were 10 out of 15 municipalities in the province detected with effective suitable areas. The predicted suitable areas had a total of 75,433.20 km². The municipality of Mansalay gave the highest in low suitability (13,549.26 km²), Calapan City for mid suitability (15,321.13 km²), and Naujan (891.11 km²) for high suitability areas. Overall, Calapan City has the highest computed suitability areas (19,847.28 km²) regardless of the categories. The generated data could be efficiently utilized in planning and management of mangrove resources. The study demonstrated the applicability of GIS framework as decision support tool for potential mangrove rehabilitation initiatives.

Keywords: GIS, Weighted Suitability, Mangroves, Oriental Mindoro

BS – 19

INTERTIDAL SEAGRASS DISTRIBUTION AND SOIL STRUCTURE IN THE PROTECTED SEASCAPE OF SARANGANI BAY, PHILIPPINES

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Seagrasses are unique angiosperms that thrive in marine environments. Transect-quadrat sampling was conducted in the intertidal zones of protected seascape of Sarangani Bay (Maasim, Alabel and Maasim provinces). In each site, there were 10 quadrats per transect with a total of 6 transects (100 meters apart) installed perpendicularly from the shoreline. A total of 11 species were accounted in the intertidal zone with two species noted outside the sampling transects. Species richness, abundance, percent cover and Shannon diversity was highest at Maasim site, dominance index at Alabel site and evenness at Glan site. Two way Anova revealed highly significant difference in vegetation-soil factors ($p < 0.0001$), significant ($p = 0.0448$) in sites factor and highly significant ($p < 0.0001$) for the interaction of factors. Post hoc analysis revealed significant difference between Alabel and Maasim sites ($p < 0.05$) while no significant difference in Maasim vs Glan and Alabel vs Glan sites. This pattern was similarly depicted in non-metric multidimensional scaling (stress value < 0.05). Soil structure in the 3 sites was composed largely of silt to medium sand. Principal component analysis gave 89.66% variances of two principal components with abundance, dominance and medium sand influencing PC1 while species richness, silt and very coarse sand in PC2. The analysis revealed that abundance and species richness is correlated by silt and medium sand while biodiversity attributes gets lower indices as soil structure becomes coarse sand, very coarse sand and gravel. This insight would be helpful for management of intertidal seagrass in protected seascape in Sarangani Bay, Philippines.

Keywords: intertidal seagrass, principal component analysis, Sarangani Bay, non-metric multidimensional scaling.

BS – 20

ZOOPLANKTON AS INDICATORS OF WATER QUALITY IN MANILA BAY

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Zooplankton abundances correspond to environmental fluctuations. They are more critical and dynamic in coastal areas because of combined land and marine influences. Hydrobiological survey was done every other month in Manila Bay in 2017. Physico-chemical parameters like temperature, salinity, dissolved oxygen and chlorophyll-a concentration were measured using SBE CTD 19 Plus. Zooplankton samples were subjected to microscopy. Redundancy analysis showed that there are significant correlations between zooplankton abundances and environmental parameters. *Microsetella norvegica* were most abundant showed inverse correlation with dissolved oxygen. *Euterpina acutifrons* was found to be aggregating in stations with high temperature and high nitrate concentrations. The inverse relationship of *Paracalanus* sp. and *Oithona* spp. with salinity was notably visible in the months of January, September and November. Dominance of *Oithona* spp. was observed in coastal areas of the bay. The 23% variance in zooplankton composition and abundance were explained by the following parameters: temperature, dissolved oxygen, salinity and nitrate concentrations.

Keywords: zooplankton assemblages, environmental parameters, redundancy analysis, zooplankton diversity

BS-21

BIOSORPTION OF NICKEL BY *Bacillus cereus* AND *Stenotrophomonas maltophilia* ISOLATED FROM BAYTO RIVER, ZAMBALES

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Heavy metal contamination of water systems is a global environmental concern and biosorption of these heavy metals using bacteria offers a more potent and cost-effective solution compared to conventional methods. In this study, 139 nickel-resistant isolates were obtained from the water samples collected from Bayto river. The metal resistance profiles of the isolates were determined using the Kirby-Bauer disc diffusion method. Sixteen isolates were able to tolerate the highest concentration of nickel and were subjected to multimetal resistance assays. Out of the 16 most Ni-resistant isolates, only four were able to tolerate 7,500 parts per million (ppm) of copper, and 10,000 ppm chromium and lead. These isolates (S2Q1, S1I2, S3Z1, S2P1) were subjected to biosorption assay. Biosorption of nickel by these isolates was done by adding 10 mL of inoculated Nutrient broth (NB) (16-hour culture) to 90 mL of NB supplemented with 1,000 ppm nickel. The metal-microbe suspensions were incubated at room temperature in a rotary shaker at 150 rpm for 24 hours. Afterwards, the NB from each setup was centrifuged and the supernatants were analyzed using atomic absorption spectrophotometry (AAS). Furthermore, the four isolates were identified via 16S rRNA sequencing. The S1I2 exhibited the highest biosorption percentage at 92.27%, followed by S3Z1 (91.67%), then S2Q1 (91.36%) and S2P1 (89.78%). S2Q1 and S1I2 were identified as *Stenotrophomonas maltophilia* while S3Z1 and S2P1 as *Bacillus cereus*. S1I2 exhibited the highest biosorption percentage at 92.27%.

Key words: biosorption, nickel, heavy metals

BS-22

METABOLIC PROFILE AND COMPOSITION OF ENDOGEIC EARTHWORM *Pontoscolex corethrus* GUT BACTERIAL COMMUNITY COLLECTED FROM MT. MAKILING, LAGUNA, PHILIPPINES

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Earthworm gut microflora is known to perform important functional traits related to the decomposition of organic matter in soil. However, studies on the composition and function of the earthworm gut bacterial community in the Philippines is very limited. *Pontoscolex corethrus*, an endogeic earthworm species belonging to Family Glossoscolecidae (subclass Oligochaeta), is commonly found in tropical soils under undisturbed native vegetation. This study highlights the functional diversity of microbial communities found in the gut of *P. corethrus* collected from Mt. Makiling in Los Baños, Laguna, Philippines. Microbial response or catabolic potential index of 0.986 was assessed using Average Well Color Development (AWCD). Richness (R) value of 69 was determined as the number of oxidized carbon substrates, and Shannon–Weaver index (H) value of 0.361 as richness and evenness of response was identified. These indices were calculated, following the community level physiological profiling (CLPP) using Biolog EcoPlate™. Analysis of variance (ANOVA) and principal component analysis (PCA) were used to demonstrate the differences of the bacterial functional diversity. Wells with positive substrate utilization were run in denaturing gradient gel electrophoresis (DGGE) and extracted for molecular identification of the bacteria with the highest substrate utilization. CLPP analysis, ANOVA and PCA indicated the functional diversity of earthworm gut bacterial community. DGGE analysis further confirmed the structure and composition of these bacterial communities that positively utilized different substrates.

Keywords: earthworm gut, *Pontoscolex corethrus*, Biolog EcoPlate™, DGGE, microbial community

BS – 23

ECOLOGY OF REPTILIAN FAUNA IN ANDANAN WATERSHED FOREST RESERVE, CARAGA REGION, PHILIPPINES

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This study was carried out to assess the basic ecology of reptilian fauna in Andanan Watershed Forest Reserve, Caraga, Philippines employing the transect walk and extensive opportunistic sampling method. Environmental variables were gathered, and the association of reptiles between these variables was performed using Canonical Correspondence Analysis. Diet composition of *Eutropis multifasciata* and *Eutropis multicolorata*, and the socio-economic importance of reptiles were also assessed. A total of 216 individuals of reptiles belonging to nine families, 23 genera and 27 species were recorded, of which 77.77% are considered least concern species. Eighteen significant record of Philippine and Mindanao endemics were also accounted in the area. Species richness was highest in Brgy. San Juan (S=19), and high species abundance was recorded in Brgy. Calaitan (N=73). Dietary compositions of *E. multifasciata* and *E. multicolorata* were mainly insects particularly Orthopterans and Odonata. Platyhelminthes was the only endoparasite observed in the stomachs of *E. multifasciata*. Moreover, nine environmental variables were strongly associated with the abundance of reptiles. The reptilian fauna utilized aquatic, arboreal, and terrestrial microhabitat types and highly preferred forest habitats. However, reptiles are threatened not only because they are consumed, sold and used in traditional medicine, the destruction and degradation of the habitats in the area also elevated the threats to reptilian faunal diversity. Monitoring, protection and conservation of the forests of the Andanan Watershed are essential to safeguard the reptiles and other biodiversity of the watershed.

Keywords: diet analysis, microhabitat, Philippine endemic, socio-economic importance, threats

BS – 24

DISENTANGLING MULTIPLE STRESSORS AND HIGHLIGHTING THE IMPORTANCE OF FRESHWATER PROTECTED AREA IN HIGHLY URBANIZED WATERSHEDS IN THE PHILIPPINES

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Urban lotic ecosystems are impacted by multiple environmental stressors due to social-economic activities in the catchment. To aid in mitigation, global expansion of protected areas aquatic environments was recently set based on the Convention of Biological Diversity Aichi Target 11. As such, this study aims to disentangle the overlaying effects of deforestation and nutrient pollution on benthic macroinvertebrate communities (BMC) and assess the recent protection efforts in the watersheds of Laguna de Bay. Study sites in Silang-Santa Rosa Subwatershed (13) and Marikina Watershed (16) were sampled for BMC and surveyed for environmental factors such as land use patterns, human population density (HPD), and physicochemistry. Multivariate and regression analyses on taxa assemblages and environmental variables efficiently delineated study sites according to the degree of human impact and status of protection. Canopy openness, HPD, dissolved oxygen, and total phosphorus appeared to be the most important variables in predicting BMC. Also, the recent establishment of Upper Marikina River Basin Protected Landscape inside Marikina Watershed was successfully used to timely show how freshwater protected areas are effective in combating stream habitat destruction and biodiversity loss.

Keywords: human population density, freshwater protected area

BS – 25

INTEGRATED VULNERABLE ASSESSMENT OF WATER-ENERGY-FOOD SECURITY NEXUS IN WARAS-LALO SUBWATERSHED, BICOL RIVER BASIN, PHILIPPINES

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The usual vulnerability assessment is often sectoral- and hazard-specific approach. With the *nexus* approach on water, energy and food (WEF), it is recognized that these three sectors have interactions and synergies/trade-offs in their activities. *Security* has five dimensions namely: availability, accessibility, affordability, accessibility, quality and sustainability. This paper discusses how a developed conceptual framework on *integrated vulnerability assessment* (IVA) and methodology of WEF security nexus was applied to a watershed. The framework considered the watershed with three systems of ecological, energy and food, interacting with water as the common element. The same concept of vulnerability assessment was used for IVA, a function of exposure, sensitivity and adaptive capacity. IVA was done by identifying parameters among WEF and inclusion of sectoral variables related to the various dimensions of security. The overall concept is to attain sustainable development if recommended measures will be done. Based on the identified relationships and parameters, IVA of WEF nexus was applied to the Waras-Lalo Subwatershed. The results show that the parameters were responsive to the assessment. Furthermore, the IVA of the study area had a result of being highly vulnerable to climate change related factors such as typhoons, rainfall change, drought and temperature rise. The recommendations for the study are: 1. Indicator responsiveness – the indicators used were responsive and replicating these to other sites can be recommended; 2. Data improvement - indicators used in this study were not strictly to be used in IVA of WEF nexus security in other study sites, there can be some data that can still be included if available; 3. Framework recommendation - concept of IVA is highly relevant not only for the study area but for the whole country with increasing population consuming water, energy and food. The developed IVA framework for WEF nexus security can be recommended in other study sites for a holistic and comprehensive assessment of the limited resources on water, energy and food.

Keywords: Sustainability, Watershed, climate change

BS – 26

IDENTIFICATION OF ACTIN AND BETA-TUBULIN HOUSEKEEPING GENES IN THE *Moringa oleifera* Lam. LEAVES

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Moringa oleifera is a high valued plant. Its multi - purpose uses and numerous health benefits have attracted the attention of farmers and researchers since time immemorial. However, there are limited studies and information about its genome. Thus, the study was conducted to extract, amplify and sequence the actin and beta - tubulin housekeeping genes from *M. oleifera* leaf. DNA was extracted using the DNazol plant DNA extraction kit. Then, DNA quantity and quality were checked using spectrophotometry. The housekeeping genes were amplified using PCR. PCR products were run in agarose gel electrophoresis. Results revealed that beta-tubulin gene size is 275 bp while actin is 79 bp. The consensus sequence and phylogenetic analysis using Chromas and Bioedit, and NCBI BLAST and MEGA respectively showed that beta tubulin housekeeping gene from *M. oleifera* is closely related to the same housekeeping gene from *Cucumis sativus* and *Cucurbita maxima* having a bootstrap value of 56. Based on their taxonomic details, *M. oleifera*, *C. sativus* and *C. maxima* are species all belonging to the same subclass *Dileniidae*. The sequence analysis has proven that the housekeeping gene isolated from *M. oleifera* is indeed a beta tubulin gene. Our results will provide a valuable reference for future studies on extraction, amplification and sequence analysis of important functional genes.

keywords: *Moringa oleifera*, housekeeping genes, beta-tubulin, actin

BS – 27

TRANSCRIPT AND GENOMIC ANALYSIS OF OSBADH1 IN CLSU AROMATIC RICE (*Oryza Sativa* L.) ACCESSIONS UNDER SALINE CONDITION

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The relation of BADH1 to aroma and salinity stress was investigated through stress evaluation, sequence and gene expression analysis using the selected aromatic rice accessions from Central Luzon State University. Polymorphisms including SNPs, insertion and deletion were observed in genomic analysis between the tolerant accessions during saline condition. On the other hand, OsBADH1 transcript level in tolerant varieties revealed that during salt treatment, the salt tolerant check Pokkali and moderately salt tolerant accession Leyte Special have increased transcript level compared to non-treated saline condition relative to house keeping gene actin. The downstream investigation of the OsBADH1 using genomic and transcriptomic approach is important information to elucidate the molecular mechanism of fragrance development among aromatic rice in CLSU and its response to abiotic stresses.

Keywords: OsBADH1; polymorphism; aroma; genomics; transcriptomics

BS – 28

**MORPHOLOGICAL OBSERVATIONS ON THE FLORAL
VARIATIONS OF NIYOG-NIYOGAN
(*Combretum indicum* (L.) DeFilipps)**

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Niyog-niyogan (*Combretum indicum* (L.) DeFilipps) is important both as a medicinal plant and an ornamental plant. The utilization of its mature fruit as vermifuge is recommended by Department of Health. In the Philippines, different floral types can be observed both in natural and cultivated settings; however, reports on the distinction among the floral types are limited. A study of the variations in floral structure of *C. indicum* was carried out. Seven variants of single and double flowers were classified on the basis of quantitative (petal length and width, hypanthium length, stigma length) and qualitative (petal shape, style type, relative length of stamens, relative length of stamen with the perianth) traits. Fruit set was noted in both floral types. Two single flower types were observed and were differentiated only by petal size (11 x 5 mm; 20 x 8 mm) and hypanthium length (50 mm; 90 mm). The double flower types, all of which were found in cultivation, were distinguished through qualitative attributes as (a) pin type, without stamens, (b) pin type, with exerted stamens, (c) pin type, with included stamens, (d) thrum type, with exerted stamens, and (e) tristylous type, with exerted stamens. This study to characterize *C. indicum* variants in the Philippines is relevant in elucidating the mechanisms of its pollination in order to formulate ways to increase fruit set and select variants for higher fruit set.

Keywords: *Combretum indicum*, floral type, single flower, double flower

BS – 29

CHARACTERIZATION OF PILI (*Canarium ovatum* Engl.) KERNEL SHAPE VARIATION USING ELLIPTIC FOURIER ANALYSIS

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Shape is often characterized through subjective means. This research attempts to systematically characterize pili kernel shape variation using elliptic Fourier analysis. Images of 53 pili accessions from the National Plant Genetic Resources Laboratory (NPGRL)- University of the Philippines Los Baños were acquired using VideometerLab 3. Shapes outlines were characterized using elliptic Fourier coefficients calculated from SHAPE software. Principal component analysis and cluster analysis were used to elucidate shape variations among accessions which was subsequently visualized through R's shape on r package. With the first component accounting for the 92.94% of the total variation, principal component analysis revealed that 98.62% of the total variance is explained by the first three components. The first principal component accounts for the variation in length to width ratio; whereas, the second and third principal components explains the variation in the location of the widest portion and the truncation of the apex and base of the kernel, respectively. Cluster analysis separated the different accessions into 6 distinct clusters at 0.04 Euclidian distance. Accessions belonging to cluster 3, 1 and 5 represent the elliptical series of shapes-narrowly elliptic, elliptic, and widely elliptic. Whereas, accessions belonging to cluster 2, 4 and 6 represent the ovate-shaped variants-ovate, obovate and lance-ovate. The systematic characterization can be used to objectively elucidate the shape variations of all parts of the plant of all crop species.

Keywords: *Canarium ovatum*, kernel shape, elliptic Fourier analysis, image analysis, phenotyping

BS – 30

THE RICE LESION MIMIC MUTANT (*Lms*) WITH ENHANCED RESISTANCE TO DROUGHT

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Although a substantial number of mutants that show spontaneous cell death or necrotic lesions in the absence of pathogens and abiotic stresses, commonly called lesion mimic mutants (LMMs), have been identified in multiple crop species, only a few of the genes associated with the LMM phenotypes are characterized so far. Based on the identity of these genes, it has been suggested that most lesion mimic phenotypes are caused by physiological alterations that affect the plants response to biotic and abiotic stress. Some LMMs are also known to confer resistance to multiple isolates of rice blast and bacterial blight, and are thus associated with defense responses. Here we report the identification of a rice *lesion mimic and senescence (lms)* mutant, the isolation of the corresponding *LMS* gene harboring the mutations responsible for the abnormal mutant phenotypes, as well as show that the *lms* mutant exhibits an enhanced tolerance to drought.

Keywords: lesion mimic, necrotic, *LMS* gene, cell death

BS – 31

DNA BARCODING OF COMMERCIALY CULTIVATED *Coffea* SPECIES IN THE PHILIPPINES

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Accurate identification of the commercially cultivated *Coffea* species is necessary since the cup quality may be attributed to the kind of species. Morphological identification may lead to inconsistent data due to limited variation within species of the same genus and affected by the environment. To complement the traditional method, DNA barcoding using *nuclear ribosomal internal transcribed spacer (nrITS)* and *maturase K (matK)* regions was performed. Genomic DNA was extracted, amplified and purified from twenty-four *Coffea* samples cultivated in the Philippines. Both markers had 100% amplification and sequencing success rates. The Wilcoxon two sample test showed that the interspecific distances of *nrITS*, *matK*, and *ITS + matK* combination were significantly higher than their intraspecific distances, respectively. *MatK* had a higher percentage of resolved monophyletic taxa. The results showed that *matK* is an efficient barcode over *nrITS* for commercially cultivated *Coffea* species by generating the highest rate of both universality and discriminating power. The result of this study is essential baseline information to authenticate *Coffea* planting materials at juvenile stage. Identity of coffee seedlings being sold by nursery owners can be assessed using *matK* barcode. This method of authentication will benefit the coffee growers for large-scale plantations.

Keywords: *Coffea*, DNA barcoding, *nuclear ribosomal internal transcribe spacer (nrITS)*, *maturase K (matK)*

BS – 32

GLYCEROL-3-PHOSPHATE DEHYDROGENASE cDNA OF PILI (*Canarium ovatum* Engl.) EXHIBITS HIGH SIMILARITY WITH OTHER DICOT SPECIES

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Glycerol-3-phosphate dehydrogenase (GPDH) converts dihydroxyacetone phosphate (DHAP) and NADH (reduced form of nicotinamide adenine dinucleotide) into glycerol-3-phosphate (G3P) and NAD⁺ (oxidized form of nicotinamide adenine dinucleotide). G3P serves as the backbone for triacylglycerol synthesis. In this study, GPDH gene was isolated and characterized to investigate its role in designing modern biotechnology strategies for pili pulp oil as an alternative fuel source. The gene sequence was generated by polymerase chain reaction using pulp complementary DNA (cDNA) followed by nucleotide sequencing. It was then analyzed using different bioinformatics tools. A 983 base pair *GPDH* cDNA was obtained which corresponded to a 327 amino acid-polypeptide that shows 95% homology with cytosolic GPDH sequences from *Citrus clementina*, *Citrus unshiu* and *Hevea brasiliensis*. The deduced protein was a homodimer consisting of the N-terminal NAD-binding domain and the C-terminal DHAP-binding domain that are both critical in the interconversion of DHAP and G3P. The two domains were connected by a short three-residue loop Asn219-Gly220-Asp221. Phylogenetic analysis revealed that the *C. ovatum* GPDH grouped with the cytosolic GPDH in dicots. This observation indicated that the isolated GPDH is homologous to the cytosolic isoform of the enzyme.

Keywords: glycerol-3-phosphate dehydrogenase, triacylglycerol synthesis, *Canarium ovatum*, complementary DNA

BS – 33

ISOLATION AND MOLECULAR CHARACTERIZATION OF THE COCONUT (*Cocos nucifera* L.) 7S GLOBULIN cDNA

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Coconut (*Cocos nucifera* L.) is a widely used seed crop known for its coconut oil and water. Storage proteins also accumulate in the coconut endosperm during seed development and offer novel coconut-based products that could find applications in the food and non-food systems. This study focused on the isolation and characterization of the complementary DNA (cDNA) sequence of coconut 7S globulin, the second most abundant globulin in the endosperm. Total RNA from the solid endosperm of a 6-7 month old coconut was isolated and subjected to cDNA synthesis. Degenerate primers were designed to amplify approximately 1 kb size of the gene. The 7S globulin cDNA consisted of 982 base pairs and the deduced amino acid sequence had 325 residues with a molecular weight of 36871.7 kDa and pI of 9.79. BLAST analysis revealed that it is most similar to its homologues, *Elaeis guineensis* and *Phoenix dactylifera*, which have identities of 94% and 89%, respectively. Arginine was the most abundant amino acid at 10.8% of the total amino acid residues. The deduced amino acid sequence has two cupin domains. The coconut 7S globulin was also found homologous to the Pis v3 and Ses i3 allergens from *Pistacia vera* and *Sesamum indicum*, respectively.

Keywords: Coconut, 7S globulin, storage protein, molecular characterization

BS – 34

**PRODUCTION, PURIFICATION, AND
CHARACTERIZATION OF β -MANNANASE FROM
*Aspergillus niger***

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β -Mannanases are endo-acting hydrolases that attack the internal glycosidic bonds of the mannan backbone chain, which in the recent years, have gained interest due to its various industrial applications in food and feed technology, coffee extraction, oil drilling, and detergent industry. As a result, fungal sources have been used for their ability to produce sizable amounts of extracellular enzymes. In this study, β -mannanase from *Aspergillus niger* was produced via solid-state fermentation and purified by ammonium sulfate precipitation, exhibiting a specific activity of 19.27-U/mg protein. The SDS-PAGE of the purified enzyme showed a single protein band and an estimated molecular weight of 64 kDa. The β -mannanase was optimally active at pH 4.0 and 30 °C. It was thermostable and retained 62 % activity after 3 hours at 30 °C. The enzyme was stable over a broad pH range of 3.0 to 10.0.

Keywords: β -mannanase, *Aspergillus niger*, solid-state fermentation, enzyme purification, enzyme characterization

BS – 35

MOLECULAR IDENTIFICATION OF FAKE DRUGS: AN EXAMPLE FROM *Antidesma bunius* (Bignay) PRODUCTS IN THE PHILIPPINE MARKET

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Years of research and quality control procedures of herbal medicinal products (HMPs) have revealed that adulteration, contamination and substitution are indeed present in the global market. Authenticity and the process of authentication remain to be a concern, especially as these products are utilized by consumers even before seeking proper medical care. In the Philippines, the HMP market is flourishing due to the abundance of pharmacologically important species, and the high level of ethnomedicinal knowledge is still widely accepted by the public. As such, herbal products from the *Antidesma bunius* (L.) Spreng, locally known as Bignay, are popular as medicine for various ailments of the circulatory and digestive systems. Though efficacy is guaranteed, the authenticity of the marketed products are still in question as several other herbal plants can provide the said benefits. The authenticity of the marketed HMPs was established by means of molecular techniques that made use of genetic data analyzed using the (1) Basic Local Alignment Search Tool (BLASTn) and (2) Standard Reference Material (SRM) Herbal barcode library for *Antidesma* spp. To establish the reliability of these methods, wild *Antidesma* spp. were also subjected to the protocol. The molecular analyses revealed that of the eleven (11) HMPs tested, only four (4) products were confirmed to be *Antidesma* sp. while the other seven (7) products were proven to be of different species. These results indicate that product safety should be reinforced with complete HMP authentication by the use of traditional methods supported by molecular data.

Keywords: *Antidesma bunius*, DNA barcoding, herbal medicinal products, medicinal plants.

BS – 36

REINFORCING INFRAGENERIC CLASSIFICATION OF PHILIPPINE *Ophiorrhiza* L. (Rubiaceae): ESTABLISHING SPECIES DELINEATION USING MORPHOLOGY AND DNA DATA

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The identification and classification of species remain the stepping stone in the exploration of scientific possibilities in all living organisms, especially in the plant sciences. The questionable status and uncertain species delineation confine the mastery and further utilization of these species. In the extensive field survey for interesting Philippine rubiaceaceous species, two endemic *Ophiorrhiza* L. species from Agusan, Mindanao (*O. caespitulosa* Elmer and *O. curtiflora* Elmer) and one endemic from Negros Oriental, Visayas (*O. biflora* Elmer) were collected. Morphological examination was conducted to determine both identity and comprehensive characteristics of the species. All samples were subjected to molecular analysis utilizing the nuclear ITS and chloroplast *rbcL* and *rps16* regions to infer phylogenetic placement within the Philippine *Ophiorrhiza*. The recollection of these species provided additional morphological and geographical distribution data. The combined morphological and molecular data also supported the delineation of the Philippine *Ophiorrhiza* into two major subclades defined by the position of the inflorescences, persistence of the stipules and pubescence of the floral parts. The larger, suffrutescent *O. caespitulosa* and *O. curtiflora* of Agusan, with its pseudo-axillary inflorescences, deciduous stipules and glabrous stems showed affinity to species of the same morphological traits (subclade A) while *O. biflora* of Negros was more closely related to the species with opposite traits (subclade B). Ultimately, proper identification and classification will render these species useful for further studies in ethno-medicine and drug discovery.

Keywords: delineation; endemic; molecular phylogeny; *Ophiorrhiza* L.

BS – 37

GENETIC DIVERSITY OF THE HSP70 GENE IN NATIVE CHICKEN (*Gallus gallus domesticus* L.) BREEDS OF THE PHILIPPINES

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Heat stress leads to high mortality and low productivity in chicken livestock industry. This study elucidated the genetic diversity of the HSP70 gene in 7 native chicken breeds of the Philippines based on molecular techniques. The HSP70 gene was amplified using primers designed from red-jungle fowl HSP70 gene sequence (J02579). The 5'UTR and partial exon fragment was cloned in puc19 vector prior to DNA sequencing. A total of 39 single nucleotide polymorphisms (SNPs) were identified. There were 14 observed haplotypes; 9 are breed-specific and 5 are shared between chicken breeds. The native chickens are characterized by low nucleotide diversity ($\pi = 0.003475$) and high haplotype diversity ($h = 0.796$). Haplotype distribution indicates unique haplotypes prevalent in breeds from the Southern Philippines. Analysis of molecular variance showed strong yet statistically insignificant differentiation between breeds ($F_{st}=0.22738$, $p>0.05$). Lastly, the heat stress tolerant genotype A258A was detected in 4 out of 7 native chicken breeds of the Philippines. Thus, these native breeds might be a potential source population in developing heat stress tolerant chickens. Significantly, findings from this study will provide crucial baseline information regarding the molecular characteristics of the HSP70 gene of the Philippine native chickens.

Keywords: Philippine native chicken, HSP70 gene, single nucleotide polymorphism, haplotype

BS – 38

UTILIZATION OF NATURAL LOCAL DYES IN LOOP-MEDIATED ISOTHERMAL AMPLIFICATION (LAMP) PRODUCTS FOR THE COLORIMETRIC NUCLEIC ACID DETECTION OF VARIOUS PATHOGENS IN SHRIMP

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Outbreaks of lethal diseases such as White Spot Syndrome Virus (WSSV) and *Vibrio parahaemolyticus* in shrimp farms increased mortality rate and induced a decline in the Philippine shrimp production. Early detection using the Loop-Mediated Isothermal Amplification (LAMP) technique is the best option to mitigate the effects of virulent infection. Utilizing local dye sources through colorimetric nucleic acid detection can optimize farmer accessibility and cost-efficiency. Through this method, selected local plants' pigments were screened to observe their potential as an alternative visual dye to commercial dyes used in LAMP today. Extracted dyes from Turmeric and Annatto showed significant differences in results between both positive and negative controls when tested on both pathogens. The distinct color reaction of the aforementioned natural dyes proves efficiency in their function as a nucleic acid stain as well as their capability as a visual dye in detection. Therefore, the utilization of natural, local dyes as an alternative holds great promise, which allows rapid detection of pathogens with resources more readily at reach, especially in times of critical urgency.

Keywords: wssv, *vibrio parahaemolyticus*, lamp, colorimetric nucleic acid detection, natural dyes

BS – 39

HEAVY METALS, TRACE ELEMENTS AND SEDIMENTATION SAMPLES IN THE MARINE PROTECTED AREAS IN LANUZA BAY, SURIGAO DEL SUR

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The presence of a high concentration of heavy metals in marine protected areas is considered indicators of anthropogenic influence. Currently, 19 marine protected areas have been established and locally managed within the local government units in Lanuza Bay, Surigao del Sur that may be threatened by pollutants from various sources. Sediment samples and sedimentation rate were taken using the PVC tube sampler and sediment traps respectively inside the MPAs in Lanuza Bay. Heavy metals and trace elements from sediment samples were analyzed using Inductively Coupled Plasma (ICP). The mean concentrations of the different metal ions in the 19 MPAs were remarkably low except for those abundant elements such as Al, Fe, P, and K which varied in the sampling sites. The concentration of heavy metals in Buenavista MPA was consistently higher as compared to other sampling sites, although the recorded values did not exceed the established PEL values. The concentration of total chromium in Adlay MPA and San Pedro MPA exceeded the established PEL value of 90 ppm. Noticeably, the MPA with higher total chromium concentration also obtained higher sedimentation rate with 2.632 mg cm⁻² d⁻¹ and 1.23 mg cm⁻² d⁻¹ in Adlay and San Pedro MPAs, respectively. The concentration of trace elements such as Mo, Ge, W, and Sb was also determined, but the environmental risk currently cannot be assessed yet considering that there are no established PEL values.

Keywords: Heavy metals, sedimentation rate, chromium, trace elements

BS – 40

SPECIES COMPOSITION OF THE MACROFOULING COMMUNITY IN SOUTH HARBOR MANILA BAY DURING THE NORTHEAST MONSOON PERIOD

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Manila Bay is one of the most important bodies of water in the Philippines. Within it is the Port of Manila which facilitates international logistics via its South Harbor. International vessels carry macrofoulers from foreign waters. When an introduced fouling organism is transported and established into a native fouling community, it may become invasive. This study assessed the species composition of the macrofouling community in South Harbor, Manila Bay during the northeast monsoon period. Nine fouler collectors adapted from the North Pacific Marine Sciences Organization (PICES) were submerged in five sampling points in Manila Bay on Oct 2017 until Feb 2018. Identification was done via morphological and CO1 gene analyses. A total of 18,830 organisms were classified into 17 families. For the first two months, *Amphibalanus sp.* was most abundant; in succeeding months, polychaetes became most abundant. This shift is attributed to intraspecific competition within barnacles and the reproductive pattern of polychaetes. Diversity and richness values across sites increased, a common trend in primary succession events. New macrofoulers were reported: *Barbatia sp.*, *Membranipora sp.*, a Stylochid flatworm, a Venerid clam, and Hesionid, Phyllodocid and Cirratulid polychaetes. Non-indigenous species were observed: *Mytilopsis sp.*, *Mytella charruana*, *Brachidontes sp.*, *Hydroides sp.* and Family Spionidae. These species are potentially invasive and may alter the ecosystem. Hence continuous monitoring is being done.

Keywords: Fouling, Manila Bay, Species Composition, DNA Barcoding

BS – 41

DISTRIBUTION AND DIVERSITY OF *Gracilaria* spp. IN THE PHILIPPINES

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Gracilaria is one of the economically important seaweeds in the world because of its “agar” content and varied applications. But the concern on proper identification must be addressed due to high variability in the morphology and rampant phenotypic plasticity in many species under this genus. DNA barcoding using cytochrome oxidase subunit I (COI) as marker was used to discriminate and determine the phylogenetic relationships of the samples analyzed. The *Gracilaria* samples were collected from 107 coastal barangays nationwide. A total 249 COI-5P sequences were verified and categorized into 16 different species under the two genera: *Gracilaria* and *Gracilariopsis*. The species considered dominant in terms of distribution are *Gracilaria edulis*, *G. salicornia*, and *Gracilariopsis heteroclada*. The species that were confirmed up to the species level with intraspecific divergence of 0-1.72% are *G. changii*, *G. euchumatoides*, *G. fisheri*, *Gp. heteroclada*, *G. manilaensis*, and *G. salicornia*. Haplotype analysis revealed new records for seven species of the 16 species identified in this study.

Keywords: DNA barcoding, COI-5P, morphology, phylogenetic tree, distribution

BS – 42

CORAL REEFS ASSESSMENT WITHIN AND OUTSIDE THE MARINE PROTECTED AREAS IN LANUZA BAY

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Currently, there are 19 marine protected areas (MPAs) that can be found in the five coastal municipalities (Carrascal, Cantilan, Cortes, Lanuza and Tandag) in Lanuza Bay. Increasing management effectiveness of MPAs and MPA Networks (MPAN) and enhancing fisheries management definitely contributes food security in Lanuza Bay. Thus, this study is very significant in assessing the conditions and effectivity of these MPAs based on their coral reefs. Coral reef within and outside MPAs were surveyed using the digital fixed photo-transect method where 50 photo frames consisted of five points of coral life-forms were identified using the standard coral life-form code. A total of three replicated transects with 50 m length were established per monitoring stations. Highest and lowest percentages of Hard Coral Cover (HCC) within and outside MPAs are present in Carrascal, with 65.59% and 73.32% in Adlay, 14.41% and 31.19% in Caglayag, respectively. Diverse coral reef benthic life-forms at different depths are present in Lanuza Bay such as massive, branching, foliose and soft corals. Most of the coral reefs in Lanuza Bay are in good to excellent conditions (14.41 - 73.32%), these are indications that proper and strict implementations and good managements on MPAs were observed. Threats such as siltation, natural disasters and other human activities have affected the coral reef conditions in Lanuza Bay.

Keywords: Coral reefs, Marine Protected Areas

BS – 43

VISUAL CENSUS SURVEYS OF REEF FISHES IN MARINE PROTECTED AREAS OF LANUZA BAY, SURIGAO DEL SUR

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Reef fishes are important food sources and act as key indicators because they are highly affected by any change in an ecosystem. Assessment parameters such as species richness, density and biomass allow us to measure the condition of the reef ecosystem. To determine the status of reef fishes in Lanuza Bay, nineteen Marine Protected Areas (MPAs) from Cantilan, Carrascal, Lanuza, Cortes and Tandag, Surigao del Sur were assessed from September 2018 to November 2018 by evaluating fish groups (coral indicators, major and commercially important species) both inside and outside MPAs. In each site, fish visual census was conducted using three 50 m transect lines with 10 m wide in the shallow depths (~10 m) of the coral reef area. Species richness and density was highest in Lanuza MPA with 137 species/1,000 m² and 1,399 ind/1000 m², respectively and lowest in San Pedro MPA with 40 species/1,000 m² and 125 ind/1,000 m², respectively. Difference between species richness and density can be noted between inside and outside zones in all sites which were highly represented by major species. In terms of biomass (MT/km²), all MPA sites in Cortes reveal high to very high conditions influenced by the commercially important species. Years of strict and proper management of MPAs in the area have reaped great results with excellent fish biomass such as in Lanuza and Cortes MPAs that highly support the fishery industry in Lanuza Bay. Low levels of the measured parameters in some sites may be influenced by threats including natural disasters, human activities and siltation. This study serves as supplementary information to enhance management of MPAs and regulate fisheries in the said bay.

Keywords: coral reef fish, species richness, density, biomass, fish visual census

BS – 44

POPULATION STRUCTURE OF BLACK MUSSEL (*Mytella Charruana*) IN LINGAYEN GULF, PHILIPPINES

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The proliferation of exotic mussels was recently reported in Manila Bay and Lingayen Gulf. This particular invasive mussel is outcompeting other species present in these waters. Previous studies indicated that the exotic mussels are *Mytella charruana*. However, it remains unclear whether the Lingayen Gulf populations are panmictic. Thus, this study explored the morphology, reproductive biology and population genetic structure of *M. charruana* from the Lingayen Gulf. These exotic mussels are found to be longer by 2 cm compared to charru mussels found in their native habitat. Likewise, examination of gonads indicated a female-dominated population, consisting of up to 89% of the total population. Lastly, mitochondrial *COI* gene sequences showed that majority of the Philippine *M. charruana* shares the same haplotype with those found from the coasts of Brazil, South America. Moreover, the *COI* gene sequences data showed a cryptic male mitochondrial DNA haplotype. Taken together, findings from this study can provide crucial information regarding the population structure of this potential invasive species. Such information might provide insights for fisheries managers in curbing the population growth of this exotic mussel species in the Philippine waters.

Keywords: *Mytella charruana*, Lingayen Gulf, invasive species, population structure

BS – 45

**OPTIMIZATION OF A METHOD TO DRY “TAMILOK”
(*Teredo navalis*) SOFT TISSUES, EXTENDING THE SHELF
LIFE AND INCREASING PROTEIN DIGESTIBILITY
USING U.V. IRRADIATION**

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A method for drying the soft tissues of wood worms or “tamilok” (*Teredo navalis*) was optimized employing a series of procedures for “salting out” soluble proteins using saturated solutions of potassium aluminum sulfate and potassium hydrogen tartrate. The dried material was then irradiated with ultra violet, u.v., to prolong the shelf life and make the proteins more digestible. Proximate analyses (wet, and ash-free dry mass, C, N, P as a percentage of wet and dry mass) were made on: (a.) wet tissues; (b.) dried (u.v.)- light irradiated soft tissues; and (c.) dried non-irradiated tissues. Results showed that there was no significant difference between the protein contents of wet/raw (30 ± 5 g /100 g), dried ultra violet (u.v.)- light irradiated soft tissues (28 ± 5), and dried non-irradiated tissues (29 ± 3). Drying extended the shelf life (prevented microbial decomposition and growth of molds) of raw/wet tissues up to seven (7) months while U.V. irradiation extended the shelf life of the dried tissues up to more than 7 months. U.V. irradiation improved protein availability in a fecal digestibility test of the dried tissues (0.82) compared to digestibility of the un-irradiated tissues (0.65) in growing rats. The study will have great applications in the nutritional supplements, food additives, pharmaceutical and cosmetics industry considering that woodworms were found to be attractive sources of edible proteins.

Keywords: tamilok, u.v. irradiation, fecal digestibility, proximate analysis

BS – 46

GFL DATABASE SYSTEM: A PORTAL AND REPOSITORY OF DNA BARCODE OF MARINE WILDLIFE STRANDING

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GFL database system is an online platform and repository specifically designed for DNA barcoding, aiding the storage of DNA barcode records of samples analyzed under Genetic Fingerprinting Laboratory. It was established in 2016 and provides an integrated environment for the assembly of DNA barcode data. It delivers an online database for the collection and management of specimen, distributional, and molecular data as well as the analytical sources and tools to support their validation. As of 2018, it included a library of over 91 identified species from over 541 specimens. Stranding of individual marine wildlife has been recorded in Genetic Fingerprinting Laboratory database, with different event patterns. Records of stranding of marine wildlife species were analyzed for patterns on species composition, temporal and spatial variations of stranding events, and stranding hotspots. A total of 6 stranding events were recorded and all of them were confirmed species of marine mammals in the Philippines, including the validation of the mysterious, hairy-looking sea creature washed ashore in the island of Dinagat in Surigao del Norte as *Physeter catodon* known as sperm whale; identification of the whale *Balaenoptera edeni* which was found dead in the bay of So. Guitan, Brgy. Sibaltan, El Nido, Palawan; the identification of dead shark *Carcharodon carcharias* commonly known as great white shark found in the coastal area of Brgy. Lobbot, Dipaculao, Aurora; the discovery of the identity of tissue samples from stranded marine species from Davao del Norte and Davao City as *Grampus griseus* known as Risso's dolphin, *Kogia breviceps* known as Pygmy sperm whale, and *Stenella longirostris* known as spinner dolphin. These strandings in general validate the diverse marine mammal assemblage in the Philippines and reveal the various environmental threats with which they deal.

Keywords: GFL database, stranding, *Physeter catodon*

BS – 47

**EVALUATION OF THE PRESENCE OF BETA
LACTAMASE (BLA) GENE IN *E. coli* ISOLATED
AND IDENTIFIED FROM CAGE-CULTURED TILAPIA
(*Oreochromis Niloticus*) FROM LAGUNA LAKE,
PHILIPPINES**

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Inland fish and fisheries play important roles in ensuring global food security providing a critical source of animal protein for local communities in developing countries. Laguna Lake, the largest inland freshwater system in the Philippines is largely used for aquaculture purposes. However, its location at the center of domestic and industrial activities makes it vulnerable to pollution by human, animal and industrial wastes. This study aimed to: (a) investigate the presence of *E. coli* from the skin mucus, gills and gut of adult cage-cultured tilapia obtained from Pila and Biñan stations of Laguna Lake and (b) detect for the presence of Bla (beta-lactamase) genes in *E. coli* isolated from the fish samples. Tilapia were randomly sampled over a three-month period from January 2018 until March 2018. The skin mucus, gills and gut were sampled for bacterial isolation. All bacterial isolates were subjected to morphological and biochemical tests and were all found positive for the presence of *E. coli*. Conventional Polymerase Chain Reaction (PCR) analyses showed that the samples were all negative for the presence of the Bla gene. However, the presence of *E. coli* in the fish samples is recognized as a reliable indicator of fecal contamination and therefore water pollution and may represent a risk to the consumers and therefore could be a basis for further study.

Keywords: Bla gene, PCR analysis, *E. coli*, aquaculture, fecal contamination

BS – 48

BACTERIOLOGICAL ANALYSIS OF COMPLEMENTARY SAUCES OF STREET-VENDED FOOD

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Street-vended food, especially in the Philippines are being sold together with complementary sauces – either sweet or spicy based on the preference of the customers. Since food borne diseases are being linked to these types of products, this study aimed to detect the presence of fecal coliforms in complementary sauces of street-vended food. Specifically, the study aimed to identify the bacteria present in the samples and the possible harm they may cause. Standard tests were used in determining bacterial growth from tubes and plates and in identifying possible bacteria present. The microbial quantity of collected samples exceeded the standard MPN value of <1.1. The biochemical tests showed that the samples may contain coliform organisms like *Citrobacter species*, *Proteus vulgaris*, *Klebsiella*, *Providencia*, *Serratia*, *Enterobacte*, *Escherichia coli* and non-coliform organisms like *Salmonella* and *Shigella*, are present in the samples. It is suggested that the food handling practices of street vendors should be observed and further investigation should be conducted to possibly identify other sources of contamination.

Keywords: bacteria, food borne diseases, complementary sauces, street-vended food, contamination

BS – 49

STUDY ON AFLATOXIN PRODUCTION OF *Aspergillus* SPECIES ISOLATED FROM PHILIPPINE DRIED FISH PRODUCTS USING LC-MS/MS

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Mycotoxin contamination due to toxigenic fungi occurs frequently in various food commodities. These can have serious human and animal health risks. In the Philippines, dried fish is still widely considered as an important commodity due to its availability in the market and ease of processing. Testing of these food products in the market ensures its safety. This study entails the evaluation of aflatoxin-producing *Aspergillus* from Philippine dried fish products. Thirty-one samples of eleven types of dried fish products from nine local markets were collected for the isolation of toxigenic fungi. A total of 115 *Aspergillus* isolates were recorded from all the dried fish products. Morphological characterization grouped the isolates into nine morphospecies. Identification of these fungi using sequence analysis of the ITS genes and morphocultural characterization confirmed their identities as *Aspergillus alliaceus*, *A. clavatus*, *A. flavus*, *A. niger*, *A. ochraceous*, *A. oryzae*, *A. steynii*, *A. tamarii* var. 1, and *A. tamarii* var. 2. The nine morphospecies were cultured on Malt Extract Broth for 14 days for the detection of aflatoxin. Determination of aflatoxin was done using LC-MS/MS. Results showed that all of the *Aspergillus* cultures were positive for aflatoxin production. Different levels of aflatoxin were detected but still need further confirmation and quantification. *Aspergillus* species isolated on the dried fish products are capable of aflatoxin production after the 14-day incubation period.

Keywords: aflatoxin, *Aspergillus*, dried fish products, mycotoxin

BS – 50

**NITROGEN FIXATION AND PHOSPHATE
SOLUBILIZATION ACTIVITIES OF GUT-ASSOCIATED
BACTERIA ISOLATED FROM AFRICAN NIGHT
CRAWLER (*Eudrilus Eugeniae* Kinberg, 1867)**

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Recognized as “ecosystem engineers,” earthworms play an important role in soil nutrient cycling. With the benefits offered by their decomposition activities and microbial interactions, it is of significance to explore the nutrient mineralization potential of their gut-associated microorganisms in relation to the nutrient content of their vermicasts. In this study, adult individuals of *Eudrilus eugeniae* Kinberg, 1867 or African night crawler were collected from the vermicompost facility of University of the Philippines Diliman, starved to accumulate their vermicasts, and dissected to obtain their gut samples for microbial isolation. Two bacterial isolates showed solubilization of inorganic phosphate on Pikovskaya medium with solubilization index (SI) ranging from 2.55 to 2.67. High phosphate availability (56-73 kg/ha) was measured in the vermicasts. Interestingly, all phosphate solubilizing isolates were also able to fix nitrogen on nitrogen-free malate medium. Nitrate nitrogen (NO₃-N) content of vermicasts (50 kg/ha) was found to be more than twice compared with the adjacent soil (20 kg/ha). 16S rRNA sequencing confirmed the genotypic identifications of the isolates showing highest homology (99%) to *Aeromonas* and *Bacillus* species previously reported for nitrogen fixation and phosphate solubilization activities. The gut-associated bacteria from *E. eugeniae* Kinberg, 1867 exhibit promising nitrogen-fixing and phosphate solubilizing activities that need to be further explored for various agricultural applications.

Keywords: gut-associated bacteria, vermicasts, nitrogen fixation, phosphate solubilization, *Eudrilus eugeniae*

BS – 51

MELANIN PRODUCTION OF *Streptomyces* Sp. ISOLATED FROM MEYCAUAYAN RIVER SEDIMENTS: POTENTIAL INDUSTRIAL APPLICATIONS

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Melanin is a brown or black pigment that functions as protective agent against UV damage and as antioxidant. It is formed from L-tyrosine via tyrosinase activity followed by non-enzymatic reactions. This study reports the melanin production of a *Streptomyces* sp. (H28) isolated from the sediments of the Meycauyan tributary of the Meycauyan-Marilao-Obando River system (MMORS), one of the top 30 dirtiest rivers in the world. The melanin produced by the isolate was characterized in terms of quantity, response to metal ions, solubility, precipitation, heat stability, photooxidation, and antioxidant activity. Pigment production is induced by and increases with the presence of Cu²⁺ ions. The extracted melanin has absorbance at the expected UV-vis spectrum (200 – 700 nm), with peaks at around 230 – 260 nm that gradually decreases as it approaches the infrared region. The melanin produced is soluble in NaOH and precipitates in the presence of Cu²⁺, Fe²⁺, Mg²⁺, and Mn²⁺ ions. It is also heat stable but subject to bleaching due to oxidation, reduction, and UV exposure. The synthesized melanin exhibited 65.09% free radical inhibition in DPPH assay. The tyrosinase activity of the isolate increased after six days in response to Cu²⁺, however, incubation periods of nine and twelve days showed no increase in tyrosinase activity. *Streptomyces* sp. (H28) is a candidate for further studies involving enzyme activity and melanin synthesis.

Keywords: *Streptomyces*, melanin, tyrosinase, sediments, Meycauyan River

BS – 52

DETECTION OF MULTIDRUG-RESISTANT SHIGA TOXIN-PRODUCING *Escherichia coli* IN PHILIPPINE NATIVE SWINE FROM QUEZON PROVINCE, PHILIPPINES.

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The spread of antibiotic resistance among bacterial pathogens, such as the Shiga toxin-producing *Escherichia coli* (STEC), is a major public health concern worldwide. Swine are considered as reservoir of antibiotic-resistant STEC and multiple outbreaks of STEC have been attributed to both domestic swine and wild boar. Therefore, the introduction of Philippine native swine (PNS) to a large market should be coupled with pathogen detection to ensure public safety. Fecal samples from 57 Philippine native swine (PNS) housed in 29 farms located in ten municipalities of Quezon province were obtained for the isolation of *E. coli*. The isolates were confirmed to be STEC by amplifying the *stx* gene. Fifty-three (93%) of the fifty-seven PNS were found to be positive for the presence of STEC. Antibiotic resistance profiles were obtained by testing 12 antibiotic classes using the disc diffusion method. Relatively high resistance rates to tetracycline (73.58%), ampicillin (37.74%), trimethoprim/sulfamethoxazole (32.08%), streptomycin (32.08%), and chloramphenicol (22.64%) were found among the STEC isolates. Seventeen (32%) STEC isolates were found to have the multidrug resistance (MDR) phenotype. The detection of MDR-STEC in the study poses a public health risk, especially when the post-antibiotic era is nearing. Therefore, changes in farming practices that would minimize the persistence of the pathogen at the farm level were implemented.

Keywords: Philippine native swine (PNS), Shiga toxin-producing *Escherichia coli* (STEC), multidrug resistance (MDR)

BS – 53

PATHOGEN SCREENING OF FOOD PRODUCTS DEVELOPED BY SOME LOCAL GOVERNMENT UNITS IN ILOCOS NORTE

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There are Local Government Units (LGUs) in Ilocos Norte that focus on the development of food products to augment the income of their constituents. Production of such food products is assisted by the Department of Science and Technology and the Department of Trade and Industry. To ensure the safety of their products, a study was conducted to determine microbial load and to detect pathogens on the developed food items. Pathogen screening is crucial to ensure safety of the products as well as the consumers. Using the traditional detection method, detection of the following was done: *Listeria monocytogenes*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella* and *Campylobacter*. The water used by the manufacturers was also tested for the presence of *E. coli*. Moreover, water activity using the water activity meter was measured to determine the probable shelf life of the products. Results show that pathogens are detected during the first round of testing. However, after discussing the results with the food handlers and after inculcating the importance of safety measures to eliminate pathogens and the danger of food contamination, products tested tremendously improved during the succeeding screening.

Keywords: pathogen, microbial load, food products, food safety and detection

BS – 54

BACTERIAL COMMUNITY OF LABORATORY SCALE ANAEROBIC DIGESTION OF KITCHEN WASTES FOR BIOGAS PRODUCTION

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This study aimed to isolate and identify bacteria from kitchen wastes integrated into a improvised laboratory scale anaerobic digestion. The anaerobic digestion process of each digester was characterized by determining the degradation rates, retention times and biogas production rates. Sampling of the slurry was made every three days along with measurement of pH, temperature and biogas production. Slurry samples were serially diluted and inoculated to Nutrient Agar and MacConkey Agar to obtain pure cultures of microorganisms. The bacterial isolates were molecularly identified using 16S rRNA (16S ribosomal RNA) and *mcrA* (methyl coenzyme-M reductase) gene sequencing. Thioglycollate broth test was conducted to evaluate the oxygen requirements of the pure cultures. The highest percentages of identified species belong to class Gammaproteobacteria (66.67%), order Enterobacteriales (61.11%), family Enterobacteriaceae (50%) and genus *Citrobacter* (22.22%). The 18 identified microorganisms were *Bradyrhizobium* sp., *Lysinibacillus* sp., *Morganella morganii*, *Comamonas testosteroni*, *Burkholderia multivorans*, *Paenibacillus peoriae*, *Bacillus flexus*, *Proteus mirabilis*, *Shimwellia blattae*, *Citrobacter* sp., *Citrobacter freundii*, *Escherichia coli*, *Kosakonia sacchari*, *Citrobacter koseri*, *Klebsiella variicola*, *Acinetobacter pittii*, and *Citrobacter* sp.

Keywords: anaerobic digestion, biogas, 16SrRNA gene, *mcrA* gene

BS – 55

**MOLECULAR IDENTIFICATION OF BACTERIA IN
Siganus vermiculatus (Valenciennes, 1835) COLLECTED
FROM SELECTED SITES IN CURRIMAO,
ILOCOS NORTE**

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The study aimed to isolate, characterize, and identify bacteria associated with the mouth, gills and stomach of *Siganus vermiculatus* collected from Maglaoi Norte (Site 1) and Gaang River (Site 2) Currimao, Ilocos Norte. Bacterial flora between wild and cultured siganids samples were compared, and result showed that fish collected from wild contains a higher bacterial numbers (CFU ml⁻¹ of 5.33 x 10³) compared to fish collected from cultured site (CFU ml⁻¹ = 2.85 x 10²). There were 11 bacteria isolated, six (6) isolates from cultured and five (5) from wild siganids with different cultural characteristics. Gram staining affinity showed 90% of the bacterial isolates classified as Gram negative. Biochemical tests (sugar tolerance test) reveals two (2) among the 11 isolates tolerated 2.5% and 5% sugar concentrations. These two isolates were subjected to DNA extraction, PCR amplification and sequenced using their 16S rRNA region. After sequencing the v4/v6 16S Rrna, BLAST and phylogenetic analyses, one (1) isolate showed 100% similarity to various strains of *Bacillus spp.* namely; *B. aryabhatai* strain B8W22; *B. flexus* strains SBMP3 and NBRC 15718 and the other isolate shared 99% identity to various *Proteus spp.* strains (*Proteus mirabilis* strains JCM 1669 and ATTC 29906 and one strain of *Proteus cibarius* JS9). Further verification with full 26S rRNA sequencing, isolation, and purification of the isolates and other physiological and biochemical tests should be done.

Keywords: molecular identification, 16S rRNA, phylogenetic analysis, bacterial flora, gram staining affinity

BS – 56

CHARACTERIZATION OF PLANT GROWTH-PROMOTING DIAZOTROPHIC BACTERIA FROM CACAO (*Theobroma cacao* L.) RHIZOSPHERE TREATED WITH BAMBOO BIOCHAR AND MYCORRHIZAL FUNGI

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Diazotrophic or nitrogen-fixing bacteria (NFB) are considered as plant growth-promoting rhizobacteria, which provide available nitrogen for plant nutrition. This study isolated, characterized, and identified putative diazotrophic bacteria from the cacao (*Theobroma cacao* L.) rhizosphere treated with arbuscular mycorrhizal fungi and bamboo biochar. Biochar serves as a refuge for colonizing bacteria such as those NFB and mycorrhizal fungi. Using a nitrogen-free malate medium, the recorded population count of NFB in the cacao rhizosphere was about 1.28×10^6 CFU g soil⁻¹. Of these, a total of 20 NFB isolates were selected based on unique cultural characteristics, such as color and shape. These isolates were subjected to acetylene reduction and phosphate solubilization aptitudes. Based on the results, all putative NFB isolates successfully reduced acetylene to ethylene gas ranging from 16.35 ± 1.68 to 60.71 ± 2.57 ppm. In addition, 19 out of 20 NFB isolates performed phosphate solubilization on Pikovskaya medium with solubilization index ranging from 1.11 ± 0.01 to 3.74 ± 0.16 mm. Analysis of the sequence of the 16S rRNA gene revealed that these diazotrophic bacterial isolates belonged to the genera *Bacillus*, *Burkholderia*, *Rhizobium*, *Ralstonia* and *Staphylococcus*. These plant growth-promoting rhizobacteria are promising natural biofertilizers to improve the growth and yield of cacao crops, especially in the Philippines.

Keywords: cacao rhizosphere, biofertilizer, diazotrophic bacteria, plant growth promoting rhizobacteria

BS – 54

RAPID DETECTION OF TILAPIA LAKE VIRUS (TiLV) BY LOOP-MEDIATED ISOTHERMAL AMPLIFICATION (LAMP)

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Tilapia Lake Virus (TiLV) is a novel orthomyxo-like pathogen associated with tilapia aquaculture disease outbreaks. Loop-Mediated Isothermal Amplification (LAMP), is an emerging, rapid and cost effective diagnostic method proven to be as sensitive and specific as conventional PCR. This study aims to develop a LAMP based diagnostic method with gene specific primers that can be utilized by fish farmers and small-scale laboratories in the Philippines. LAMP assay was optimized at 60°C for TiLV detection using the designed primers (F3, B3, FIP, BIP), targeting segment 3 of the TiLV genome. PCR results were notably consistent with LAMP results. The expected band size of 415 bp and smearing pattern of the amplified Philippine TiLV isolate were produced in the PCR and LAMP assay, respectively. Fluorescence was also detected under both UV and black light, confirming positive results. PCR assay indicated a detection limit of 2.86×10^{-5} µg/mL, but this detection limit was significantly surpassed by LAMP assay. Comparative genetic analysis revealed genetic variations of the Philippine strain to the prototype Israel strain, sharing 94% nucleotide identity. To conclude, LAMP provides a better alternative for TiLV detection as compared to PCR, providing field based or point of care diagnostics. This is also the first report of the use of LAMP for TiLV detection in the world.

Keywords: tilapia, tilapia lake virus, loop-mediated isothermal amplification, diagnostic

BS – 58

POPULATION PARAMETERS OF JAPANESE THREADFIN BREAM (*Nemipterus japonicus*, Bloch 1791) IN MANILA BAY, PHILIPPINES

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Japanese threadfin bream (*Nemipterus japonicus*, Bloch 1791) formed about 89% of nemipterid catches in Manila Bay landed catch from January 2012 to December 2015. The growth and mortality parameters, exploitation ratio and annual recruitment pattern for this species were estimated from raised length-frequency data collected in four (4) years. Monthly data collection reported the regular appearance of this species in the landed catch. Results of the length frequency analysis are summarized. The growth parameters of this species from 2012-2015 changes per year as follows, 2012 ($L_{\infty} = 27.50$ cm, $k = 0.57$ yr⁻¹); 2013 ($L_{\infty} = 25.96$ cm; $k = 0.62$ yr⁻¹); 2014 ($L_{\infty} = 26.88$ cm; $k = 0.78$ yr⁻¹); and 2015 ($L_{\infty} = 28.31$ cm; $k = 0.72$ yr⁻¹) though results showed insignificant difference from published studies in Manila Bay. For the mortality parameters, L_{50} and E-values results also showed a slight increase in values compared to previous studies. The E-values of this threadfin bream nearly exceeded its optimum exploitation value of $E=0.5$ in 2013 and 2014 but exceeded in 2012 and 2015. This indicates that overharvesting is already happening and needs reduction in the fishing effort. This study is the first estimation of growth and mortality parameters of *Nemipterus japonicus* in the Manila Bay. Results obtained can be helpful for the sustainable management of this species in the bay.

Keyword: *nemipterus japonicus*, nemipterids, growth and mortality parameters, exploitation rate.

BS – 59

PHYTOCHEMICAL ANALYSIS AND TOXICOLOGICAL SCREENING OF CRUDE AQUEOUS EXTRACT FROM THE ROOTS OF *Derris elliptica* Benth. (Tubli) USED AS A PISCICIDE TO *Oreochromis niloticus*

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Tubli plant *Derris elliptica* root crude aqueous extract is indigenously used as a piscicide in many freshwater bodies. However, the mechanism of its toxic effect is largely unknown. Six classified treatments (distilled water), 0.04, 0.05, 0.07, 0.14, 0.21, 0.28 mg/L of *D. elliptica* root powder solutions were utilized as test treatments to arrive at set concentration with 50% fish mortality (0.13 mg/L). Phytochemical screening revealed the presence of flavonoids, saponin, steroids and alkaloids in crude aqueous extract of *D. elliptica* roots. Mature tilapia were eventually exposed to 0.13 mg/L of crude aqueous extracts of *D. elliptica* for 24 hours to examine for acute toxicity under laboratory conditions. Toxic response exhibited by the fish includes erratic swimming, slow opercular movement, gulping for air, loss of reflex and settling at the bottom of the tank. Hematological indices were assessed (RBC, WBC, and Platelets). Monocyte, eosinophils, and platelets counts were highly significant in treated fishes whereas erythrocyte counts were significantly low. Treated fish experienced lymphopenia, hemorrhagic anemia, and blood clotting. Hypertrophy and hyperplasia of the gill epithelium and mucous cells, synechia, aneurysm, necrosis and cell degeneration and leukocyte infiltration were observed whereas the liver exhibited inflammation, necrosis, clogged vein and hyaline droplet degeneration in the hepatic tissue. The kidney showed a reduction of Bowman's space, cellular rupture, necrosis, tubular, granular and nuclear degeneration and changes in renal tissue. The results show that tubli root extract exposure lowered RBCs and hemoglobin and caused irreparable alterations in the vital organs of *O. niloticus* causing immediate death to fishes exposed to acute conditions.

Keywords: indigenous piscicide, tubli, rotenone

BS – 60

EMBRYONIC DEVELOPMENT OF CLIMBING PERCH (*Anabas testudineus*) IN THE PHILIPPINES

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Climbing perch (*Anabas testudineus*), locally known as 'Liwalo/Martiniko', is an edible freshwater fish, commonly found in swamps, rice paddies, and ponds of Southeast Asia. As a labyrinth fish, it can be sold in markets for extended period of time. This study is conducted to provide an insight on the embryonic development and artificial spawning of climbing perch. Sexually mature samples were collected from Nueva Ecija, Philippines, then induced to spawn using 30 µg/kg commercially available salmon gonadotropin releasing hormone analog (sGnRH_a). Eggs were immediately collected right after spawning and embryonic development was monitored in water with average temperature of 27.2°C. Fertilized eggs ranged from 0.920 to 1.230 mm in diameter. First cleavage was observed one hour after spawning (HAS), epiboly started at 5 to 6 HAS. The first heartbeat was observed 16.5 HAS and hatching occurred 20 HAS; the newly hatched larvae's average length was 2.164 mm. This is the first recorded study on embryonic development of climbing perch in the Philippines and is very significant in developing culture techniques for future production. Successful culture of this species may help in sustainable food production in the country.

Keywords: anabas, climbing perch, embryogenesis, aquaculture

BS – 61

NEMATODE ENDOPARASITES OF INVASIVE ALIEN SPECIES (IAS) OF AMPHIBIANS IN PAOAY LAKE, ILOCOS NORTE PROVINCE

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Parasitism associated with invasive alien species (IAS) plays a huge role in emergence of wildlife diseases, even in zoonotic diseases. Unfortunately, the identity of alien parasites in the Philippines is yet to be known. The presence of exotic parasite species has dire implications on the health of Philippine native fauna. Frog hosts were retrieved in Paoay Lake on November 2018 and were examined for internal helminth infections. The study collected metazoan endoparasites found in the alimentary canal of three major invasive species in the Philippines namely the Giant Cane Toad *Rhinella marina* (Linnaeus 1758), Chinese Bullfrog *Hoplobatrachus rugulosus* (Wiegmann 1834) and Asian Painted Frog *Kaloula pulchra* Gray 1831; along with quantitative measures. The nematodes were initially identified as cosmocercids (Nematoda, Family Cosmocercidae). Among 33 inspected individuals, the study found *Kaloula pulchra* had highest prevalence of nematode infection (88%; 7 of 8 individuals infected), followed by *Hoplobatrachus rugulosus* (29%; 2 of 7) and *Rhinella marina* (17%; 3 of 18). Mean worm burdens of 3, 11 and 76 worms (accounting for 2 hyper-parasitized individuals) were found for the three IAS frogs, respectively. The parasitological assessment contributes the baseline information for IAS parasites currently present for the Northern Philippine region.

Keywords: endoparasites, invasive species, Lake Paoay, Ilocos Norte, biodiversity

**ENGINEERING SCIENCES &
TECHNOLOGY**

EST – 01

A STUDY ON THE POTENTIAL OF AGRICULTURAL WASTE FROM *Oryza sativa* – RICE STRAW AND RICE HUSK – AS A POTENTIAL ADSORBENT FOR CARBON DIOXIDE CAPTURE

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Post-combustion carbon dioxide capture through adsorption process has been receiving widespread attention over the past decade as a mitigating technology for climate change. Since desirable adsorbents for CO₂ capture are those that are both efficient and low-cost, one of the most sought materials is biochar from agricultural wastes. In this study, biochar derived from the slow pyrolysis of rice straw and rice husk were investigated for its potential as adsorbents for carbon dioxide capture. Specifically, the surface characteristics, selectivity, adsorption capacity, and thermal stability of the biochar were investigated. Results showed that the rice straw biochar with adsorption capacity of 2.6 wt% is more capable of adsorbing carbon dioxide than the rice husk biochar with adsorption capacity of 1.1 wt%. Furthermore, to determine the conformity of biochar with commercially available adsorbent, the adsorption capacity of rice straw biochar was compared to that of a commercial activated carbon. Meanwhile, the rice husk biochar was compared to carbon residue derived from rice husk used as a boiler fuel to further determine the potential for CO₂ capture of a carbon material derived from industrial waste. Since both biochar derived from rice straw and rice husk were selective to carbon dioxide, it can be deduced that both agricultural waste from rice after pyrolysis can be potential adsorbents for carbon dioxide capture.

Keywords: rice straw, rice husk, carbon dioxide capture, climate change mitigation

EST – 02

GIS-BASED DROUGHT VULNERABILITY ASSESSMENT OF RICE FARM AREAS IN BUTUAN CITY, AGUSAN DEL NORTE, PHILIPPINES

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The study seeks to evaluate the vulnerability of the area by providing calculated information to predict drought hazard and strengthen disaster preparedness management. It aims to assess the geospatial landscape map on drought vulnerability in Butuan City by integrating the actual information gathered from actual interviews, surveys and GIS/RS analyses with the use of LIDAR derived dataset. The analyses include physical, agro-ecological and socio-economic indicators clustered under the components such as exposure, sensitivity and adaptive capacity. Key Informant Interview (KIIs) was conducted to assign the weights of each indicators and was determined using Analytical Hierarchy Process (AHP). Results revealed that 5 barangays, among 46 barangays, topped as the most vulnerable drought attributed to generally low adaptive capacity and high in potential impact (sensitivity and exposure). These barangays are attributed low capacity to adjust or survive to certain hazard disturbances. Also, this component (adaptive capacity) has greatly contributed to the entire vulnerability status of an area since its effect depends on the availability of the coping mechanisms to adjust such disturbances.

Keywords: drought, vulnerability, analytical hierarchy process (AHP), adaptive capacity

EST – 03

**INFLUENCE OF NUTRIENT SUPPLEMENT IN THE
SINGLE HEAVY METAL (Pb²⁺, Cd²⁺, Cr³⁺) UPTAKE AND
MINERAL NUTRIENTS ABSORPTION BY WATER
KANGKONG (*Ipomea aquatica* Forsk.)**

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The present study investigated the effects of Cd²⁺, Pb²⁺, and Cr³⁺ stress on mineral contents (K⁺, Na⁺, Ca²⁺, P, Mg²⁺, Fe²⁺, Cu²⁺, Zn²⁺ and Mn²⁺) in the different parts of water kangkong (*Ipomea aquatica* Forsk.) by point analysis method using Horiba XGT-72000, as well as the influence of nutrients on the uptake and accumulation of these heavy metals. *I. aquatica* cuttings were grown in tap water supplemented with a very small amount of NPK fertilizer and treated with Pb(NO₃)₂, Cd(NO₃)₂·4H₂O, and K₂Cr₂O₇ under two soaking solutions – hydroponics solution and tap water solution. Results revealed that Cd²⁺, Pb²⁺, and Cr³⁺ alter the mineral nutrient absorption of *I. aquatica*. Particularly, the approximate concentrations of most mineral ions (K⁺, Ca²⁺, Fe²⁺, Cu²⁺, Zn²⁺ and Mn²⁺) in the leaves and stems were reduced by Cd²⁺, Pb²⁺, and Cr³⁺ exposure, thus making *I. aquatica* deficient in nutrients when consumed as food. It was also observed that these heavy metals caused a disturbance in K⁺/Ca²⁺ and K⁺/Na⁺ ratio, which could have a great impact on water balance. Data also suggest that nutrient optimization may help *I. aquatica* to develop tolerance to Cd²⁺, Pb²⁺, and Cr³⁺ and can be a good strategy to alleviate the accumulation of heavy metals by *I. aquatica*. The mechanisms of translocation of Cd²⁺, Pb²⁺, and Cr³⁺ from roots to shoots behave differently in the presence of nutrients.

Keywords: *Ipomea aquatica* Forsk., absorption, heavy metal uptake, mineral nutrients, nutrient supplement

EST – 04

KINETICS AND EQUILIBRIUM MODELING OF SINGLE AND BINARY ADSORPTION OF ALUMINUM (III) AND COPPER (II) ONTO CALAMANSI (*Citrofortunella microcarpa*) Fruit Peels

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The present study aimed to study and compare the adsorption ability of calamansi (*Citrofortunella microcarpa*) fruit peels (PCFP) for the removal of both Al(III) and Cu(II) ions in single (non-competitive) and binary (competitive) aqueous systems by batch adsorption techniques. Electron microscopic and spectroscopic techniques were used to characterize the surface morphologies for the biosorbent and quantify the removal rates of heavy metal, respectively. Models were then used to describe in detail the adsorption kinetics and isotherms for both single and binary metal system. The influence and dependency of different experimental conditions on adsorption performance were also analyzed. PCFP was successful in adsorbing Al(III) and Cu(II) heavy metal ions in single and binary system with removal rates reaching 100%. The biosorption process follows Ho's pseudo-second order kinetics. The Langmuir isotherm model was useful to explain the adsorption process, dominated by electrostatic interaction between adsorbent and adsorbates, indicating a monolayer adsorption at the binding sites on the surface of the peels. The results obtained in this study will provide insights into adsorption mechanism and phenomena involved and will be useful for further applications of system design in the treatment of practical waste effluents.

Keywords: *Citrofortunella microcarpa*, biosorption, adsorption kinetics, isotherm models, binary heavy metal system

EST – 05

CARBON-SUPPORTED NICKEL-BASED CATALYSTS FOR HYDROGEN EVOLUTION REACTION

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One promising method to produce hydrogen is through the use of platinum (Pt)-based electrodes to catalyze hydrogen evolution reaction (HER) in water electrolysis. However, though this method is proven to be efficient, the small reserve of platinum makes this method expensive; thus, its large-scale applications are limited. To address this problem, carbon-supported nanostructured metals, such as nickel and cobalt, have been used as alternatives to platinum. In this study, carbon black was used as the carbon support for nickel, and the HER catalytic performance was tested. The catalysts were synthesized by chemical reduction method using hydrazine as reducing agent. SEM and XRD revealed the structural and morphological characteristics. Linear sweep voltammetry (LSV) was used to evaluate the HER performance of the catalysts in 1 M KOH and the overpotential was determined. The polarization curve of the catalyst obtained was compared to that of carbon black alone and results revealed an improvement in the performance upon the addition of nickel. Stability studies show that the performance of the catalyst decreased after 500 cycles of cyclic voltammetry (CV) indicating instability which may be possibly due to delamination of the catalyst from the current collector.

Keywords: hydrogen evolution reaction (HER), carbon-supported nickel, catalyst

EST – 06

CAPACITIVE CHARACTERISTICS OF 1-ALKYL-3-METHYLIMIDAZOLIUM ADIPATE IONIC LIQUIDS AS ELECTROLYTES FOR CARBON-BASED SUPERCAPACITORS

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Ionic liquids (ILs) are ideal electrolytes for supercapacitors due to their large electrochemical window (EW), and their chemical and thermal stability. They are also highly tunable and can easily be modified by changing the cation or the anion. A problem that has presented in studies involving ILs as supercapacitor electrolytes is their low conductivity due to high viscosity. Carboxyl groups are known to decrease the viscosity index of ILs. In this study, 1-alkyl-3-methylimidazolium (C₂MIM, C₄MIM) adipate ILs were synthesized via halide-to-anion exchange method and were characterized using FT-IR, ¹H-NMR, and ¹³C-NMR spectroscopy. Conductivity measurements were also done and it was found that the ionic conductivity is inversely proportional to chain length of the cation with 473.5 μS/cm and 444.4 μS/cm for C₂MIM adipate and C₄MIM adipate, respectively. Furthermore, the EWs were found to be 2.08 V for C₂MIM adipate and 2.24 V for C₄MIM adipate as determined using cyclic voltammetry recorded at a scan rate of 20 mV/s at a working potential of -4V to 4V. These considerable results showed that adipate-containing imidazolium-based ILs offers promising electrochemical properties for next-generation energy storage devices. It is recommended that different cations be explored in future studies.

Keywords: ionic liquids; imidazolium; adipate; electrolytes; supercapacitors

EST – 07

FABRICATION OF SUPERCAPACITORS UTILIZING NOVEL CARBOXYLATE-FUNCTIONALIZED METHYLIMIDAZOLIUM-BASED BINARY IONIC LIQUIDS

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Owing to their distinctively tunable properties including low volatility, low flammability, inherent conductivity, wide electrochemical window, and high thermal stability, developing low viscosity ionic liquids (ILs) is vital for emerging energy storage applications including lithium-ion batteries and supercapacitors. This work introduces novel ILs based on 1-alkyl-3-methylimidazolium cations and carboxylate anions. The ILs were prepared via solventless sonochemical synthesis followed by halide-to-anion exchange and were characterized using FT-IR, ¹H-NMR, ¹³C-NMR spectroscopy. Ionic conductivity results manifested that the synthesized ILs with dicarboxylates as anions exhibit higher conductivity of up to 653.7 μS/cm as compared to ILs with monocarboxylate and halide anions. Interestingly, ILs having shorter alkyl chain length and more number of RCO₂⁻ in their structure have shown promising electrochemical characteristics as observed by cyclic voltammetry and impedance measurements. In addition, mixtures of ILs containing different anions have been successfully tested as electrolytes. The fabricated carbon-based supercapacitor prototypes with a combination of low molecular weight carboxylate-functionalized ILs showed a significantly improved capacitive performance through cycling, hence making them an excellent candidate as electrolytes. The utilization of these non-halogenated ILs as substitute for aqueous- and organic-based electrolytes can address issues on energy storage devices, particularly on electrode corrosion and thermal degradation when used at higher working potentials and at elevated operating temperatures.

Keywords: supercapacitor; electrolytes; ionic liquids; imidazolium; dicarboxylates

EST – 08

INVESTIGATING THE IONIC CONDUCTIVITY AND ELECTROCHEMICAL WINDOW OF 1-ALKYL-3-METHYLIMIDAZOLIUM HALIDE [RMIM]X IONIC LIQUIDS

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Rapid increase on energy demand has led to the use of supercapacitors which has higher power density and longer cycle life than conventional capacitors and batteries. However, the applications of supercapacitors are hindered by their low energy density. This could be addressed by increasing the capacitance with the use of ionic liquids (ILs) as electrolytes, primarily due to their wide electrochemical window (EW) and high ionic conductivity. In this study, 1-alkyl-3-methylimidazolium halides [RMIM]X ILs (X = Br, Cl, I) were prepared and were utilized as electrolytes for carbon-based supercapacitors. The [RMIM]X ILs (C₂, C₄, C₆) were synthesized via solventless sonochemical reaction between 1-methylimidazole and 1-haloalkane. ¹H-NMR, ¹³C-NMR, and FT-IR spectroscopy were used to confirm their structures. Conductivity measurements showed that among the synthesized [RMIM]X ILs, [C₂MIM]Cl exhibited the highest conductivity of 539.67 μS/cm. Moreover, cyclic voltammetry results revealed that [C₂MIM]Br has the widest EW of 1.44 V recorded at a scan rate of 100 mV/s at a working potential of -3V to 3V. These significant results proved that [RMIM]X ILs can be used in place of aqueous- and organic-based electrolytes for energy storage applications.

Keywords: ionic liquids; electrochemical window; electrolytes; supercapacitor

EST – 09

**SOURCE ESTIMATION AND CORRELATION ANALYSIS
OF THERMAL-OPTICAL TRANSMITTANCE
ELEMENTAL CARBON (EC) AND REFLECTOMETER
BLACK CARBON (BC) FROM AN URBAN AND A RURAL
SITE IN THE PHILIPPINES**

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Black carbon (BC) and elemental carbon (EC) are light absorbing atmospheric particulate matter that pose significant effects on health, visibility, and climate. BC and EC, though often well correlated, are not interchangeable due to their different properties and methods of measurement. To better understand the differences between EC and BC and their implications to general air quality, samples were compared from urban (Valenzuela City) and rural (Angat, Bulacan) sites from September 2011 to August 2012. Valenzuela City EC and BC concentrations were determined to average $5.54 \mu\text{g}/\text{cm}^3$ and $6.54 \mu\text{g}/\text{cm}^3$ while Angat, Bulacan values were found to average $1.82 \mu\text{g}/\text{cm}^3$ and $1.28 \mu\text{g}/\text{cm}^3$ respectively. Cluster analysis revealed that for the rural site, Angat, EC1 is grouped with BC, though EC1 and EC2 fractions are present in nearly the same concentrations. For the urban site, Valenzuela, BC clustered with EC1 and other OC fractions, which is expected since Valenzuela is EC1 predominant. Nevertheless, for both rural and urban site, BC is consistently grouped with EC1, while EC2 and EC3 are grouped separately. These results were further verified by Conditional Probability Function (CPF) analysis as Valenzuela EC1 fraction shows different major sources compared to its co-fractions EC2 and EC3. In addition, EC1 shows common major sources with BC. These results give further insights on the fundamental differences between EC and BC.

Keywords: elemental carbon, organic carbon, black carbon, EC vs BC

EST – 10

GROUNDWATER VULNERABILITY ASSESSMENT OF THE DAVAO RIVER BASIN USING GIS-BASED DRASTIC METHOD

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Groundwater vulnerability is a burning issue all over the world due to the deterioration of groundwater level and increasing contamination which pose serious detrimental risk to the environment. To identify this risk, extensive research has been carried out to assess the groundwater vulnerability by using different methods. In this study, a GIS-based DRASTIC method was use assess the groundwater vulnerability of the Davao River Basin. Results of the study showed that the river basin generally has low vulnerability to groundwater pollution. The northern portion which covers the province of Bukidnon has relatively higher vulnerability index (VI>90) compared to the southern part covering Davao City. Small patches near the mouth of the river basin were found to have relatively higher vulnerability index compared to other areas in Davao. In spite of the low vulnerability index, the basin was found to be highly susceptible to non-point pollution coming from agrichemical wastes. Results of the study serve as an important input in the development of groundwater management plan in the area and may prove useful in land use zoning and in identifying priority areas where appropriate pollution control can be established in the area.

Keywords: DRASTIC, GIS, vulnerability, groundwater, Davao River

EST – 11

FACE RECOGNITION SYSTEM USING LOCAL TERNARY PATTERNS FOR BLIND ASSISTANCE

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Blind people require auditory stimulus in order to determine what is near them. Many tools have been developed to help them explore the world more easily. Face recognition using image processing techniques can be used to determine persons around a blind person however, existing methods are easily affected by noise, which is a common problem when dealing with real world images and imaging systems.

This study designed a portable system that can capture images, detect and recognize faces in the images, and output an audio signal regarding the total number of detected faces and if a face is recognized. The focus of this study is to create a face recognition algorithm that is robust in the presence of noise. The local ternary pattern (LTP) is a relatively new enhanced local texture descriptor of the local binary pattern (LBP). It is basically composed of two LBP codes whose threshold can be easily changed, which makes it more robust to noise. Its histograms are used as a texture descriptor of the detected face. This method is computationally simple and illumination invariant. The said descriptors are the inputs to a previously trained support vector machine (SVM) in order to recognize the detected face.

An 8-fold cross-validation on known images resulted to higher recognition rates for a polynomial kernel. Thus, this is used for training the SVM and testing other images. An accuracy of 92.7% resulted when actual captured images are tested. The same images are artificially added with Gaussian noise to determine the algorithm's performance. The results show that as the noise level increases from 10 to 30, the accuracy slightly decreased and maintained at above 90%. In comparison, other methods' accuracy significantly decreased to below 90% even at noise level of 10. Furthermore, the system is capable of recognizing persons up to a distance of approximately 2.8 m.

Keywords: face recognition, local ternary pattern, blind assistant, support vector machine

EST – 12

SYNTHESIS AND CHARACTERIZATION OF CERAMIC LIGHTWEIGHT AGGREGATE UTILIZING ILOCOS NORTE CLAY AND CORN COB CHAR

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Ilocos Norte clay (IC) and corn cob char (CC) were synthesized as ceramic lightweight aggregate (CLA) for lightweight concrete (LWC) application. Chemical analysis of IC and CC were determined using x-ray fluorescence (XRF) technique. Likewise, mineral compositions of IC were determined using x-ray diffraction (XRD) technique. Chemical analysis of IC were 45.01% SiO₂, 25.17% Al₂O₃, 20.62% Fe₂O₃, 7.50% MgO, 1.28% TiO₂, 0.16% MnO and 0.25% CaO. Chemical analysis of CC were 72.65% SiO₂, 4.91% Fe₂O₃, 11.13% CaO, 11.14% P₂O₅, 0.15% ZnO and 0.02% ZrO₂. Major minerals present in IC were clay, quartz and hematite. Three (3) varying percentage amount of IC and CC were made (97:3, 94:6, and 91:9) and fired at 950°C for two (2) hours. Physical characterization after firing was based on American Standard for Testing Materials (ASTM). CLA1 (97:3) samples have 17.8% water absorption, 33.14% apparent porosity and 20.05% linear shrinkage. CLA2 (94:6) have 22.76% water absorption, 39.16% apparent porosity and 20.48% linear shrinkage. CLA3 (91:9) have 32.03% water absorption, 47.57% apparent porosity and 20.43% linear shrinkage. Results show that CLA2 and CLA3 have better physical properties than CLA1, therefore CLA2 and CLA3 were mixed with ordinary Portland cement to form lightweight concrete (LWC2 and LWC3) samples. Morphology of CLA2 and CLA3 were observed using scanning electron microscope (SEM). Bulk density and compressive strength of LWC2 were 1.62 g/cm³ and 12 MPa respectively. Also, bulk density and compressive strength of LWC3 were 1.6 g/cm³ and 9.36 MPa, respectively. Results of the LWC samples were comparable to normal concrete cement. The advantages of using CLA are that they are lightweight and better insulator to heat and cold temperature because of their porous nature.

Keywords: ceramic lightweight aggregate, x-ray fluorescence, x-ray diffraction, scanning electron microscope

EST – 13

SOLUTION COMBUSTION SYNTHESIZED-POROUS CO₃O₄-BASED NANOPARTICLES AS OXYGEN EVOLUTION REACTION CATALYSTS IN ALKALINE MEDIUM

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Over the recent years, cobalt (II, III) oxide (Co₃O₄) has been used as an oxygen evolution reaction (OER) catalyst due to its abundance, low cost, environmental sensitivity, and good stability even in alkaline medium. In this work, porous Co₃O₄ nanoparticles were synthesized through solution combustion. Cobalt nitrate hexahydrate and glycine were used as the oxidant and fuel, respectively. Stoichiometric amounts ($\phi = 1.0$) of such were dissolved using a very minute amount of distilled water. Upon mixing, the precursor solution was heated until it reached its combustion temperature. The samples were then calcined at 300, 500, and 700 °C. FESEM analysis revealed the sponge-like morphologies of the powders and showed the presence of nanosized pores. On the other hand, SSA values were found to decrease as the calcination temperature was increased. XRD results showed that a subsequent heat treatment is required to produce a single phase-oxide, as the uncalcined sample was composed of spinel Co₃O₄, and periclase CoO phases. For the electrochemical results, the as-synthesized oxide exhibited the best electrocatalytic performance in 1 M KOH with onset overpotential and Tafel slope values as low as 356 mV and 80 mV·dec⁻¹, respectively. Following such findings, uncalcined samples were synthesized with fuel-to-oxidizer ratios (ϕ) equal to 0.5 and 1.5. Electrochemical testing showed that the nanopowders synthesized at $\phi = 0.5$ has better OER catalytic properties than that synthesized through stoichiometric conditions ($\phi = 1.0$). The onset overpotential was found to be 319 mV. The overpotential required to obtain a 10 mA cm⁻²- current density was also lower at 447 mV, in contrast the 452 mV required for the sample synthesized at $\phi = 1.0$.

Keywords: solution combustion synthesis, cobalt oxide, oxygen evolution reaction, electrocatalyst

EST – 14

DEVELOPMENT OF LEADLESS GLAZE UTILIZING INDIGENOUS RAW MATERIALS FOR LOCALLY MADE CERAMIC DECORATIVE WARES

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Glaze is a vitreous coating applied to a ceramic item which has been fired to fuse and to give strength or waterproofing, decoration and color. Glaze materials are generally classified into three groups of oxide constituents as intermediates (Al_2O_3 , Fe_2O_3), acids (SiO_2), and bases (CaO , MgO , Na_2O , K_2O , MnO). The potters in the province rarely used glaze in their ceramic wares due to unavailability of local suppliers. The objective of this study was to develop a leadless glaze utilizing indigenous raw materials such as: Imelda red clay (IRC) as source of Al_2O_3 , SiO_2 , and Fe_2O_3 ; rice hull ash (RHA) as source of SiO_2 ; banana leaves ash (BLA), coconut husk ash (CHA), and commercial soda ash (SA) as sources of the CaO , MgO , Na_2O , K_2O , MnO oxides. Five varying percent ratio of clay (5-25 wt. % - increasing) and RHA (30-20 wt. % - decreasing) with constant percentages of the bases oxides (BLA-20, CHA-20, SA-25, wt. %) were prepared and mixed with water. The mixtures were ground using mortar and pestle until glaze slip consistency was achieved. The specific gravity of the glaze slip was controlled and the viscosity was also measured. The glaze slip was applied into bone-dried ceramic decorative ware specimens by brushing and dipping method, and glost-fired at 1050°C in an electric kiln. Basedon the results of the evaluation, a greenish matt to glossy glaze surface appearance was successfully achieved from the glaze slip mixture with 5:30:65 wt. % of IRC, RHA, and base oxides, respectively and applied by dipping method. These can be evidently observed visually and through the microscope. With the abundance of indigenous raw materials possible for leadless glaze development, production of glaze for local potter's utilization is very promising.

Keywords: decorative wares, formulations, leadless glaze

EST – 15

DEVELOPMENT OF TERRA SIGILLATA UTILIZING ILOCOS CLAY AND LOCALLY PREPARED SODIUM SILICATE AS THIN COATING FOR CERAMIC COOKING WARES

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Terra sigillata slip (TSS) is generally prepared from ultra-refined clay, water, and deflocculant. This was often used in ancient times to coat thinly bone-dried ceramic wares instead of glaze. Pottery is an old industry in Ilocos Norte since the province is known to be rich in clays and other indigenous materials for ceramic production, however, potters utilize thick clays in coating outer surfaces of their ceramic products. In this study, wet beneficiated clay from Barabar, San Nicolas, Ilocos Norte, tap water, and locally produced sodium silicate solution prepared from rice hull silica and sodium hydroxide solution as deflocculant were used in the development of TSS. The mixture of clay, water, and deflocculant is 1:2.2:0.03 by percent volume ratio. The mixture was left undisturbed for at least three hours then the top 1/3 layer was siphoned and specific gravity adjusted to 1.15-1.20. The TSS was applied to the inner surface of bone-dried ceramic cooking ware specimens by brushing 3 to 5 coatings and was polished immediately with a soft cloth until glossy coating was achieved. The specimens were dried and fired (open and electric) at 900°C to 1200°C. The surface appearance, fit, and thickness of the fired TSS were evaluated using polarizing microscopy and scanning electron microscopy (SEM) techniques. Evaluation showed that the developed TSS applied to the specimens resulted to a glossy and glaze-like appearance. The SEM images evidently showed the thin coating of TSS applied to the specimens with an average thickness of 27.2 µm while the conventional coating used by local potters is 173 µm. These results suggest that the developed TSS utilizing local raw materials can be adopted by potters as coating to their ceramic products.

Keywords: clay, ceramic cooking pot, sodium silicate, terra sigillata

EST – 16

PREPARATION AND EVALUATION OF SODIUM SILICATE SOLUTION FROM RICE HULL CHAR AND SODIUM HYDROXIDE FOR CERAMIC SLURRIES APPLICATION

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Sodium silicate (Na_2SiO_3) solution is mostly prepared from quartz as source of silica (SiO_2) with sodium carbonate as source of sodium oxide (Na_2O) and melted at around 1300°C . Na_2SiO_3 is widely used as a raw material or component in various industries as deflocculant, electrolyte in coatings, detergents, soaps, and many others. Though commercial Na_2SiO_3 is relatively cheap, it is not readily available. In this study, an industrial waste rice hull char (RHC) was used as SiO_2 source and sodium hydroxide (NaOH) as Na_2O source in the preparation of Na_2SiO_3 solution. Five varying ratios of RHC to 3 M NaOH solution were mixed and heated at 80°C while continuously stirred for 3 hours. The heated mixtures were filtered and the specific gravities (spg) of the filtrates were adjusted through heating at 200°C with stirring until spg of 1.55-1.60 is achieved. The viscosity and pH of the prepared Na_2SiO_3 were also measured. The amount of SiO_2 in the RHC and washed residue were determined by XRF analysis. The effects on the specific gravity, viscosity, and casting rate of the clay slurries with the prepared Na_2SiO_3 as deflocculant were determined. Results of the XRF analyses revealed that the RHC consisted mainly of SiO_2 and the washed residue had an intense black color which was associated with the presence of mainly carbon and low SiO_2 . The clay slip with prepared Na_2SiO_3 as deflocculant exhibited favorable properties such as consistent specific gravity, controllable viscosity, good casting rate, and clean casted samples. Therefore, the preparation of Na_2SiO_3 from waste rice hull char and sodium hydroxide at very low temperature is very promising for production of this material for local users.

Keywords: clay slurries, deflocculant, rice hull char, sodium silicate

EST – 17

SYNTHESIS AND CHARACTERIZATION OF FORSTERITE (Mg_2SiO_4) USING ILOCOS NORTE SOAPSTONE AND MAGNESIUM CARBONATE

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The study focused on the synthesis and characterization of forsterite using Bangui soapstone from Ilocos Norte to synthesize Forsterite. Magnesium carbonate was used to adjust the MgO-SiO₂ molar ratio to 1:0.3, 1.1:0.4, 2:1, 1.5:0.9, and 1.34:1. Powdered raw Bangui soapstone (BSR) was prepared for calcination. The oxide composition from the X-ray fluorescence analyses of the calcined Bangui soapstone (BSC) and MgCO₃ was used to calculate the amount of materials required to obtain five 20-gram formulations. The homogenized mixtures were pelletized to form 1.5-centimeter diameter pellets to be sintered at a temperature of 1300°C for an hour. The amounts of forsterite formed in the specimens were determined using the X-ray diffraction patterns obtained. Specimens with 2:1 molar ratio, having the highest amount of forsterite were ground for observation under the Scanning Electron Microscopy. The apparent bulk densities of the samples were determined using the Archimedes' principle. The relative density of forsterite was also calculated using the lattice parameters obtained in the XRD results. The study showed that BSR and BSC contained an almost 1:1 MgO-SiO₂ weight percent ratio and revealed that sintered specimen containing ideal amount of MgO and SiO₂ formed 92.6% forsterite, as predicted in the MgO-SiO₂ binary phase diagram. The low apparent bulk densities of the specimens are indicative of the presence of pores in the samples. The relative densities of the materials containing forsterite (1:0.3, 2:1, and 1.5:0.9 mole ratios) indicate the densification of the crystalline material during nucleation. This suggests that sintering time facilitates the densification of the materials.

Keywords: Forsterite, soapstone, SEM, XRF, XRD

EST – 18

SYNTHESIS OF COPPER-MANGANESE SPINEL NANOPARTICLES VIA OXALATE PRECIPITATION FOR METHANOL STEAM REFORMING

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CuMn spinel nanoparticles were prepared using the oxalate precipitation synthesis technique using nitrate salts as precursors. The samples were characterized using X-ray diffractometry (XRD), and field emission – scanning electron microscopy (FE-SEM). The mixed oxalate precursor, $\text{CuMn}^*\text{C}_2\text{O}_4$, was found to be single-phase and crystalline compound. H_2 -assisted temperature-programmed decomposition of the mixed oxalates yielded $\text{Cu}_{1.5}\text{Mn}_{1.5}\text{O}_4$ spinel nanoparticles with CuO present in very minute amounts. FE-SEM analysis of the $\text{Cu}_{1.5}\text{Mn}_{1.5}\text{O}_4$ spinel showed a spherical morphology of the nanoparticles. The average size of the $\text{Cu}_{1.5}\text{Mn}_{1.5}\text{O}_4$ spinel nanoparticles was 11.512 nm. Thus, the nano-sized $\text{Cu}_{1.5}\text{Mn}_{1.5}\text{O}_4$ spinel nanoparticles can be used as catalysts for the methanol steam reforming (MSR) reaction.

Keywords: oxalate precipitation, methanol steam reforming, nanoparticles

EST – 19

HYDROTHERMAL SYNTHESIS OF ZEOLITE CRYSTALS INCORPORATED BY NITROGEN-DOPED TiO₂ NANOPARTICLES FOR THE PHOTOCATALYTIC DEGRADATION OF TATRAZINE

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Water pollution due to wastewater effluents particularly from organic dyes and pigments of textile and food industries have been a global concern. Various materials and processes have been developed to address this problem. In this study, a composite material of zeolite crystals and nitrogen-doped TiO₂ nanoparticles was synthesized to degrade tartrazine via combined effects of adsorption and photocatalysis. Firstly, doped TiO₂ nanoparticles were produced by sol-gel method. The TiO₂ colloidal solution was then incorporated in zeolite crystals through *in situ* hydrothermal technique. Based on the results, the synthesized zeolite-TiO₂ composite products had crystalline structure and spherical morphology. The incorporated TiO₂ nanoparticles had particle size of 59.96 ± 0.77 nm, good uniformity with polydispersity index of 0.387 ± 0.010 , and great stability in water due to Zeta potential of 32.8 ± 2.4 eV. A red shift in the ultraviolet-visible spectrum was also observed upon doping. These material properties led to a catalytic efficiency of $85\% \pm 2.1$ in the photodegradation of tartrazine for 1 hour. In summary, the material was found feasible as a photocatalyst in degrading organic dyes.

Keywords: zeolite; titania; photodegradation; tartrazine; nanoparticles

EST – 20

PHYSICAL CHARACTERIZATION OF LOW FIRED POROUS CERAMIC WHITEWARE UTILIZING BONE ASH, QUARTZ AND CLAY FOR ARTWARE PRODUCTS

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There are numerous studies on bone ash as raw materials in both earthenware and porcelain whiteware bodies that produce translucent and vitreous compound with minimal to zero porosity. In contrast, this study focused on utilizing bone ash in low fired porous ceramic whiteware bodies for artware products. The formulation was based on the ideal “Bone China” compound which has 50% bone ash, 25% quartz, and 25% clay. These were substituted with local materials from Ilocos Norte. The bone ash was obtained by calcining up to 1050°C of cow’s bone collected from the local restaurant. After calcination, this was ground for several hours using pot mill prior to screening at 75 µm sieve. The Pasuquin quartz and Sta. Ana clay were gathered from the mountainside of Ilocos Norte. Both materials separately underwent preliminary processes such as drying, crushing and grinding prior to screening at 75 µm sieve. The three materials were proportioned, mixed with the desired amount of water together with 0.3% Na₂SiO₃ as dispersing agent until a homogeneous mixture was achieved to form a slip. The test samples were solid cast using 2 in x 2 in x 8 in plaster of Paris mold, dried and fired separately one at 1050°C and the other at 1100°C, respectively. Results showed that the total linear shrinkage obtained were 2.15% and 3.56%, respectively, which are within the ideal range of 17% maximum. The modulus of rupture (MOR) were 51.21 lb/in² and 136.21 lb/in² which were very low compared to the ideal range of 1400~2000 lb/in². The water absorption values were 31.13% and 29.87% and the apparent porosity were 48.20% and 46.78%, of the samples fired at 1050°C and 1100°C, respectively. Whiteware products can be classified as “vitreous” when water absorption and apparent porosity is less than 1%, otherwise this is classified as “porous” ceramic whiteware.

Keywords: low firing, ceramic whiteware, bone ash, artware

EST – 21

SHORT-TERM AND LONG-TERM STABILITY STUDIES OF COPPER AND IRON IN DRINKING WATER – REFERENCE MATERIAL

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Reference materials (RMs) are vital for validation and quality control of analytical procedures. The RMs are prepared using accepted protocol for RM production in drinking water. In this study, evaluation of stability of the RM during shipment to the end-user (short-term stability) and during storage (long-term stability) was conducted. After the RM material was dispensed into separate bottles and found to be statistically homogeneous, 14 samples for short-term and 18 samples for long-term were identified using stratified random sampling. For short-term studies, the method followed an isochronous approach. Samples were placed in three different locations each with monitored temperature conditions (0°C, 27°C and 40°C). After three weeks, the samples were collected and analyzed in triplicates under repeatability conditions using Teledyne Prodigy 7 ICP-OES. For long-term studies, the samples were stored in two different temperature conditions (0°C and 27°C). The samples were analyzed 3, 6 and 9 months after production of the RM. Stability of the RM was determined using Trend Analysis in accordance to ISO Guide 35. Results of tests showed no-bottling trend indicating that the RM was stable after 9 months. Long term stability testing is on-going and will continue until 24 months after production.

Keywords: Reference material, Stability Test, Trend Analysis

EST – 22

SELECTIVITY, SENSITIVITY, AND STABILITY TESTING OF DNA-NANOBIOSENSOR PROTOTYPES FOR *E. coli*, *E. coli* O157:H7

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Nanobiosensors which combine bio-specific recognition systems with physical or electrochemical signaling and utilizes nanoparticles may have the potential for a simpler, more rapid, highly sensitive, and specific detection compared with Polymerase Chain Reaction (PCR) and Loop-mediated Isothermal DNA Amplification (LAMP) assays that need prior enrichment or immunomagnetic separation steps. Nanobiosensors could be quantitative and field-operable for a 'point-of-care' (POC) detection system. Prior to field validation of the prototypes, selectivity, sensitivity, and stability testing of the developed DNA-based nanobiosensor should be done. The fabricated nanobiosensors derived from the *stx1* gene of *E. coli* O157:H7, *yaiO* gene of *E. coli*, and *hila* gene of *Salmonella enterica* have shown selectivity toward their target DNAs over that of their non-target DNAs with sensitivity of as low as 0.1 ng/μL of genomic DNA which can be successfully extracted using the modified 30-second cellulose-based extraction protocol. Stability tests on the DNA-probes functionalized with the electrically-active magnetic nanoparticles (PRO-EAM-NPs) showed minimum detachment of the detector probe, Ph-PRO, from the EAM-NPs up to 48 h at 4°C.

Keywords: DNA nanobiosensor, *E. coli*, *E. coli* O157:H7, electrically-active magnetic nanoparticles, *Salmonella enterica*

EST – 23

CARBON FIBER-SUPPORTED $\text{Ni}_3(\text{NO}_3)_2(\text{OH})_4$ FLOWER-LIKE STRUCTURES FOR SUPERCAPACITOR APPLICATIONS

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Supercapacitors are considered the next generation energy storage devices because of their high power and energy densities. Nickel (Ni)-based electrodes have already been identified as one of the promising electrodes for supercapacitors because of their good electrocatalytic performance. In this work, nickel nitrate hydroxide [$\text{Ni}_3(\text{NO}_3)_2(\text{OH})_4$] nanostructures were grown on the surface of carbon fiber paper via hydrothermal method. X-ray diffraction (XRD) confirmed the presence of carbon as current collector and the as-prepared product to be $\text{Ni}_3(\text{NO}_3)_2(\text{OH})_4$. Scanning electron microscopy (SEM) revealed the flower-like structures attached on the surface of carbon fibers. A surface area of $36.46 \text{ m}^2/\text{g}$ was observed based on Brunauer–Emmett–Teller (BET) measurements. The electrochemical behavior was characterized using cyclic voltammetry (CV) and charge-discharge measurements in a three electrode set-up. Highest capacitance was observed at lower scan rates and lower current densities. A specific capacitance of $1,352.40 \text{ F/g}$ and 782.73 F/g were calculated at a scan rate of 2 mV/s and a current density of 2 A/g , respectively.

Keywords: supercapacitor, carbon fiber, nickel nitrate hydroxide

EST – 24

COLORIMETRIC DETECTION OF COPPER (II) IONS IN WATER USING HUMIC ACID-FUNCTIONALIZED SILVER NANOPARTICLES

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Many metal-working industries can introduce copper into the water supply which poses potential dangers to people from the ingestion of copper-contaminated water. This merits the need for a low-cost method to monitor the amount of copper present in water. This can be done through the use of silver nanoparticles (AgNPs) as a colorimetric sensor. In this study, humic acid-functionalized silver nanoparticles (HA-AgNPs) were synthesized and used to detect Cu(II) ions in aqueous media. The HA-AgNPs were synthesized by chemical reduction approach using silver nitrate (AgNO₃) as the Ag precursor, sodium borohydride (NaBH₄) as the reducing agent, and humic acid (HA) as the stabilizing and functionalizing agent. The amount of HA was varied from 0 – 200 ppm HA and their stability was studied for a storage period of two months. To test its ability to detect Cu(II) in water, the HA-AgNPs were mixed with aqueous solutions of Cu(II) and their spectral changes were observed. The UV-Vis spectra of the synthesized HA-AgNPs showed the location of the surface plasmon resonance (SPR) peak at around 413 to 421 nm, which is the typical range of the location of the SPR peak of AgNPs. The HA-AgNPs were found to be stable for two months of storage with HA concentrations above 5 ppm. The HA-AgNPs showed a linear response with increasing Cu(II) concentration. The best HA-AgNPs assay yielded a limit of detection (LoD) for Cu(II) of 18.26 ppm and a limit of quantification (LoQ) of 60.85 ppm. This shows that the HA-AgNPs can be used as a low-cost method for Cu(II) detection.

Keywords: colorimetric detection, silver nanoparticles, humic acid, surface plasmon resonance, copper detection

EST – 25

FUSING OF SILVER NANOPARTICLES AT ROOM TEMPERATURE USING HALIDE SOLUTIONS FOR CONDUCTIVE INKS

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Printed electronics has recently gained much attention due to its potential applications in photovoltaics, transistors, displays, batteries, antennas, and sensors. Printed patterns usually utilize inks consisting of metal nanostructures designed for various substrates and thus, application. In this work, a highly conductive ink for printable electronics was formulated at room temperature using silver (Ag) nanoparticles as the conducting material and halide solutions as fusing agents for print-on-paper applications. Ag nanoparticles were synthesized in an aqueous system via chemical reduction method. The synthesized Ag nanoparticles were then washed and treated with halide solutions (NaCl and NaBr) at room temperature for fusing of nanoparticles and thus increase the conductivity of the ink. The fused Ag nanoparticles were dispersed in an ink formulation and were printed on different substrates. Results showed that the as-synthesized Ag nanoparticles had an average diameter of about 24 nm. After dispersing the Ag nanoparticles in a halide solution, a significant increase in particle size to about 188-197 nm was observed. The enlargement of particle size was accompanied by the increase in conductivity of the Ag nanoparticle ink. The resistance was reduced from 110 kilohms to 35 and 9.3 ohms for the as-prepared and sintered Ag nanoparticles using NaBr and NaCl solution, respectively.

Keywords: Silver, nanoparticles, halides, room-temperature sintering, printable electronics.

EST – 26

PHOTOCATALYTIC PROPERTY OF CU-DOPED HEMATITE (α -Fe₂O₃) HIERARCHICAL NANOSTRUCTURES

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Photocatalysis is a promising route in the treatment of dye-laden wastewater as this process does not produce any sludge that would require secondary treatment and is also relatively easy to handle. Hematite (α -Fe₂O₃) is a good candidate as a photocatalyst because it is very cheap, stable, and environmentally benign. This work reports the enhancement on the photocatalytic property of Cu-doped hierarchical α -Fe₂O₃ nanostructures synthesized via hydrothermal method. Precursor materials (FeCl₃, CuCl₂, and Na₂SO₄) were mixed in 40 ml distilled H₂O at varying mole ratios and hydrothermal treatment was done at 120°C for 6 h. Precipitates were then washed and consequently calcined at 400°C for 2h. X-ray diffraction and Raman spectroscopy methods reveal successful synthesis of rhombohedral α -Fe₂O₃ phase and doping of Cu. Morphological analysis using SEM showed formation of urchin-like nanostructures, with uniformity decreasing with increasing dopant levels. Photocatalytic activity was assessed via photodegradation of methyl orange under UV-C irradiation and showed that degradation efficiency and kinetics was best at 15% Cu dopant. The pseudo-first order kinetic rate constant of the 15% doped sample had about twenty times improvement compared with the undoped sample. Improved photocurrent for the 15% doped sample was obtained through chronoamperometric measurements which is consistent with the degradation performance of synthesized photocatalyst.

Keywords. Photocatalysis, Cu-doped hematite, urchin-like structures

EST – 27

EFFICIENT ELECTROCATALYTIC OXYGEN EVOLUTION OF UNIQUE HIERARCHICAL HOLLOW NiCo₂O₄ NANOURCHINS IN ALKALINE MEDIUM

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Noble metal oxides such as iridium and ruthenium oxides (IrO₂ and RuO₂) remain to be the state-of-the-art electrocatalysts for oxygen evolution reaction (OER) due to their excellent electrochemical properties. However, these materials are expensive, scarce, and unstable in aqueous medium, hence impeding their use for large-scale applications. As such, transition metal oxides have attracted considerable attention as electrocatalysts for OER. In this study, cobaltic oxide (Co₃O₄) was synthesized using a simple and controllable hydrothermal method followed by a post-thermal treatment. Effects on the physico-chemical and electrochemical properties of partial substitution of Ni²⁺ in Co₃O₄ structure were determined. Initially, quasi-spherical Co₃O₄ nanoparticles with a mean diameter of 63.03 nm, BET specific surface area of 30.83 m²/g, and crystallite size of 20.43 nm were produced. Incorporation of Ni²⁺ led to dramatic morphological transformation, forming microspherical urchin-like aggregates of NiCo₂O₄ with a mean spike diameter of 20.62 nm. It was observed that the crystallite size decreased to 12.25 nm while BET specific surface area increasing to 49.04 m²/g. Such improvements in the physico-chemical properties translated to better electrochemical performance of NiCo₂O₄ in alkaline medium. It recorded an onset overpotential of 290 mV and a Tafel slope of 68.4 mV/dec while Co₃O₄ obtained 340 mV and 95.1 mV/dec, respectively. Even after 1000 cycles of cyclic voltammetry, a quite minimal reduction in current density at 1.75 V of about 4.18% was registered, suggesting good stability in alkaline medium. In addition, sulfurization of NiCo₂O₄, producing NiCo₂S₄ resulted to an even better electrochemical performance. It attained an onset overpotential of 250 mV, one of the lowest reported for such system. This is competitive with the commercially available IrO₂ and RuO₂, making it a promising electrocatalyst for OER.

Keywords: hydrothermal, NiCo₂O₄, nanourchins, NiCo₂S₄, OER

EST – 28

SILVER-DOPED TITANIUM DIOXIDE NANOTUBES FOR PHOTOELECTROCATALYTIC DEGRADATION OF ACID ORANGE 52

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Titanium dioxide (TiO₂) is the most widely used photocatalyst because of its low cost, wide availability, and non-toxicity. However, it requires UV light for photoactivation due to its fast electron-hole recombination and wide band gap. Doping TiO₂ with transition metals such as silver is one way to extend its photoactivity in the visible light region. In this study, highly-ordered Ag-doped TiO₂ nanotubes (Ag-TiNTs) were synthesized by one-pot double anodization of Ti sheets. The as-anodized TiNTs were calcined, characterized, and used as photoelectrodes for photoelectrocatalytic degradation of Acid Orange 52 (AO 52). The effects of varying light intensity and electrical bias on the degradation of AO 52 were investigated. Ag-TiNTs were successfully synthesized with an average diameter of 46.82 nm, a wall thickness of 8.71 nm, and nanotube length of 1.18 μm. Silver was found to be homogeneously doped within the interstitials of Ag-TiNTs with 2.06 wt% Ag loading. Increasing the applied potential and light intensity both resulted in faster degradation of AO 52. Maximum degradation was achieved after 120 min under a constant current density of 1.0 mA cm⁻² and UV intensity of 2,000 μW cm⁻² achieving 94.62% AO 52 degradation with a pseudo-first order kinetic rate constant of 21.14 x 10⁻³ min⁻¹. Ag narrows the band gap of TiO₂ by acting as an electron trap that minimizes electron-hole recombination and extending its activity to the visible light region. Overall, Ag-doping was shown to enhance the photoelectrocatalytic performance of pristine TiNTs in degrading AO 52.

Keywords: titanium dioxide nanotubes, doping, anodization, photoelectrocatalysis, Acid Orange 52

EST – 29

APPLICATION OF LOW-COST MODIFIED CAMERA FOR NDVI MAPPING OF SUGARCANE FIELD IN TRANCA, BAY, LAGUNA

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Normalized difference vegetative index (NDVI) has been used as a tool to assess the health of a vegetation. Multispectral cameras are used to acquire this index; however; this type of camera is very expensive. This paper explores the cheaper alternative of acquiring NDVI of a sugarcane field using a modified, digital camera. Modification was done on a digital point and shoot Canon SX230 HS camera by replacing its IR blocking filter with a red filter and loading CHDK settings into its memory. Before actual flight, calibration was performed by customizing the camera's white balance setting with a red card under a shaded location. The NDVI camera was then attached to an unmanned aerial vehicle, the quadcopter. The quadcopter followed a pre-loaded mission for capturing monthly images of the sugarcane field in Tranca, Bay, Laguna. The series of images were stitched into a single image and loaded into QGIS software for extracting the index values and recoloring of images. Recoloring was done using a Red-Yellow-Green color scheme. Resulting images showed that the modified camera was able to discriminate the crop from the soil, as well as, the difference in photosynthetic activity among the sugarcane varieties.

Keywords: ndvi, modified camera, sugarcane, low-cost, mapping

EST – 30

HIGH RENEWABLE ENERGY (SOLAR AND WIND) PENETRATION HYBRID ENERGY SYSTEMS FOR DEEP DECARBONIZATION IN OFF-GRID AREAS

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The country's off-grid islands rely on diesel fuels for electricity supply which are unreliable, expensive, and emit greenhouse gas emissions. The government subsidizes the electricity costs, and most grids operate at certain hours only to reduce the economic and environmental impacts. This study evaluated the techno-economic viability of solar-wind-battery-diesel hybrid energy systems as an alternative solution in 143 existing off-grid island areas using HOMER® Pro. The application obtains the optimal hybrid system architecture with the minimum electricity costs using typical island load behavior. The solar and wind resource data were obtained from the PHIL-LiDAR 2 Program. The results showed that 135 out of 143 islands favor both solar and wind energy, 5 islands favor solar only, and 3 islands favor wind only. Putting up these hybrid energy systems require PHP 55.19 billion in investments with potential savings of PHP 7.93 billion annually or about 69% reduction in the required subsidies. The results suggest high sensitivity towards wind resource potential due to the lower costs of wind energy. With a potential energy share of 62%, wind power for off-grid islands should be highly considered alongside solar power, especially in areas with high wind resource potential, to provide reliable energy access, reduce electricity costs, and reduce greenhouse gas emissions.

Keywords: renewable energy, solar, wind, techno-economic analysis, off-grid

EST – 31

DETECTION OF MALATHION USING MOLECULARLY- IMPRINTED POLYMER ON QUARTZ CRYSTAL MICROBALANCE

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The extensive use of pesticides can result in overexposure and residues in soil, water and produce. For instance, residues of malathion are found on some vegetables. Molecularly-imprinted polymers (MIP) have been recently developed for sensing pesticide residues. In this study, malathion-imprinted polymers were prepared via precipitation polymerization and deposited on quartz crystal microbalance (QCM) electrodes. FTIR spectroscopy proved the incorporation and removal of malathion in the matrix of MIP. SEM images revealed that MIP particles are larger than the non-imprinted polymer (NIP) particles due to the incorporation of malathion. Binding experiments were done using standard malathion solutions of 10 to 60 ppm. The MIP-QCM sensor had a greater response than the NIP-QCM sensor. This is due to the specific binding sites in the MIP matrix. On the other hand, the response of NIP-QCM sensor is attributed to the non-specific adsorption sites in its matrix. A sensitivity and detection limit of 1.62 Hz·L/mg and 5.67 ppm, respectively, were determined for the MIP-QCM sensor. Lastly, the MIP-QCM sensor is stable and reusable up to three (3) cycles.

Keywords: MIP, malathion, QCM, pesticide, sensor

EST – 32

DISCARDED RUBBER TIRES AS AN ALTERNATIVE FOR SAND IN A SOUNDPROOFING MIXTURE

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There is a large market for cars and their accessories in the Philippines in which 200,000 tons of used tires are generated in the country yearly. Used tires can only be recapped up to three times before they are discarded, thus, resulting in environmental issues due to improper disposal of tires. The use of waste rubber tires as construction material replacement has become an unstable recycling activity. This has resulted to an increased supply of waste rubber crumbs in the market for reuse. This study focused on the sound absorbance characteristic of waste rubber crumb. Waste rubber crumb was utilized as sand replacement for cement tile and its sound absorbance was determined. Waste rubber crumb and cement were mixed with the varying ratio of 2:1, 1:1, and 1:2. A 250 mm x 250 mm x 2 mm mold was used to make a concrete tile. To determine the effect on sound absorption, a decibel meter was used to measure the level of sound inside a cube covered with rubber crumb cement tile. Results showed that of the three ratios of cement to rubber crumb, 1:1 displayed a 6.4% decrease in sound level.

Keywords: rubber, soundproofing, sound absorption

EST – 33

REMOVAL OF ACID BLACK DYE FROM AQUEOUS SOLUTION BY THE USE OF PERLITE FROM LEGAZPI, ALBAY AND THE DESIGN OF AN AGITATION TANK FOR THE ADSORPTION PROCESS

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Treatment of textile waste water has emerged as a great matter of concern amongst scientific community because of essentiality and scarcity of this valuable natural resource. Various techniques have been employed for waste water treatment, amongst which use of natural materials have made a significant contribution in the area of sustainable environment. In this study, the adsorption performance of perlite for acid black dye from aqueous solution was investigated. Residual solutions of the adsorption process were spectrophotometrically examined at the maximum wavelength of 615 nm. Effects of the parameters such as grade of perlite, treatment of perlite, dosage of perlite and contact time on the removal of the dye were studied. Maximum decolorization of about 96% was observed after 10 minutes with 0.8 g of the modified filter aid perlite. Adsorption isotherms like Langmuir and Freundlich were used to describe this phenomenon. The experimental data were correlated reasonably well by the Langmuir adsorption isotherm with an R² value of 0.9895. Spectroscopic tests such as Ultraviolet Spectroscopy (UV-Vis), Fourier Transform-Infrared Spectroscopy (FT-IR) and Scanning Electron Microscopy (SEM) were done and helped to the conclusion of the effectivity of perlite as an adsorbent for the removal of AB1 dye in aqueous solutions. Using the effluent flowrate from Saffron Philippines, Inc. of 7656 L/day as basis, an agitation tank was designed with a diameter and height of 2.30 m and 2.14 m respectively for the adsorption of acid black dye 1 using 122.5 kg Expanded Perlite (EP) and a power consumption of the impeller motor at 1160 kW.

Keywords: acid black dye, adsorption, agitation tank, expanded perlite (EP), textile waste water

EST – 34

PHOTOELECTROCATALYTIC DEGRADATION OF ACID ORANGE 52 USING COPPER-DOPED TITANIUM DIOXIDE NANOTUBES UNDER UV LIGHT

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Doping titanium dioxide (TiO₂) has been the traditional approach to narrow the band-gap of TiO₂, hence, extending its photocatalytic activity to the visible-light region and allowing the possibility of solar-driven photocatalysis. Previous studies have shown that doping with transition metals widens the light absorption range of TiO₂ by introducing new energy levels lower than the conduction band of TiO₂. Among the transition metals, copper has received considerably less attention compared to the rare earth metals such as Pt and Pd which are very expensive. In this study, highly-ordered arrays of copper-doped titanium dioxide nanotubes (Cu-TiNTs) were synthesized by double anodization of titanium sheets. Cu-TiNTs were shown to have an average inner diameter of 52.13 nm, a wall thickness of 14.28 nm, and a tube length of 0.6401 μm. Fourier-transform infrared spectroscopy confirmed the presence of characteristic O-Ti-O bond of TiO₂ while X-ray fluorescence spectroscopy confirmed copper-doping with an average dopant loading of 0.0248 wt%. Even at this low dopant loading, Cu-TiNTs were shown to be photo-active in degrading Acid Orange 52 (AO 52) under UV light illumination. The kinetic data of AO 52 photodegradation were best described by the pseudo-first-order kinetic model ($R^2 \geq 0.991$) with a kinetic rate constant of $9.42 \times 10^{-3} \text{ min}^{-1}$ for Cu-TiNTs as compared to $6.04 \times 10^{-3} \text{ min}^{-1}$ for pristine TiNTs. Overall, doping pristine TiNTs with Cu was shown to enhance their catalytic properties in degrading textile dyes such as AO 52.

Keywords: titanium dioxide nanotubes, doping, anodization, photoelectrocatalysis, Acid Orange 52

EST – 35

LOCALLY AVAILABLE AGRICULTURAL WASTES AS SOURCE OF XYLOSE SUGARS FOR XYLITOL FERMENTATION IN THE PHILIPPINES

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Agricultural wastes are abundant in corn and sugarcane production. Corn cobs, corn stovers and sugarcane bagasse are rich in hemicellulose and good sources of xylan for breakdown to xylose sugars and the high-value product, xylitol. Studies were conducted aimed to initiate the development of a local technology for the production of xylitol via biotechnology. Three kinds of lignocellulosic agricultural wastes, sugarcane bagasse (SB), corn cobs (CC) and corn stovers (CS) were hydrolyzed as sources of xylose sugars for the biotechnological production of xylitol. Using Response Surface methodology, the optimum conditions for the high temperature-dilute acid hydrolysis of ground SB, CC and CS were obtained. All responses had reasonable agreement between predicted and actual values of the response. Utilization of the optimized conditions obtained for each substrate led to the production of hydrolysates with high xylose content, low glucose content and insignificant amounts of inhibitory compounds. The hydrolysates obtained were amenable to xylitol fermentation. Selected agricultural wastes can be used in exchange for corn fibers and birch tree materials being used in other countries. The Philippines can still enter the worldwide xylitol market if we initiate the use of unlimited resources like agricultural by-products as raw material for xylose sugar and eventually, xylitol. The biotechnological process is an interesting alternative to the chemical process due to reduced production cost, cheaper downstream processing and higher yields.

Keywords: agricultural wastes, xylose, xylitol fermentation

EST – 36

CRITICALITY SAFETY ASSESSMENT OF PHILIPPINE RESEARCH REACTOR-1 FRESH FUEL STORAGE VAULT

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The PNRI Philippine Research Reactor-1 (PRR-1) is in possession of fresh low-enriched nuclear fuel that has been in dry storage for 30 years. Recently, a storage vault was constructed to further secure these fresh fuel rods. As a nuclear facility, it is essential that the storage remains subcritical with an effective neutron multiplication factor, $k_{eff} < 1$, to ensure that fission chain reaction cannot be sustained and the possibility of inadvertent criticality is remote even in worst case scenarios. To determine the subcriticality of the system, we prepared a detailed model of the fuel storage vault containing 15 unirradiated TRIGA fuel rods. The model was used to calculate the k_{eff} of the system with MCNP5v.1.6, a Monte Carlo radiation transport code. Calculations were performed with a criticality calculation control of 1,100 cycles with nominally 10^4 neutrons per cycle. Results show that the system has a k_{eff} of $0.06879 \pm 2.05 \times 10^{-4}$ at the 99% confidence level. We also performed an accident analysis assuming that the storage vault was completely inundated. This accident scenario resulted in a k_{eff} of $0.37821 \pm 4.75 \times 10^{-4}$ at the 99% confidence level. The increase in k_{eff} is due to addition of water in the system that can reflect and moderate neutrons more effectively than air. Our results show that in all normal and accident conditions, the facility will remain deeply subcritical and criticality accident is highly improbable. The substantial safety margin is due to measures such as restrictions in the shape and dimension of the system to a favorable geometry, limiting the mass of fissile material, and controlling the moderation of the system. These demonstrate that the design of the PRR-1 fresh fuel storage vault is criticality safe.

Keywords: nuclear criticality safety, Monte Carlo simulation, neutron multiplication factor

HEALTH SCIENCES

HS – 01

ATR-FTIR SPECTRAL DISCRIMINATION BETWEEN MALIGNANT AND NON-MALIGNANT THYROID TISSUES

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The gold standard for diagnosing thyroid cancer, which is the histopathologic microscopic examination of hematoxylin and eosin (H&E)-stained tissue, is prone to intra- and inter-observer biases. Hence, this study aimed to evaluate the potential of ATR-FTIR as a more objective and highly efficient method in discriminating malignant from non-malignant thyroid tissues. Three (3) 5 μ m-thick sections of each histologically-confirmed malignant (n=50) and non-malignant (n=50) thyroid tissues were prepared – the outer sections were stained with H&E and evaluated by a pathologist to locate the tumor, and the inner section was deparaffinized and then subjected to ATR-FTIR analysis. Spectral profiling of the FFPE tissue sections was carried out and multivariate analyses such as principal component analysis (PCA) and hierarchical cluster analysis (HCA) were performed. The fingerprint IR region showed distinct variations in several peak patterns, particularly at bands 1634cm⁻¹, 1533cm⁻¹, 1452cm⁻¹, 1395cm⁻¹, 1236cm⁻¹, 1032cm⁻¹ and 882cm⁻¹, representing the nucleic acids and carbohydrates. The increased peak intensity in cases reflects the enhanced replication of nucleic acids and uncontrolled cell growth due to malignant transformation by sugar chains. PCA evidently separated the malignant cases from non-malignant controls. HCA resulted into two (2) clusters of malignant and non-malignant tissues, and a third cluster which showed a degree of heterogeneity between the two groups. Results of the present study indicate that ATR-FTIR fingerprint analysis, in conjunction with chemometric data, is potentially a more objective and specific new method for diagnosing malignant thyroid tissues, prompting more timely onward referral of patients for further testing.

Keywords: thyroid cancer, ATR-FTIR, PCA, HCA, cancer diagnosis

HS – 02

A FORMULATED SUNSCREEN EMULSION FROM THE EUCALYPTUS DE GLUPTA (L) LEAVES EXTRACT WITH ANTIOXIDANT PROPERTY

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The leaves of *Eucalyptus deglupta* or locally known as “Bagras” an endemic tree in the Philippines were utilised as a potential natural cosmetic ingredient. The methanolic leaf extract of *E. deglupta* shows the highest number of phytochemical constituents such as flavonoids, phenols, tannins and alkaloids. The total flavonoid and phenolic content of the extract were found at 170 ± 5 mg quercetin/g extract (n=3, RSD=0.33%) and 709 ± 1 mg gallic acid/g extract (n=3, RSD=1.37%), respectively. The antioxidant capacity was tested by 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. The sample exhibited an antioxidant capacity of 88% (n=5, RSD= 2.21%) and a half maximal inhibitory concentration (IC₅₀) of 4.64 mg/ml (n=3, RSD= 2.60%). The in- vitro sunscreen protection factor (SPF) was found at 27 SPF and was later formulated as a sunscreen emulsion. Results on the fourier transform infrared attenuated total reflectance spectroscopy (FTIR-ATR) showed that the extract and the main raw materials for the sunscreen were compatible. The optimum amount of active ingredient that has a good and acceptable formulation was at 0.50% (w/w). The SPF of the formulated emulsion was 21. The SPF of the emulsion decreased by 29% based on accelerated stability testing (i.e. approximately one year).

Keywords: *Eucalyptus deglupta*, crude extract, antioxidant

HS – 03

CYTOGENETIC FINDINGS IN WOMEN WITH INFERTILITY

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Infertility among women may arise from genetic anomalies which can be detected as chromosomal abnormalities through routine cytogenetics. Chromosomal studies have been proven useful for identifying the etiology of infertility as well as in genetic counseling for those with reproductive complications. The study aims to (1) describe clonal chromosomal abnormalities found among females with infertility (2) provide a baseline cytogenetic data for future molecular genetic studies. Sample population is composed of 362 females (age range 20 to 44 years old) referred to the lab as part of their fertility work up. Peripheral blood samples were drawn from patients and these were cultured and harvested after a 72 h incubation period with phytohemagglutinin (PHA) stimulation. Metaphase spreads were stained using GTG banding and at least 25 cells were screened and analyzed for each patient following The International System for Human Cytogenetic Nomenclature (ISCN) guidelines. Clonal chromosomal abnormalities (numerical and structural) were found in 26 patients (7.2%) among which 11 were mosaic while 336 (92.8%) showed normal karyotypes. A total of 29 abnormalities were observed including hypodiploidy (10.34%), polyploidy (6.90%), near-tetraploidy (3.45%), +mar (10.34%), qh+ (13.79%), translocations (13.79%), deletions (10.34%), inversion (3.45%), isochromosome (6.90%), and ps+/pstk+ (6.90%). We also report 3 novel translocations first seen in Filipino infertile females. Data from this study support the idea that infertility is not solely caused by mutations in genes of the sex chromosomes (X and Y). Autosomal genes also play a role in maintaining female fertility. Our results highlight the importance of cytogenetic studies in patients with infertility before the start of their treatment regimen (e.g. assisted reproduction techniques). Presence of chromosome aberrations may help clinicians determine the etiology of infertility and can guide them in their treatment approaches.

Keywords: infertility, clonal chromosomal abnormality, cytogenetics

HS – 04

NONCLONAL CHROMOSOME ABNORMALITIES IN FILIPINO PATIENTS WITH HEMATOLOGIC MALIGNANCIES

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Increasing reports on nonclonal chromosome abnormalities (NCCAs) in hematologic malignancies raise questions on their role in disease causation and progression and their relationship with clonal chromosome abnormalities (CCAs) and genomic instability. The objective of this study is to document nonclonal chromosome abnormalities specifically deletions in chromosome 9 in various hematologic malignancies. Peripheral blood or bone marrow aspirates from patients were obtained and cultured using standard cytogenetic protocol. G-banded chromosomes were analyzed and karyotypes were prepared based on International System for Human Genetics Nomenclature (ISCN). We present 643 various cases of hematologic disorders carrying NCCAs seen in the laboratory from 1995 to 2018. Of these, 44 (7%) cases specifically carried nonclonal deletions at various locations in the short (p) and long (q) arms of chromosome 9. Deletion in 9q12 was seen in 17 cases. The highest number of del(9) was found among patients diagnosed with leukemia (23%) that includes AML, CML CLL and Pre-B ALL followed by myelodysplasia (18%), cytopenia (14%), myeloproliferative disease (9%), multiple myeloma and anemia (7%). Single non-clonal del(9) were seen in 27 patients (61%) of 44 patients in hematologic cases while 17 patients (39%) had more than one non clonal abnormality. Published works have documented that chromosome 9 harbors several oncogenes and tumor suppressor reported to be involved in disease progression. The findings of this study underscore the role of NCCAs in the etiology and disease progression and thus must be studied further.

Key words: chromosome 9, nonclonal chromosome abnormalities

HS – 05

IDENTIFICATION OF UNIQUE IMMUNOGENIC EPITOPES OF ZIKA VIRUS

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In 2016, the World Health Organization declared a Public Health Emergency of International Concern for Zika virus (ZIKV), an emerging flavivirus infection associated with microcephaly and neuropsychological disorders to unborn babies of infected pregnant women, because of the outbreaks in the Americas and Asia. This infection, which is usually asymptomatic and is highly related to dengue, has become a public health concern because of the lack surveillance programs to prevent and control the infection and rapid and inexpensive diagnostic tools that can discriminate ZIKV from other flaviviruses. In this study, we aimed at identifying unique immunogenic epitopes of Zika Virus *in silico* and *in vivo*. Immune epitope prediction of ZIKV polyprotein was done based on the antigenicity, surface accessibility and hydrophilicity parameters using the epitope prediction tools available at Immune Epitope Database (IEDB) and Analysis Resources. Blastp was used to determine if the predicted epitopes is unique to ZIKV. Immunogenicity of the synthetic peptide comprising the immunogenic sequence was tested in White New Zealand rabbits. Immunogenicity as well as peptide-binding specificity were evaluated by Indirect ELISA. We were able to identify a unique immunogenic linear peptide sequence of ZIKV located at the 169th -184th position of the polyprotein. Increase in the anti-peptide antibody in the sera prior to and after immunization was observed confirming the immunogenicity of the predicted epitopes in animal models. Anti-peptide antibody binding was observed only in the identified immunogenic sequence in the ELISA done using a panel of synthetic peptides as capture molecule. This suggests that the peptide specifically binds to the identified immunogenic epitopes.

Keywords: Zika, ZIKV, peptide epitopes, immunodiagnostics

HS – 06

IN SILICO PREDICTION AND IN VIVO DETERMINATION OF IMMUNOGENIC EPITOPES OF DENGUE VIRUS NON-STRUCTURAL PROTEIN

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One common problem in dengue immunodiagnostic kits is cross-reactivity due to the non-specificity of the capture antigen used in available immunoassays. In order to prevent misdiagnosis, there is a need for an identification of a unique immunogenic epitope that is specific only for dengue virus non-structural (NS1) protein. The study aims identify dengue-specific epitopes of NS1 using *in silico* approaches and validate it *in vivo*. Immune epitope prediction was done based on antigenicity, surface accessibility and hydrophilicity prediction parameters available in the Immune Epitope Database and Analysis Resources (IEDB). Exclusivity to dengue virus was determined using Blastp protein sequence alignment. Production of anti-peptide antibody in peptide immunized rabbits and peptide-antibody binding specificity were determined by indirect ELISA. We were able to identify a potentially immunogenic NS1 epitope specifically found in dengue located at 945th to 958th amino acid position of the dengue virus polyprotein. Anti-peptide antibody was predicted from the sera of the peptide immunized White New Zealand rabbits suggesting that the *In silico* predicted epitope is immunogenic. The antibodies produced specifically bind to the identified NS1 immunogenic epitopes when tested against a battery of synthetic peptides.

Keywords: dengue, DENV, peptide epitopes, immunodiagnostics

HS – 07

PCR-BASED DETECTION OF RUMINANT TREMATODE METACERCARIAE ENCYSTED IN PLANTS

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The metacercariae of specific species of trematodes may encyst either alone or concurrently in the same plant. Their morphological characteristics is very similar leading to misidentification that constraints in dealing with the disease etiology and transmission in ruminants. Therefore, proper identification of these species is important and the most sensitive and accurate means of identifying them would be using molecular-based technique. PCR-based detection of *Fasciola gigantica*, *Fasciola hepatica* and *Calicophoron calicophorum* was performed to assess their presence from collected plants in selected barangays of Science City of Muñoz, Nueva Ecija. Their occurrences from specific plant species, types of water submerged areas and barangay origin were also determined. DNA sequence analysis revealed 1 out of 2 representative samples at 98% homology to *C. calicophorum*. The percentage occurrence based on PCR result revealed 6.1% for *C. calicophorum* and no occurrence for *Fasciola* spp. Plant samples with *C. calicophorum* were *Oryza sativa* L., *Melochia concatenata* L. and *Leptochloa chinensis* (L.) Nees. These were collected from three barangays namely: Brgy. Franza, Brgy. Bantug, and Brgy. Calisitan located in irrigation canals and rice fields. The knowledge of the distribution of the parasites at the target community coming directly from the source will help in the formulation of control strategies and in ways of educating farmers on the transmission of trematode infections affecting the ruminants.

Keywords: PCR, metacercariae, encyst, etiology, DNA sequence analysis

HS – 08

METAL ORGANIC FRAMEWORK AS POTENTIAL DRUG CARRIER FOR MAGNOLOL

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Magnolol, a neolignan derived from *Magnolia officinalis*, has been reported to possess various pharmacological property. The neuroprotective property was further proven due to its ability to counteract the toxic effects of beta amyloid peptides on rat pheochromocytoma cells (PC12) making it a good candidate for the management of Alzheimer disease. However, the main limitation for the use of magnolol is its low bioavailability. The study is aimed to prepare a metal organic framework carrier for increased oral bioavailability of magnolol. Metal Organic Frameworks (MOFs) were synthesized using solvothermal method. MOF preparations were characterized and tested for their beta-secretase inhibitory potential, acute oral toxicity, bioavailability profile, tissue distribution behavior, and neuroprotective property. Percentage yields of the following MOFs were 19.72% for MIL-53(Fe), 71.99% for MIL-100(Fe), 53.03% for Uio-66(Zr), 26.29% for MIL-88A(Fe) and 11.15% for MIL-88B(Fe). Among MOF carriers, Uio-66(Zr) was found to load 72.16% magnolol (~0.721 mg magnolol/mg MOF) after 36 hours. Further characterization and analyses are still on going. Uio-66(Zr) MOF provided the maximal drug loading capacity for magnolol and can be of potential use in the oral treatment for Alzheimer's disease.

Keywords: magnolol, metal organic framework, drug delivery

HS – 09

**FORMULATION STUDY OF ANTIMICROBIAL
OINTMENT FROM PHILIPPINE *Punica granatum* L.,
(LYTHRACEAE) FRUIT PEEL EXTRACT**

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The purpose of the study is to formulate an antimicrobial ointment from fruit peel extract of pomegranate. Maceration was used for extraction and its physicochemical properties were evaluated using the methodologies of USP 31. Microbial assay was conducted using the paper disc diffusion and test tube dilution method. Compatibility of excipients was tested using differential scanning calorimetry (DSC). Mechanical incorporation was used for the manufacture and stability was determined using accelerated stability method. Results revealed the extract was most active even at the lowest concentration (25%) to *Pseudomonas aeruginosa* (31 mm), followed by *Aspergillus niger* (17 mm) and *Trichophyton mentagrophytes* (17 mm), *Staphylococcus aureus* (14 mm) and inactive to *Candida albicans* (9 mm) at all concentrations (100%, 75%, 50% and 25%). DSC results showed that the lyophilized extract was compatible with excipients. The formulated antimicrobial ointments were brown in color, odorless, non-gritty, neutral (pH 6.6), with average spreadability of 30.55 mm, average viscosity of 64,000 cP and average sensitivity test of 0 for both water and oil based 60% formulations. It disclosed sensitivity to all test microorganisms. Formulated ointments were subjected to accelerated stability test that showed they were stable until the 6th month but on the 12th month, it showed instability like solidification of ointment, bleeding and crystallization. The results show that that the lyophilized extract of pomegranate can be formulated into an antimicrobial ointment. However it needs further study in formulation as it manifested instability on the 12th month.

Keywords: antimicrobial ointment, pomegranate, peel extract

HS – 10

NANOSTRUCTURED LIPID CARRIERS (NLCS): A PROMISING AND STATE-OF-THE-ART DRUG CARRIER FOR DELIVERING ANTIMICROBIALS

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Mupirocin is a promising *broad-spectrum antibiotic* that is effective in treating MRSA infections. It has a unique structure and mode of action from most antimicrobials. However, due to its high protein binding, rapid elimination and hydrolysis following injection, current therapeutic use is limited to topical administration. Nanotechnology-driven innovations provide hope for patients and practitioners in overcoming the problem of drug resistance, facilitating drug transport and protecting the drug from degradation. Nanostructured lipid carriers (NLC) offer the advantage of improved drug loading capacity, release properties and targeted drug delivery. The objective of this research is to develop and characterize Mupirocin-Loaded Nanostructured Lipid Carriers (MNLC) for intravascular administration. The MNLC was produced by a combination of high-shear homogenization and high-pressure homogenization of solid (cetyl palmitate) and liquid (caprylic/caprylic acid) biocompatible lipids in 5 different ratios. The particles showed spherical shape under FESEM. The mean particle size, polydispersity index (PDI) and the zeta potential (ZP) of the MNLC formulations, as determined by dynamic light scattering (DLS), were between 99.8 to 235 nm, PDI lower than 0.164, ZP from -25.96 to -19.53 and pH ranging from 6.28-6.49. The MNLC formulation also enhances the antibacterial activity of mupirocin. All formulation showed sustained drug release and good physical characteristics during three (3) months storage under 25°C and 40°C. It also revealed that the MNLC is safe at 250 mg/kg dose in rats. The MNLC also showed a significant increase in plasma concentration in rabbits following IV administration thus demonstrating an enhancement on its pharmacokinetic profile as compared to free mupirocin.

Keywords: Mupirocin, nanostructured lipid carrier, drug delivery

HS – 11

GREEN SYNTHESIS OF SILVER NANOPARTICLES USING *Antidesma bunius* AQUEOUS LEAF EXTRACTS AND ITS CYTOTOXICITY IN HUMAN- DERIVED COLORECTAL CANCER CELL LINES

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Silver nanoparticles (AgNPs) have received vast attention in recent years due to its promising biomedical and therapeutic applications. Biogenic synthesis of AgNPs has become an attractive biogenic route for the synthesis of AgNPs by using plant-derived materials. This study aimed to synthesize AgNPs using the aqueous extract obtained from *Antidesma bunius* (*A. bunius*) leaves as a reducing agent. The properties of the synthesized AgNPs were characterized by UV-VIS spectroscopy, FT-IR spectroscopy, energy dispersive x-ray (EDX), scanning electron microscopy (SEM), and dynamic light scattering (DLS). The toxicity of AgNPs was assessed in colorectal cancer cell line, HCT116, using the presto blue cytotoxicity assay. Synthesized AgNPs displayed the characteristic maximal absorption at 424.0 nm which remained prominent for at least 5 weeks. FT-IR analysis showed that the AgNPs exhibit the characteristic Ag molecular vibration and the chemical functional groups associated with *A. bunius* extracts. EDX analysis of AgNPs showed Ag as the predominant atomic species. SEM revealed spherical Ag nanoclusters which are commonly observed in AgNPs preparation. DLS analysis showed that AgNPs had a mean size of 71.8 ± 0.510 nm and polydispersity index (PDI) of 0.212 ± 0.001 . AgNPs had a zeta potential of -34.2 ± 0.103 mV which indicate moderate stability. The viability of HCT116 cells decreased following exposure to AgNPs for 24 hours. Overall, the results indicate the AgNPs synthesized using *A. bunius* extracts exhibited the properties of AgNPs produced via traditional synthetic approaches. Furthermore, AgNPs exhibited anti-cancer potential and may have therapeutic benefits for the treatment of cancer.

Keywords: silver nanoparticles, *Antidesma bunius*, green synthesis, anticancer activity

HS – 12

ISOLATION AND STRUCTURE ELUCIDATION OF TWO NEW TETRASUBSTITUTED α -PYRONE DERIVATIVES FROM THE ENDOPHYTIC FUNGUS *SORDARIA* SP. WITH ANTIFUNGAL AND CYTOTOXIC ACTIVITIES

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There is a growing need for new antibiotics, chemotherapeutic agents, and agrochemicals that are highly effective, possess low toxicity, and have a minor environmental impact. Endophytic fungi are a promising source of novel biologically active compounds, and have proven to yield a considerable hit-rate of novel compounds when screening larger strain numbers for biological activities. In this study, two new α -pyrone derivatives, sordariapyrones A (**1**) and B (**2**), including four known compounds, were isolated from the endophyte *Sordaria* sp. Their structures were elucidated by extensive spectroscopic methods and single crystal X-ray diffraction. Both compounds feature oxidized functionalities at C-2 position not previously observed in other tetrasubstituted α -pyrone structures. Compound **1** exhibited moderate antibacterial (vs. *Staphylococcus aureus*) and antifungal (vs. *Rhodoturula glutinis*) activities (MICs = 66.6 μ g/mL) and cytotoxicity against KB3.1 cells (IC₅₀ = 27 μ g/mL).

Keywords: α -pyrones, *Sordaria* sp., endophytic fungi, antifungal, cytotoxic.

HS – 13

MOLECULAR BIOEXPLORATION OF THREE NEW DOTHIDEOMYCETE FUNGI FOR DRUG DISCOVERY OF NOVEL ANTIBIOTIC, ANTI-BIOFILM, NEMATICIDAL AND ANTI-CANCER AGENTS

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The phylum Ascomycota is known to be the most diverse group in the fungal kingdom with over sixty thousand species occurring worldwide. While many studies have reported the diversity of biologically active secondary metabolites in this group of fungi, little is known on natural products produced by plant-associated Ascomycota, especially, those belonging to the class Dothideomycete. In this study, we demonstrate the isolation and structure identification of new biologically active secondary metabolites from three new Dothideomycete fungi namely, *Sparticola junci*, *Rousella sp.* and *Pseudolophioblastoma mangiferae* with antimicrobial, bacterial biofilm inhibitory, nematicidal and cytotoxic activities. Large scale fermentation followed by preparative HPLC of crude fungal extracts allowed the isolation of sixteen compounds. These were spectroscopically identified as oxidized *nor-seco* bisnaphthalenes, abscisic acids, cyclodepsipeptides, phenolics and meroterpenoids. In general, the compounds exhibited potent antimicrobial activities against four fungi and three Gram-positive bacteria, inhibited *Staphylococcus aureus* biofilm formation, toxicity against *Caenorhabditis elegans* and cytotoxic activities against cancer cells. Our results show the promise of Dothideomycete fungi in drug discovery.

Keywords: Dothideomycete fungi, antibiotic, biofilm inhibitor

HS – 14

PREPARATION AND CHARACTERIZATION OF PLGA/CHITOSAN ENCAPSULATED QUERCETIN

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In this study, quercetin which is a flavonoid widely distributed in many fruits and vegetables, which have unique biological properties which are known to have benefits to overall health and disease resistance but have poor solubility and availability, is encapsulated by chitosan (deacetylated chitin) and polylactic-co-glycolic acid (PLGA) to increase bioavailability. An emulsion solvent diffusion method in water method was used to encapsulate quercetin within PLGA/chitosan polymeric microsphere, with the aim to protect quercetin against degradation and enhance its biocompatibility. Encapsulation efficiencies ranged from 70-86%. Statistical analysis arrived to the optimum condition of the microsphere and it was subjected to characterization. Quercetin loaded microsphere exhibited the size and zeta potential of 1.3 μm and -14.00, respectively. SEM images showed scattered arrangement of the polymer and several irregularly shaped particles. FTIR analysis showed the absence of O-H stretch in the microsphere which may be associated with chitosan covering the microspheres. This unique drug formulation was considered to be successful based on the results gathered.

Keywords: Encapsulation, PLGA/chitosan, quercetin

HS – 15

**FORMULATION OF A DIURETIC ORAL SUSPENSION
FROM THE ETHANOLIC LEAF EXTRACT OF
Basella alba L. (BASELLACEAE)**

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The ethanolic leaf extract of *Basella alba* L. has been shown to possess diuretic activity owing to the presence of saponins. The study focused on the formulation of a diuretic oral suspension, as potential alternative to oral solid diuretic medications, using the ethanolic leaf extract of *Basella alba* L. as active ingredient. Presence of saponins in the prepared extract was confirmed using froth test. An oral suspension containing 50 mg/mL of the leaf extract was formulated with carboxymethylcellulose, citric acid, glycerin, sodium benzoate, sodium chloride, and saccharin. The appearance, viscosity, pH, and redispersibility of the formulated oral suspension were assessed. Using the Lipschitz method, diuretic activity was evaluated with twenty-four Sprague Dawley rats divided into four groups: Group 1 was treated with base suspension, Group 2 received 10 mg/kg Furosemide, and Groups 3 and 4 were treated with 250 mg/kg and 500 mg/kg of formulated *Basella alba* oral suspension, respectively. The formulated oral suspension at 500 mg/kg showed a comparable diuretic effect to furosemide with a diuretic index of 1, while the formulated oral suspension at a dose of 250 mg/kg produced mild diuretic effect. Both doses of the formulated oral suspensions gave significantly higher Na⁺ and K⁺ output than base suspension (p<0.05). The results of the study show that the formulated oral suspension containing the leaf extract of *Basella alba* L. exhibits dose-dependent diuretic activity, and may be a suitable alternative to oral solid diuretic medications.

Keywords: *Basella alba*., diuretic, furosemide, oral suspension, saponins

HS – 16

EFFECT OF FORCED-AIR BLANKET, WARM BLANKET AND ITS COMBINATION TO POST-OPERATIVE HYPOTHERMIC PATIENTS

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Incidence rate of postoperative hypothermic is still high. Many factors are causing postoperative hypothermia, but the main cause of hypothermia is the administration of anesthesia due to the impairment of the normal autonomic thermoregulatory control. The body temperature of a patient under anesthesia would fall up to 6°C, with an average of at least 2°C. This study determined the effect of warm blanket, forced air blanket and its combination to postoperative hypothermic patient. A quasi-experimental design was utilized and participants were chosen through purposive sampling to ensure the 63 participants met the criteria of the study. Randomization through cast lot was employed in dividing participants into three groups with 21 participants each group. Warm blanket, forced air blanket and its combination were effective in increasing body temperature of post operative hypothermic patients. However, forced air blanket is better in increasing body temperature than warm blanket. Further, the combination of warm blanket and forced air blanket was the best intervention in increasing the body temperature of hypothermic patients. Age did not affect the mean score of the participants' body temperature in all treatments.

Keywords: forced-air blanket, warm blanket, post-operative patients, hypothermia

HS – 17

SPIRITUAL CARE, AROMATHERAPY AND ITS COMBINATION: THEIR EFFECTS ON FEAR AND PHYSIOLOGICAL STATUS OF WOMEN DURING LABOR

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This quasi experimental study aimed to find out the effect of spiritual care, aromatherapy, and its combination on the fear level and physiological status of women during labor. Purposive sampling was utilized to select 120 women, ages 19-40 years old, in their 36-40 weeks age of gestation, with intact bag of water, and were in the latent phase of labor as participants of the study. Fear level was measured using fear scale questionnaire. Data on the physiological status such as temperature, respiratory and pulse rate, and blood pressure were measured. Pain intensity was measured using the modified visual analogue scale. The participants were divided into four groups—the spiritual care group, aromatherapy group, combination group, and control group. The result of the study revealed that all the participants, regardless of the group they belong, experienced fear. The group who received spiritual care experienced lower fear level and pain intensity. Aromatherapy group experienced lower pulse rate, systolic blood pressure and fear level. Combination group experienced lower systolic blood pressure, pain intensity, and fear level. Control group experienced increased pain intensity. No other significant difference was found in fear level and physiological status among the groups when the participants' age, parity, and civil status were considered except for the temperature on the civil status. This study proved that spiritual care, aromatherapy, and its combination can lower fear level, reduce pain intensity, and minimally decrease the heart rate and systolic blood pressure on women in labor.

Keywords: standard precautions, infection control, student nurses, hand washing.

HS – 18

A SYSTEMATIC REVIEW OF HEALTH INFORMATION EXCHANGE IMPLEMENTATIONS IN DIFFERENT PRACTICE SETTINGS

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Health information exchange (HIE) facilitates secure access and electronic transfer of patient data across boundaries of the health system. In this review, we explore the landscape of health information exchange implementation in different practice settings, identifying HIE implementation models, their common features and limitations. A systematic literature search on HIE implementation from 2000 to 2018 was conducted in four databases (COCHRANE, EBSCO, ProQuest and Pubmed) following the PRISMA guidelines. Publications which passed the inclusion/exclusion criteria for selection were abstracted. Thematic analysis was done by identifying commonalities and patterns. A total of 4,748 articles were found on the topic, of which, 267 full-text articles were eligible for final review. Most HIE implementations documented are from developed countries (96%) with the majority executed in the United States (75%). HIEs in developed countries are often scaled to statewide implementation, using hybrid architecture, and practiced in ambulatory and emergency care settings. In contrast, HIE in developing countries are usually in their pilot stage or implemented locally. In both developed and developing countries, HIE is implemented for public health surveillance, clinical decision support and insurance claims reimbursements. Facilitating factors for sustained HIE adoption include government and organization support, cost savings, presence of IT governance structures, and operational efficiencies. Challenges remain in terms of data privacy protection, alignment with complex clinical workflows, use of system architecture and standards as well as technical support services. Evidence from literature suggests that HIE is a strategic opportunity for a more cost-effective, high quality and well-coordinated healthcare system. Developing countries have yet to scale HIE to maximize its purported benefits.

Keywords: HIE, health information exchange, interoperability

HS – 19

SCREENING, CHARACTERIZATION, AND EVALUATION OF CHOLINERGIC ACTIVITIES FROM PHILIPPINE *Theraphosidae* SPIDER VENOM

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Cholinergic hypofunction via acetylcholinesterase (AChE) activity alterations is essential for Alzheimer's disease (AD) progression. Thus, this prompts the study to explore the AChE inhibitory effects of Philippine *Theraphosidae* spider venom peptides for cholinergic studies. The crude venom was fractionated by C18 RP-HPLC which was monitored at 215 and 280 nm followed by BCA assay. Then, modified Ellman method was conducted *in vitro* on crude and fractionated venom followed by exploration of putative inhibition sites of AChE *in silico* and evaluation of cholinergic impact *in vivo* using *Zophobas morio* larvae. Results showed that 16 venom peptide fractions were collected as validated by UV and BCA assay. Eleven out of 16 fractions exhibited anti-AChE activities *in vitro* with F1, F3 and F16 exhibiting the highest inhibitory activities in comparison with crude venom, donepezil (400 µg/mL) and untreated AChE reaction (n=3) (p=9006). Furthermore, competitive inhibition was observed on crude venom, donepezil, and F3 while F1 and F16 displayed uncompetitive inhibitions (n=3) (p= 0.008) which were supported *in silico*. Finally, downward trend in locomotion *in vivo* was observed on the same samples which manifested cholinergic impact (n=3). The results indicate that Philippine *Theraphosidae* spider venom peptides may have potential therapeutic leads for AD studies.

Keywords: spider venom, acetylcholinesterase, Alzheimer's disease, cholinergic, *Theraphosidae*

HS – 20

PREPARATION OF SYNTHETIC PEPTIDES FROM DENGUE VIRUS NON-STRUCTURAL GLYCOPROTEIN 1 (NS1)

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Peptides are amino acid polymers that share the same chemical structure with proteins, therefore, it is possible for peptides to substitute for proteins as a biological recognition element. Recently, molecular imprinting technology has been used in the development of artificial biosensors using peptides or epitopes with specific sequences as template molecules that can provide high selectivity towards a targeted analyte. In this study, potential epitopes for the development of molecularly imprinted polymer (MIP) dengue sensors have been synthesized. The peptides were synthesized using Fmoc solid-phase peptide synthesis (SPPS) method. Lyophilized crude peptides were subjected to reverse-phase high pressure liquid chromatography (RP-HPLC) for purification and characterized using mass spectrometry and circular dichroism spectrometry (CD-ORD). Peptides screened from dengue virus NS1 protein with sequences (1) Ac-EVEDYGFG-NH₂, (2) Ac-KYSWKTWGKAK-NH₂, (3) Ac-VHTWTEQYKFQ-NH₂, and (4) Ac-TRLENLMWK-NH₂ were successfully synthesized, purified and characterized.

Keywords: Peptide Synthesis, Dengue Virus NS1, epitope

HS – 21

MICROSCOPIC IDENTIFICATION OF PARASITES ON BIOSOLIDS IN DIFFERENT FLOOD-PRONE AREAS IN CALOOCAN

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Parasitic contamination could bring danger or benefits to the living organisms in the environment. This study identified the parasites which could be found in biosolids or sewage sludge in different flood-prone barangays in Caloocan, and the factors contributing to the contamination of it in sludges. This will help people to be more aware of the risks and diseases brought by the biosolids and to prevent and improve the sanitation of the community. One sewage sludge sample each from four barangays was collected and each sample was divided to make four replicates. Through Formalin-Ether Concentration Technique, the researchers were able to observe the parasites which could be seen in sludges with the help of LCD and compound microscope. The parasites found were the eggs of *Trichuris trichiura*, *Ascaris lumbricoides* (helminths), and *Entamoeba histolytica* (amoeba); other suspected ecological protists and some artifacts were also seen. Human or animal wastes, debris, run-off water, and floods are the possible factors that contributed parasites in the environment.

Keywords: sludges, biosolids, parasites, Caloocan

HS – 22

FORMULATION AND EVALUATION OF VORICONAZOLE-NLC *IN SITU* GEL FOR FUNGAL KERATITIS

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Fungal keratitis is an infective process of the cornea which can lead to blindness. A topical voriconazole (VCZ)-loaded nanostructured lipid carrier (NLC) in *in situ* gel can improve treatment outcome. Melt emulsification and high-pressure homogenization was employed in the production of the VCZ-NLC. The VCZ-NLC was immediately cooled and incorporated with a mixture of poloxamers 407 and 188. The formulation was subjected to 90-day stability test at $40 \pm 2^\circ\text{C}$ and $25 \pm 2^\circ\text{C}$ with $75 \pm 5\%$ and $60 \pm 5\%$ of relative humidity, respectively, in triplicate and tested for physicochemical properties monthly. Voriconazole was found to be compatible with the ophthalmic solution excipients. The VCZ-NLC had size of $130.87 \text{ nm} \pm 1.9137$, PDI of 0.2813 ± 0.0058 , and zeta potential of $0.3441 \text{ mV} \pm 0.1353$. The VCZ-NLC had high encapsulation efficiency of $90.22 \pm 3.33\%$ and loading capacity of $1.70 \pm 0.10\%$. The VCZ-NLC *in situ* gel had a sol-gel transition of $32.17\text{C} \pm 0.85$ at less than 6 s. Percent recovery of VCZ in the final product was $94\% \pm 3.19$. The pH and osmolality were within the ocular tolerance limit. Antifungal activity was comparable to the voriconazole solution. Drug release was inconsistent in all of the batches. *Ex vivo* transcorneal permeation test revealed that only small amount of the drug crossed the cornea. Stability test showed that the formulation was not suitable to be stored in 40°C and 25°C , therefore, colder storage is recommended.

Keywords: nanostructured lipid carriers, voriconazole, poloxamer, fungal keratitis

HS – 23

**ALPHA-AMYLASE INHIBITORY AND IN-VITRO
GLUCOSE-LOWERING PROPERTY OF
Clausena anisum-olens (Rutaceae)**

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Diabetes mellitus is considered as one of the leading causes of morbidity and mortality worldwide. Several commercially available drugs are currently used to regulate blood glucose level. However, there are various undesirable effects associated with the use of these drugs. Among the endemic plants in the Philippines with possible medicinal properties is *Clausena anisum-olens*, more commonly known as Kayumanis of the family Rutaceae. This study will serve as a preliminary work in determining the possible role of the plant in the management of diabetes by inhibiting glucose absorption and lowering glucose levels. Phytochemical screening was performed using thin layer chromatography (TLC) followed by determination of total flavonoid content. The glucose uptake by yeast cell method was performed to determine the effect of *Clausena anisum-olens* on glucose level. Moreover, the alpha-amylase inhibition assay was done using commercially available kits. phytochemical screening revealed the presence of flavonoids. The quercetin equivalence (QE) per gram of sample was found to be 18.3 mg. The results showed that the crude ethanolic extract of *Clausena anisum-olens* in different concentrations (100 mg, 300 mg and 500 mg) promoted glucose uptake superior than the control, metronidazole. The crude ethanolic extract also exhibited an alpha-amylase inhibiting activity. The 75-mg concentration of the extract produced a 54.10% inhibition comparable to the standard drug Acarbose. The results strongly suggest that *Clausena anisum-olens* is a potential glucose-lowering agent due its ability to increase the velocity of glucose uptake in the cell as well as inhibiting the enzyme alpha-amylase. This is the first study that determined the effects of the endemic plant *Clausena anisum-olens* on glucose uptake and its inhibitory effect on alpha-amylase.

Keywords: *Clausena anisum-olens*, hypoglycemic, Diabetes mellitus, glucose uptake, alpha-amylase inhibition

HS – 24

**DETERMINATION OF THE NEPHROPROTECTIVE
EFFECT OF THE ETHANOLIC EXTRACT FROM *Carica
papaya* (Caricaceae) LEAVES AGAINST GENTAMICIN-
INDUCED NEPHROTOXICITY IN
SPRAGUE-DAWLEY RATS**

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Studies suggest that *Carica papaya* (Caricaceae) has various biological activities such as antioxidant activity, diuretic, and anti-malarial. In addition, the antioxidant activity of plants is strongly correlated to nephroprotective property. This is the first investigation of the nephroprotective potential of the ethanolic extract from *C. papaya* leaves. Acute toxicity test was done to determine the approximate lethal dose of the extract. To determine this pharmacologic activity, the ethanolic extract at concentrations, 250 mg/kg, 500 mg/kg, and 1000 mg/kg body weight was given orally to different groups of Sprague-Dawley rats with Gentamicin-induced nephrotoxicity and compared to no treatment, the negative and positive control (Vitamin E) groups. Blood samples were collected before and after the treatment for the analysis of renal function markers namely: BUN (blood urea nitrogen) and creatinine levels. The investigation revealed that the approximate lethal dose of the extract is greater than 2000 mg/kg. At 1000 mg/kg dose, the change in serum creatinine and BUN levels are comparable with the positive control group (p-value: >0.005) which suggest that the 1000 mg/kg of the ethanolic leaf extract is the most effective dose in reducing gentamicin-induced nephrotoxicity in sprague-dawley rats. The ethanolic extract of *C. papaya* leaves is not toxic and has nephroprotective property in Gentamicin-induced nephrotoxicity.

Keywords: Nephrotoxicity, Gentamicin, *C. papaya*, antioxidant

HS – 25

**LIPOXYGENASE ENZYME INHIBITION, ANTI-
INFLAMMATORY AND ANALGESIC PROPERTIES OF
THE LEAF EXTRACTS OF *Syzygium lineatum*
(PHILIPPINE CHERRY)**

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Inflammation is a response of the immune system to harmful stimuli, including pathogens, irritants, and damaged cells. Lipoxygenase (LOX) is an enzyme which catalyzes oxidation reactions and plays a major role in the regulation of inflammation. The main purpose of the study is to determine the LOX inhibitory activity and the anti-inflammatory and analgesic potentials of the leaf extracts of *S. lineatum*, an endemic plant in the Philippines. The dried leaves of *S. lineatum* were percolated then subjected to solvent partitioning and phytochemical testing. The obtained leaf extracts underwent LOX inhibitory assay and in vivo testing for the determination of its approximate lethal dose, analgesic and anti-inflammatory activities. Fifty-five (55) female Sprague-Dawley rats were randomly selected and were assigned to five (5) different groups. The butanol sub-extract was found to be the most potent having an IC₅₀ of 4.09 µg/mL. The doses of *S. lineatum* butanol extract (250 and 500 mg/kg BW) were found to have the same analgesic effect as the positive control ($p > 0.05$) while the dose of 250 mg/kg BW exhibited anti-inflammatory activity comparable to that of diclofenac ($p > 0.05$). In conclusion, the study provides sufficient evidence showing that the butanol leaf sub-extract of *S. lineatum* possesses 15-LOX inhibitory activity and exhibited both analgesic and anti-inflammatory activities.

Keywords: analgesic, inflammation, lipoxygenase, *Syzygium lineatum*

HS – 26

**BIOACTIVE COMPONENTS, CYTOTOXICITY STUDIES
AND PHARMACOGNOSTIC EVALUATION OF THE
CRUDE DRUG FROM *Broussonetia luzonica* (Moraceae)
BLANCO LEAVES**

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For standardization, plants undergo pharmacognostic evaluation, phytochemical analysis and toxicity studies before they are developed into drugs. This is the first report on the pharmacognostic evaluation of *B. luzonica* leaves, their anatomical sections, determining their macro- and microscopic features as well as quantitative analysis of the crude drug for their chemical characteristics. Three different extracts of *B. luzonica* were obtained by sequential extraction using solvents of increasing polarity namely n-hexane, ethyl acetate and methanol. The extracts were subjected to gas chromatography-mass spectroscopy (GC-MS) analysis to determine the possible bioactive compounds. Cytotoxicity against normal fibroblasts compared to a standard chemotherapeutic agent using MTT (3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium bromide) assay was determined. Microscopy of the cross section of lamina revealed presence of rosette, prismatic and cystolith crystals. Analysis of the powder revealed 15.55% total ash, 1.9% acid insoluble ash, 2.5% alcohol soluble extractive and 5% water soluble extractive. GC-MS confirmed the presence of lupeol, squalene, γ sitosterol, tetracosane, tricontane, phytol, and propanetriol-monoacetate. MTT assay revealed that the three extracts did not exhibit cytotoxicity against normal cell lines compared to Doxorubicin. The study established the pharmacognostic profile of the leaves of the plant and revealed no cytotoxic effects of the *B. luzonica* leaf extracts on normal cell lines.

Keywords: *Broussonetia luzonica* Blanco (Moraceae), cytotoxicity, pharmacognostic evaluation, Gas chromatography-Mass Spectroscopy

HS – 27

**STANDARDIZATION OF *Tinospora rumphii*
(Menispermaceae) STEM EXTRACTS THROUGH HPLC
ASSAY OF BERBERINE AND LOX-15
STIMULATORY ACTIVITY**

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Tinospora rumphii is known to have anti-inflammatory activity due to the active secondary metabolites like alkaloids, specifically berberine. This study aims to determine the amount of berberine in the *Tinospora* stem extracts and the potential activity against 15-lipoxygenase. The *Tinospora* powdered stems were subjected to exhaustive percolation and rotary evaporation. The dried ethanolic extract was then subjected to solvent partitioning using solvents of increasing polarity namely hexane, ethyl acetate, and methanol. The collected sub-extracts were tested for the presence of tannins in which the hexane and methanol sub-extracts turned positive and were detannified. The subextracts were assayed for berberine content and Lipoxygenase (LOX) inhibitory activity using High-Performance Liquid Chromatography (HPLC) and LOX-15 inhibitory assay kit respectively. The assay showed that the ethyl acetate extract exhibited a SC50 of 84.14 µg/mL on 15-LOX and is the most potent among the extracts tested. HPLC assay proved the presence of berberine in all extracts at different concentrations.

Keywords: berberine, LOX, *Tinospora*

HS – 28

APPLICATION OF ELECTROPOLYMERIZED CONDUCTING POLYMER AS SENSOR OF DENGUE BIOMARKER

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Dengue fever and dengue hemorrhagic fever are leading causes of child mortality in the Philippines. The lack of early diagnosis has led some people to mistaken the symptoms of dengue fever to common colds. In this study, the potential of a molecularly imprinted electropolymerized polymer (MIP) as an early detection tool has been explored. It took advantage of the fact that at the onset of fever, the concentration of the dengue biomarker, nonstructural protein 1 (NS1), is at its highest; making it an ideal template for biosensors. We utilized the epitope-imprinting strategy which made use of a small and exposed section of the protein instead of whole protein as templates. Using synthesized epitope of NS1, we fabricated electropolymerized molecularly imprinted polyethylenedioxythiophene/polystyrene sulfonate polymers. Surface characterization techniques were done by atomic force microscopy (AFM) and Raman spectroscopy. Calibration and detection of DENV NS1 was done by electrochemical means. A linear relationship between the DENV2 NS1 concentration in buffer and the electrochemical signals was obtained, which ranges from 1 $\mu\text{g/mL}$ to 20 $\mu\text{g/mL}$. The fabricated dengue MIP sensor was also found to be selective towards DENV2 NS1 protein compared to the non-imprinted polymer with an imprinting factor of 3, making the system a potential biosensor for dengue infections.

Keywords: Dengue, molecularly imprinted polymer, sensor

HS – 29

EFFICIENCY ASSESSMENT AND EFFECTS OF BUTUAN CITY'S SANITARY LANDFILL AND ITS LEACHATE TREATMENT EFFLUENT

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The study determined the effluent quality of the leachate treatment facility of the Sanitary Landfill of Barangay Dumalagan, City of Butuan in reference to RA 9275 otherwise known as Philippine Clean Water Act and the adequacy of the Sanitary Landfill in reference to RA 9003. It aimed to evaluate the effect of effluent quality to the receiving body of water (stream) in accordance with water quality standard, to evaluate the effects of sanitary landfill to environment including the populace of Barangay Dumalagan and to make recommendations based on laboratory tests and physical observations. Water samples were collected in three (3) different sampling sites along the Dumalagan stream where the effluent water from the landfill is drained and two (2) sampling points with the landfill, the Leachate Pond 1 and Leachate Pond 2. Each sampling point is approximately 500 meters away from each other. Standards used included DENR DAO 34 s. 1990 (DAO 90-34), DENR DAO 35 s.1990 (DAO 90-35), and DENR DAO 16 s. 2016 which conform with the water and sanitation standards in the Philippines. Laboratory tests of sampled water included: Potential Hydrogen (pH), Color, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Total Coliform Count. The levels of pH, colour, Total Dissolved Solids (TDS), and Total Suspended Solids (TSS) from all sampling stations were found to be within the standards set in DENR DAO 34 and 35. However, water samples from sampling station 4-1 (Leachate Pond) exceeded the TSS levels for class D as per DAO 90-34. TDS also exceeded the class D standard as per DAO 90-35.

Keywords: landfill, water sanitation treatment facility

**MATHEMATICAL AND
PHYSICAL SCIENCES**

MPS – 01

OPTIMIZATION AND CHARACTERIZATION OF ACTIVATED CARBON FROM CACAO PODS

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Most commercial activated carbon products are expensive. Thus, extensive researches on the production of low-cost, more effective and environment-friendly activated carbon that is equivalent to those commercially available have been conducted. Cacao pods are a possible source of activated carbon. Thus, this study was conducted to produce activated carbon from cacao pods and to evaluate its efficiency and effectiveness as an adsorbent for treatment of industrial wastewater. This study aimed to determine the percent Cr (VI) removal efficiencies of the cacao pods activated carbon (CP-AC) prepared at varying concentration of H_3PO_4 , activation temperature and holding time. Response surface method (RSM) using a central composite design (CCD) of experiment was utilized to determine the optimum activation conditions. Characterization of the functional groups present in the optimized CP-AC and its surface morphology were determined using Fourier transform-infrared spectroscopy, Boehm titration, Scanning electron microscopy and Brunauer-Emmett-Teller analysis. The optimum activation condition for the production of CP-AC were established at 37.56% H_3PO_4 , 799.87 °C and 88 minutes, resulting in 88% removal efficiency from 50 ppm Cr (VI) solutions. The optimized CP-AC contained a well-developed pore structure, and a high surface area of 212.343 m^2/g and pore volume of 0.036 cm^3/g . The pore diameter was determined to be 3.861 nm and a particle size of 300 μm , indicating that the sample was in the mesopore region. The surface and pore characteristics of CP-AC and coconut husk activated carbon (CH-AC) prepared in a previous study were compared. The optimized CP-AC was found to have a larger surface area and wider pores than CH-AC.

Keywords: Activated carbon, cacao pods, central composite design, chromium (VI), response surface methodology

MPS – 02

INVESTIGATION OF RICE BRAN PROTEIN AS ADJUNCT IN THE PREPARATION OF β -CAROTENE COACERVATE

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β -carotene (BC), a vitamin A precursor, is widely distributed among fruits and vegetables but has low bioavailability and stability. As such, encapsulation methods for BC may be employed. Rice bran protein (RBP) has good emulsifying capacity, regarded as hypoallergenic, and was reported to be beneficial to health. This study aimed to encapsulate BC in gum arabic and gelatin by complex coacervation using RBP (crude protein \approx 65%) as an adjunct for rice fortification. BC coacervate was produced by complex coacervation followed by freeze-drying. Powder characterization and determination of *in vitro* release properties were performed. Encapsulation efficiency and yield were 92% and 91%, respectively. Moisture content and water activity were 7.35% and 0.43, respectively, indicative of maximum stability. DPPH radical scavenging activity was 60% at 10 mg/mL. SEM, DSC, and FTIR suggested successful encapsulation. Product storage stability was tested under different conditions (26, 37, 55 °C and to light exposure). All conditions are significantly different from one another. BC degradation rate was observed to follow the order: light exposure ($t_{1/2}$ =3.52 weeks) < 26°C ($t_{1/2}$ =3.07 weeks) < 37°C ($t_{1/2}$ =1.49 weeks) < 55°C ($t_{1/2}$ =1.27 weeks). Higher BC release was observed in the gastric phase (15-30%) than in the intestinal phase (5-14%). BC release was lowest when the product was added to rice before cooking (5%) and highest without rice (14%). Based on BC release properties, 0.31 g of the product should be added to cooked rice to follow common fortification levels. The inclusion of RBP had been beneficial since an oil component was no longer necessary in the formulation which can be attributed to the emulsifying property of RBP.

Keywords: beta-carotene, coacervation, encapsulation, rice bran protein

MPS – 03

OPTIMIZATION AND PERFORMANCE EVALUATION OF A SYMMETRIC DIRECT ETHANOL FUEL CELL BASED ON PtCo/C ELECTROCATALYST

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Fuel cells are promising alternative sources of energy with research efforts geared towards low-loading Pt electrocatalysts. In this study, the performance of PtCo/C electrocatalysts was evaluated towards ethanol (EtOH) oxidation (anode) and oxygen reduction reactions (ORR) (cathode) as symmetric electrocatalysts (i.e., those that utilize the same material for anode and cathode) for direct ethanol fuel cells (DEFC). The performance was compared to commercial Pt/C (Premetek™), both for half-cell (using cyclic voltammetry, chronoamperometry, and rotating disk electrode voltammetry) and full-cell (single-stack fuel cell testing) configurations. As anode, the PtCo/C electrocatalyst performed significantly better than Pt/C, with current density of 17.82 mA/cm² for the former versus 14.57 mA/cm² for the latter (at 2.75 M EtOH in 0.5 M H₂SO₄). As cathode, PtCo/C electrocatalyst gave greater ORR activity (in O₂-saturated 0.5 M H₂SO₄) with current density of 2.04 mA/cm² as compared to that for Pt/C (0.67 mA/cm²). Furthermore, the ORR for both PtCo/C and Pt/C were shown to proceed via the desired four-electron route. However, chronoamperometry revealed that Pt/C as cathode electrocatalyst has greater electrochemical stability (7.87% current loss vs. 28.49%) and EtOH tolerance (4.77% current loss vs. 13.39%) than PtCo/C. Co is known to enhance the activity of Pt towards EtOH electrooxidation via the bifunctional mechanism, which in turn reduces the ethanol tolerance of PtCo/C during ORR. Full-cell testing showed that PtCo/C-based symmetric DEFC exhibited higher open circuit potential (0.31 V) and power density (1.33 mW/cm²) compared to one based on Pt/C (0.26 V, 0.93 mW/cm²). These results suggest that PtCo/C could be a cheaper alternative to Pt/C in symmetric DEFC systems, a step which could lead to the economical production and commercialization of DEFCs.

Keywords: symmetric direct ethanol fuel cell, PtCo/C, Premetek

MPS – 04

FRACTIONATION OF RICE BRAN (*Oryza sativa*) VA-286 VARIETY USING SUPERCRITICAL CARBON DIOXIDE (SC-CO₂)

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Oryza sativa, VA-286 is a common rice variety in Caraga Region, Philippines, from which rice bran is obtained. The rice bran is usually used as a fuel for agricultural factories in this region. This study conducted fractionation using supercritical carbon dioxide and fatty acid profiling as the first data for this variety. Different oil extracts under three different parameters were obtained, 10 megapascal (MPa), 20 megapascal (MPa), and 30 megapascal (MPa) at constant temperature of 40° Celsius. The highest oil yield was obtained at 20 MPa with an average of 2.98% followed by 30 MPa at 2.49%, and 10 MPa at 2.24%, from all extracts done in triplicates. Oil sample (10 MPa) was subjected to gas chromatography-mass spectrometry (GC-MS) analysis. Five compounds were obtained with Y-oryzanol and campesterol as the major compounds. For fatty acid profiling 20 MPa and 30 MPa samples were subjected to gas chromatography (GC) at DOST-ITDI and were compared. Nine fatty acids were observed with oleic (C18:1) as highest (w/w) for both 20 MPa and 30 MPa extracts. Both essential fatty acids linoleic (C18:2) and linolenic (C18:3) were found in the 20 and 30 MPa extracts. This study shows that this technique of fractionation using supercritical carbon dioxide can provide valuable products from rice bran aside from its use as fuel, which can boost the local coconut industry.

Keywords: rice bran, VA-286, supercritical carbon dioxide, fatty acid, gas chromatography, mass spectrometry

MPS – 05

CATALYTIC ASYMMETRIC DEAROMATIZATIONS OF FURAN AND BENZENE AS KEY ROUTES FOR THE ENANTIOSELECTIVE SYNTHESIS OF LIGNANS AND GEISSMAN-WAISS LACTONES

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Forwarding efforts to create new chemical entities is one of the most appealing facet of synthetic organic chemistry. It is also the corner stone why the advancement of chemistry is relevant for the sustainable development of human society. In this study, the emerging catalytic asymmetric dearomatization was utilized to streamline the enantioselective total synthesis of biologically active enterolactones and important synthetic intermediate such as the Geissman-Waiss lactone. Asymmetric cyclopropanation of furans and two step asymmetric desymmetrization of benzene-derived epoxide afforded the key enantiomeric intermediates in modest yields and good to excellent enantioselectivity after iterative crystallizations. Further transformations of the chiral intermediates furnished the enterolactones, (7'R)-hydroxyenterolactone and (7'R)-parabenzlactone with modest overall yields and high enantioinduction. Our developed methodologies thus feature a practical, short approach for the enantioselective synthesis of important synthetic intermediates and bioactive entities.

Keywords: Asymmetric dearomatization, total synthesis, enantioselective, enterolactone, Geissman-Waiss lactone.

MPS – 06

ANTIOXIDANT CAPACITY OF SOLUBLE PROTEINS AND THEIR PEPTIC HYDROLYSATES EXTRACTED FROM RAW AND COOKED COMMERCIALY AVAILABLE OATMEAL

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Functional foods have become increasingly popular in recent dietary trends as they serve as an alternative to modern medicine such as their capability to serve as antioxidants. Proteins and their hydrolysates have potentials as antioxidants. Soluble proteins were extracted using saline extractant from raw and cooked commercially available oatmeal and hydrolyzed using pepsin for 4 hours in partially simulated gastric environment (Acidic condition). Cooked oatmeal yielded higher protein content (0.7 mg/mL) in the crude extracts than raw oatmeal (0.5 mg/mL) but had comparable protein contents in the crude protein (0.1 mg/mL for cooked vs 0.2 mg/mL for raw) using the Bradford assay. SDS-PAGE profile of the extracted proteins showed faint bands at 22-24 KDa and darker bands at 54-56 KDa indicating that there were two major proteins extracted. The proteins and corresponding hydrolysates were tested for their antioxidant capacity by 2,2-diphenyl-1-picrylhydrazyl (DPPH) and potassium ferricyanide reducing ability of plasma (PFRAP) assays. Antioxidant capacities were expressed as radical scavenging activity (RSA) and ferric reducing ability (FRA). The hydrolysates showed higher RSA (64.6% to 89.5%) than unhydrolyzed proteins (3.4% to 3.6%). A different trend was observed for FRA which yielded 31.8-48.2% FRA for unhydrolyzed proteins, significantly higher than their corresponding hydrolysates (5.3-9.3%). In summary, intact proteins may exhibit greater FRA while their hydrolysates exhibit greater RSA.

Keywords: antioxidant capacity, oatmeal, peptic hydrolysates, protein SDS-PAGE profile, soluble proteins

MPS – 07

COMPARATIVE SURFACE CHARACTERIZATION OF BARE ZINC OXIDE VERSUS POLY(ACRYLIC ACID)-ENCAPSULATED ZINC OXIDE NANOPARTICLES SYNTHESIZED THROUGH SOL-GEL TECHNIQUE

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Zinc oxide nanoparticles (ZnO NPs) have various uses in multiple industries. However, a major drawback is their tendency to agglomerate in aqueous environments which results in the loss of many desirable properties. Polymers can be used to encapsulate ZnO NPs and stabilize them through steric repulsion. In this study, ZnO NPs were prepared using a sol-gel synthesis technique using zinc acetate and sodium hydroxide as precursors. Poly(acrylic acid sodium salt) was added to the solution under UV radiation to encapsulate the ZnO NPs. The samples were characterized using zeta potentiometry, dynamic light scattering (DLS), UV-visible spectroscopy, powder X-ray diffraction (XRD), atomic force microscopy (AFM), and scanning electron microscopy (SEM). The PAA-coated NPs were found to have higher zeta potential values and were more stable in solution. DLS measurements showed that the particle sizes were 3300 nm and 87 nm for the bare and coated ZnO NPs respectively. UV-vis spectroscopy determined the band gap of the encapsulated ZnO NPs was lower than that of the bare ZnO. The diffraction pattern obtained through powder XRD analysis confirmed that the desired hexagonal wurtzite form of zinc oxide was synthesized. AFM showed that the PAA-coated particles possessed a larger surface area and increased roughness as compared to the bare ZnO. SEM imaging showed the agglomeration of bare ZnO particles and coated disc-shaped nanostructures which confirmed the formation of PAA-encapsulated particles. Thus, ZnO NPs were successfully synthesized and stabilized in an aqueous environment through encapsulation in PAA.

Keywords: zinc oxide, polymer encapsulation, nanoparticles, sol-gel synthesis

MPS – 08

EFFECT OF THE CHAIN TRANSFER AGENT ON THE RAFT POLYMERIZATION OF DI(ETHYLENE GLYCOL) METHYL ETHER METHACRYLATE IN HEXAFLUOROPHOSPHATE-CONTAINING IONIC LIQUIDS

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Room temperature ionic liquids (RTILs) continue to be utilized as green, alternative solvents due to their promising properties – negligible vapor pressure, high thermal and chemical stability, and customizability. Recently, these RTILs have been applied in free-radical polymerization techniques such as Reversible-Addition Fragmentation Chain Transfer (RAFT) polymerization. Currently, the literature remains to be sparse and are directed on how the RTILs affect the polymerization process. In this light, we studied the effect of varying the chain transfer agent (CTA) in the RAFT polymerization of DEGMEMA in a series of 1-alkyl-3-methylimidazolium hexafluorophosphate [RMIM]PF₆ ionic liquids. In all RTILs, P(DEGMEMA) polymers were synthesized using two RAFT agents – 4-cyano-4-(phenylcarbonothioylthio)pentanoic acid (CPAD) and 2-cyano-2-propylbenzodithioate (CPDB) – and structurally characterized using FT-IR and ¹H-NMR spectroscopy. Data from gel permeation chromatography (GPC) have shown that the final polydispersity indices (PDI) are near unity, a consequence of the control provided by the RAFT polymerization technique. Experimental reaction rates generally increased with increasing size of the ionic liquid solvent. A significant effect of the CTA was observed in the PDI changes during the polymerization. Using CPAD, PDI values were observed to increase with reaction time. On the other hand, a decreasing PDI trend resulted when using CPDB. These findings indicate that CPDB offered better control over the polymerization than CPAD.

Keywords: RAFT polymerization; room temperature ionic liquids; DEGMEMA; chain transfer agent

MPS – 09

HYDROGENATION OF ESTERS USING A NON-PINCER IRIIDIUM CATALYST

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The reduction of ester to alcohol is an industrially important process, eg for the manufacture of flavors and fragrances. Catalytic hydrogenation presents a more atom-efficient reduction, which has been typically done through the use of heterogeneous copper chromite catalysts, under harsh conditions of very high temperature (> 200 °C) and pressure (100-200 bars); generally resulting to poor substrate scope and functional group tolerance. Homogeneous catalysts, on the other hand, can be usually done at milder conditions of temperature and pressure, providing better selectivity of the reaction.

Here we report the hydrogenation of esters using a convenient iridium catalyst with a robust and readily available non-pincer ligand phenanthroline (phen). The preparation of the reaction mixture involved preforming the catalyst by mixing tetrahydrofuran (THF) solutions of the Ir(I) salt and the ligand substituted-phenanthroline, followed by addition of the substrate solution in THF. The reaction conversion and yield were determined by GCMS, using dodecane as internal standard. By simply using the preformed iridium catalyst [Ir(cyclooctene)₂Cl₂-2,9-dimethoxyphen], in the presence of 50 bar H₂ at 100°C, good to excellent yields (70-100%) of alcohols were derived after 16 h of reaction. The catalytic system was also found to be amenable to a wide array of ester substrates, although trans-esterifications were also observed in some cases. Alkyl hexanoates and activated methyl benzoates were converted almost quantitatively. Five-membered lactones are converted in 80-85% yields. Diesters and unsaturated esters prove to be difficult substrates to reduce giving no alcohol products or just reduction of the alkene group.

Keywords: catalytic hydrogenation, iridium non-pincer catalyst, ester, alcohol

MPS – 10

COMPUTATIONAL STUDIES ON THE ENHANCEMENT OF THERMOSTABILITY AND ACTIVITY OF YAON SUCROSE: SUCROSE 1-FRUCTOSYLTRANSFERASE

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Fructans in Yacon (*Smallanthus sonchifolius*) are synthesized by two enzymes - sucrose: sucrose 1-fructosyltransferase (1-SST, EC 2.4.1.99) and fructan: fructan 1-fructosyltransferase (1-FFT, EC 2.4.1.100). The initial fructosyl transfer between two sucrose molecules is catalyzed by the enzyme sucrose: sucrose 1-fructosyltransferase (1-SST) and the subsequent chain elongation is catalyzed by other types of fructosyltransferases such as 1-FFT, 6G-FFT and 6-SFT. The computational study presented here aims to determine mutations, generated by introducing single and double two-point cysteines, that would improve the stability and activity of Yacon 1-SST. Both wild type and mutant 1-SST in water systems were subjected to Martini Coarse-grained Molecular Dynamics (CGMD) simulations and biophysical analyses. Moreover, molecular docking was exploited to further determine the activity of these mutants towards sucrose. Our results showed that the twelve single-disulfide mutants (A2C-P488C, T9C-P10C, S44C-T553C, T49C-V53C, A367C-P371C, A418C-A424C, S438C-L624C, A470C-A618C, A489C-S493C, C490C-C538C, C490C-C538C) have enhanced activities and thermostabilities relative to the wild type. The highest melting temperature achieved was 64°C on mutation S438C-L624C located at the non-catalytic domain while the highest activity improvement is on mutation A367C-P371C located on the loops between the catalytic and non-catalytic domain. Furthermore, on the additional double-disulfide mutations, thermostability enhancement was observed for mutants A367C-P371C/S438C-L624C, A470C-A618C/C490C-C538C, and C490C-C538C/A418C-A424C but with compromised activity as compared to their respective single-disulfide parent mutants. results suggest that the disulfide bridge in specific domains of Yacon 1-SST is a valuable strategy to tailor-design the thermostability and activity of this enzyme.

Keywords: yacon, disulfide bridge, 1-sst, thermostability, cgmd

MPS – 11

FACILE PREPARATION OF A POLYSACCHARIDE-BASED SELF-HEALING COMPOSITE MATERIAL

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Conventional hydrogels based on polysaccharides are low-cost, biocompatible, biodegradable, and have great potentials in industrial and biomedical applications. This work discusses self-healing capability for a hydrogel composite system made from ubiquitously abundant biopolymers, chitosan (CS) and oxidized xanthan gum (OXG) filled with modified magnetic nanoparticles (MNP). Crosslinking between CS and OXG provided through Schiff base linkages results in a self-healing material. Films from various ratios of MNP, OXG and CS were prepared and characterized. It was found that the weight ratio of 1:1 per weight of the CS and OXG achieved a good balance between the self-healing capability and the mechanical strength of the resulting material. At a weight ratio of 1:1.5 (CS-OXG) results in a less viscous gel compared to the other gels, linked to the reduction (lower OXG content). Most importantly, the CS-OXG-MNP hydrogel with a weight ratio of 1:1:0.2 exhibited the most efficient self-healing ability. Furthermore, CS-XG gels were also prepared for comparison. These gels did not exhibit any self-healing capabilities.

Keywords: self-healing, hydrogel, chitosan, composite material

MPS – 12

SPATIOTEMPORAL MODELLING OF PARASITE AGGREGATION IN LENTIC ECOSYSTEM

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Parasite aggregation is a commonly occurring phenomenon where majority of the parasites accumulate in the smaller fraction of the host population while many individual hosts have low parasite load. The goal of the study is to develop and analyze a spatiotemporal model to explain the possible mechanisms of parasite aggregation. Using Netlogo, we constructed an agent-based simulation involving fish hosts foraging in zooplanktons harboring macroparasites in a lentic ecosystem. Effects of factors such as population density, reproduction of hosts, infection and treatment area sizes, and clustering of source of infection are incorporated and analyzed in our model. Our simulations showed that (i) the initial size of the population of both the fish and zooplanktons have minimal effect on the aggregation of parasites; (ii) increasing the probability of reproduction of both fish and zooplankton leads to parasite aggregation in fish; and (iii) aggregation occurs either by decreasing the size of the infection area or increasing the size of the treatment area in the lentic ecosystem.

Keywords: parasite aggregation, spatiotemporal, agent-based model, negative binomial distribution, parasitism

MPS – 13

MECHANISTIC MODEL OF MACROPARASITE ACCUMULATION IN HOSTS LEADING TO AGGREGATION

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Parasite aggregation is considered one of the “laws” in parasite ecology because it is a recurring pattern in macroparasite infections. Some factors, such as heterogeneous exposures, infection rates and susceptibility of host individuals, are observed to produce aggregated distributions of parasites. This pattern has been widely studied using phenomenological models, such as by using the negative binomial distribution. However, if we desire to infer the mechanisms of aggregation, a mechanistic model is essential. Here we formulate a mechanistic model of aggregation based on parasite accumulation in hosts without initially assuming a negative binomial distribution. Our results show that a homogeneous pattern of parasite accumulation still arrives at an aggregated pattern as shown by the derived mean and variance of the parasite distribution. By incorporating the derived mean and variance to the host-parasite interaction, we can predict how aggregation affects the population dynamics of the hosts and parasites through time. Our model design can be used in determining the conditions that give rise to parasite aggregation which can be used in designing statistical sampling procedures, and in inferring the reasons that could strengthen the claim that aggregation can indeed occur in a wide-range of scenarios in nature.

Keywords: macroparasite, aggregation, negative binomial, mechanistic model, host-parasite interaction

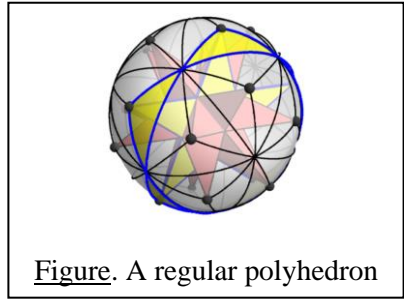
MPS – 14

REGULAR POLYHEDRA ASSOCIATED WITH NON-CRYSTALLOGRAPHIC COXETER GROUPS

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A polyhedron \mathcal{P} is said to be *regular* if its automorphism group acts transitively on the set of flags (vertex-edge-face incidence structures). Consequently, it has a single type of regular polygons as boundaries arranged in a highly-symmetric manner (see figure to the right).



The objective of this research is to enumerate all regular polyhedra whose automorphism group is abstractly isomorphic to $H_3 = [3,5]$. These objects have the intrinsic property that they contain 5-fold rotational symmetries and, hence, are intimately related to aperiodic materials and models. The computational software GAP is used to handle group-theoretic computations and the computer algebra system Mathematica is employed to render 3D graphical illustration of these polyhedra. Physical skeletal models of these objects are also constructed using Zometool.

The study reveals a list of 12 regular polyhedra associated with H_3 . This includes 2 convex types, 4 star types, and 6 skew types. Among these are those polyhedra that can geometrically represent real symmetric structures such as viruses, quasicrystals, and even nanomaterials.

Keywords: regular polytope, geometric realization, non-crystallographic Coxeter groups, string C-groups

MPS – 15

SMALL POLYHEDRA OF ORDER 2^m WITH APPLICATIONS TO GEOMETRIC CRYSTAL MODELING

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A regular polyhedron \mathcal{P} is a geometric object in 3-dimensional space that is bounded by regular polygons arranged in a highly-ordered manner. Its symmetry group is a *string C-group*, a special geometric group generated by reflections about mirror planes. A theorem in geometry establishes a correspondence between regular polyhedra and rank 3 string C-groups.

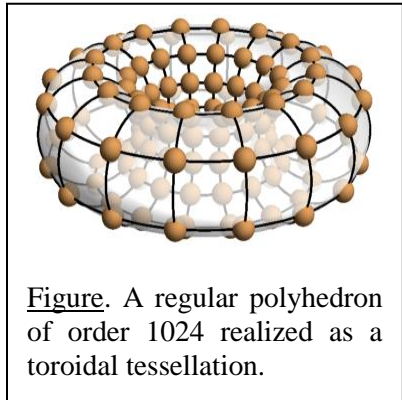


Figure. A regular polyhedron of order 1024 realized as a toroidal tessellation.

The objective of this research is to enumerate all regular polyhedra whose symmetry group is of order 2^m , where m is a positive integer. The enumeration relies on an inductive algorithm that builds a bigger polyhedron from a smaller already existing one. The algorithm is implemented in the software GAP, which is capable of handling sophisticated group-theoretic computations. Polyhedra that are realizable as convex solids are graphically illustrated using Mathematica.

The algorithm generated all polyhedra corresponding to $1 \leq m \leq 11$. Among the generated ones are those that can be used to model crystalline structures including toroidal materials such as nanocoils and nanotori.

Keywords: polyhedra, string C-groups, order 2^m , crystal, nanotorus

MPS – 16

SOLID WASTE GENERATION IN NATIONAL CAPITAL REGION: A SPATIO-TEMPORAL APPROACH

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Solid waste is one of the major problems in the Philippines especially in the National Capital Region (NCR) and population is one major factor. In this paper, the researchers aimed to predict and forecast the amount of solid waste in the next five years in the NCR by using spatio-temporal modeling. The researchers obtained the data from the Department of Environment and Natural Resources (DENR) spanning from the year 1965-2017. The researchers also wanted to determine if there is a significant difference between the actual and the predicted values of solid waste generated. For the spatial part of this study, the researchers used GeoDa for the map modeling and for the descriptive interpretation of data of the solid waste generation in relation to the counted population in the NCR. For the temporal modeling, the researchers used the ARIMA modelling to predict the values of the solid waste generation. The cities of Mandaluyong, Paranaque, and Pasig have the same ARIMA model that is ARIMA (1,1,6) while Marikina and Manila having ARIMA (1,1,0), also Caloocan and Malabon have ARIMA (2,2,3), Muntinlupa has ARIMA (1,0,9), Pateros has ARIMA (1,1,10), Pasay having ARIMA (1,1,11), Navotas has ARIMA (1,1,12). Furthermore, Taguig has an ARIMA (1,2,1), Quezon City has ARIMA (1,2,9), Valenzuela has ARIMA (1,2,10), San Juan has ARIMA (1,2,11), Makati City having ARIMA (1,3,3), and lastly the city of Las Piñas having ARIMA (1,3,5). These models were concluded based on the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) including the respective errors like RMSE, MAPE, MAE, MSE, NMSE was also computed. It was also concluded that Quezon City will produce the most amount of solid waste in the next five years.

Keywords: solid waste, spatio-temporal modelling, ncr, arima, geoda

SOCIAL SCIENCES

SS – 01

COMMUNITY-LED VOLCANO ALERT LEVEL ACTIONS: THE CASE OF BARANGAY ABELO, SAN NICOLAS, BATANGAS

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This study aims to identify action plans of the Barangay Disaster Risk Reduction and Management Committee (BDRRMC) for Taal Volcano Alert Levels. Based on historical records, San Nicolas (also known as Old Taal) was affected by major eruptions of Taal Volcano particularly in 1754. One of the prone barangays in the area is Barangay Abelo, which is 11 kilometers from the main crater of the volcano. Part of their Disaster Risk Reduction Plan is the formulation of actions per Taal Volcano Alert Levels. This will guide the community to make right decisions, during emergencies to reduce damage to properties and loss of lives. Through focus group discussions, community officials were able to develop their preliminary action plan per alert levels scenario. They have also identified existing resources and revalidated the BDRRMC Structure, Roles and Responsibility. The results of this study are expected to be integrated with their enhanced Barangay Disaster Risk Reduction Management (BDRRM) Plan specific for volcanic event.

Keywords: Volcano Alert Levels, disaster risk reduction plan, volcano scenario, Taal Volcano

SS – 02

INFORMATION-SEEKING BEHAVIOR AND WILLINGNESS TO PAY OF THE RESIDENTS VULNERABLE TO VOLCANIC HAZARDS

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This study determined the factors that influence the information-seeking behavior and willingness to pay of the residents vulnerable to volcanic hazards in Barangay Gulod, Laurel, Batangas. The study area is one of the lakeshore communities exposed to the various hazards of Taal Volcano. In spite of history of hazards, through the years, population continued to increase because of abundant aquatic resources (fishery) as one of the main sources of income. Data were gathered from March to April 2018 among 147 respondents chosen using stratified random sampling. Results of the study showed that the current sources of information used among residents were television, barangay announcements, and radio. While for their preferred sources of information, they rely on barangay officials as credible source and accessible whenever an emergency or disaster occurred. Majority of the respondents are willing to pay for disaster preparedness services such as mobile phone DRR information and alerting, emergency insurance, and for DRR training. The more they trust the information sources and the more willingness to pay for DRR related services, the higher their chances to practice disaster preparedness for volcanic eruption. These results will be a valuable input to the enhancement of disaster risk reduction and management plan of the barangay and in the formulation of communication strategy for disaster preparedness at the municipal level.

Keywords: disaster risk management, volcanic hazards, risk communication, taal volcano

SS – 03

ECOSYSTEM SERVICES IN THE HAND OF THE FARMERS: WHAT MATTER MOST?

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The dynamic nature of agro-ecosystem enables it to provide ecosystem services such as provisioning, supporting, regulating and cultural services that are important to humans. However, availability of these ecosystem services in agricultural fields is highly governed by the management practices employed by the farmers resulting in dis-services of some available ecosystem services. The existing services do not only affect the productivity of the agricultural systems but also help in its stability especially in the face of climate change. To determine the factors that contribute to the loss of ecosystem services in the agricultural field, a social survey using a pre-tested questionnaire and one-on-one interview was employed to obtain the socio-demographic profiles of the registered farmers from Barangay Bagupaye, Mulanay, Quezon. While a focus group discussion aimed at determining their level of prioritization and factors that contribute in their decision-making process on what ecosystem services to be mostly rendered. Results show that farmers prefer (1) provisioning and (2) regulating services, followed by (3) cultural services, while the least preferred were supporting services. The study also found that their social networks such as involvement in religious groups, farmers association/organization and financing membership highly affect their decision making more than sex, age, years in farming and educational attainment. It also revealed that farmers tend not to understand fully the ecosystem services concepts in the farming community. Also, their limited knowledge on the dynamics and importance in the different ecosystem services hinders their appreciation and holistic view of the ecosystem functions as an ecological approach in agricultural landscape thus, affecting the integrity of their farming landscape.

Keywords: agroecosystem, ecosystem services, agricultural landscape, climate change, ecological science

SS – 04

PERCEIVED ECOSYSTEM SERVICES OF AGUSAN MARSH WILDLIFE SANCTUARY, CARAGA REGION, PHILIPPINES

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Wetlands provide important and diverse benefits to people around the world, contributing provisioning, regulating, habitat, and cultural services. Despite the high value of ecosystem services derived from wetlands, around the world they have been systematically drained and filled to support agriculture, urban expansion, and other developments. It is in this plight that a survey was conducted to determine the role of one of the biggest wetland ecosystems in Mindanao which is the Agusan Marsh Wildlife Sanctuary. An interview with different stakeholders such as farmers, fishermen, local residents, and local leaders were done. A focus group discussion was conducted in order to validate the collected data. Results indicated that provisioning services was more important for stakeholders living closer to the marsh while regulatory services were more important for downstream communities. Communities living closer to the marsh are willing to pay around 50 PhP as an environmental fee for the conservation of AMWS in particular for its water provisioning services. Flooding control service is the regulatory service that has an impact towards the lower stretches of Agusan River and too much financial effort has been given to flood control projects particularly in Butuan city but less priority to enhance the conservation and environmental development of the marsh.

Keywords: conservation, ecological services, wetland, willingness to pay

SS – 05

PREFERRED MOTIVATIONAL STRATEGIES OF SCIENCE STUDENTS: BASIS FOR PEDAGOGICAL ENHANCEMENT

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A variety of methods was done by teachers to engage students in classroom activities and foster critical thinking which can ignite their interest in the lesson. Through motivational strategies employed by the teachers, the students understand better the concepts and perceive learning as an enjoyable venture. This descriptive-survey research explored the preferred motivational strategies of 106 Grade 7 Science students in a government-run secondary national school in Zambales, Philippines. The study showed that the students moderately preferred visual-auditory motivational strategies, logical-mathematical motivational strategies and kinesthetic motivational strategies. The most preferred motivational strategy is ‘4 pics 1 word’ and the least preferred motivational strategy is ‘bingo.’ The students chose their most preferred motivational strategies because these are fun and enjoyable. However, they do not prefer some motivational strategies because they are unfamiliar. Science trivia, picture presentation and mini lab work are the most common motivational strategies used by science teachers. The study recommends that teachers vary their motivational strategies to cater to the multiple intelligences of the students. Teachers may use the proposed pedagogical enhancement plan to arouse students’ interest in Science learning.

Keywords: motivational strategy, students’ preferences, science education, pedagogical enhancement plan, STEM

SS – 06

FACULTY PERSPECTIVES ON ORGANIZATIONAL CULTURE AND OTHER KEY INFLUENCING FACTORS OF TECHNOLOGY INFUSION

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Quality education is one of the foundations of sustainable development. Integration of innovative tools can bring not only quality education but also accessibility and inclusivity. However, there are other factors that must be considered in the infusion of technology in the educational settings. Thus, this study focused on organizational culture, attitudes and behavior of teachers towards technology (technology acceptance) and teachers' profile as push and pull factors of technology infusion in a university setting. The study utilized a descriptive-correlational research design. The respondents of the study were faculty members from both private and public universities in the Philippines. The study utilized the Organizational Culture Assessment Instrument (Cameron & Quinn, 2005) and the Technology Acceptance Questionnaire (Davis, 1986). The results of the study were interpreted and analyzed using descriptive and inferential statistics. The results of the study reveal that hierarchical culture is the dominant culture that exists in higher educational institution. Most teachers use technology for communications purposes and information gathering. Technology acceptance is high as expressed by the respondents' behavioral intention to continuously use e-learning. Significant relationship exists between infusion of technology and the type of institution as well as academic rank of faculty. Four out of six dimensions of organizational culture also influence technology infusion. Lastly, linear regression analysis shows that all constructs of the Technology Acceptance Model (TAM), predicts actual infusion of technology in an educational setting. While there are several influencing factors revealed in the infusion of technology, results suggest the following: 1. Management of organization's acculturation through empowerment and active involvement; 2. Proper control and monitoring of processes and structures needed in technology infusion; 3. Expectations and performance indicators should be well communicated; 4. Appropriate coordination systems within the organization should be in place; and, if necessary, 5. Benefits and rewards system should be considered.

Keywords: open distance learning, distance education, educational technology, management and implementation

SS – 07

MEASURING RISK ATTITUDES INFLUENCED BY EMOTIONS: AN AUDIAL EXPERIMENT

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Laboratory experiments in the field of experimental economics and behavioural finance have shown that there is an undeniable effect of emotions on decision making. Past studies prove that risk tolerances of individuals are measurable in controlled environments and the usual form of emotion induction is through the use of audio-visual stimuli. In this study we examined the influence of music on an individual's emotions and in turn their investment decisions, as we believe music is an overlooked source of emotional bias. Here we extend the literature by using a continuous double auction format where participants can simultaneously sell off and buy assets at the prices they prefer, all while under the influence of emotional treatments through music. The high-intensity emotions were excitement and fear, and these two emotions were compared to a low-intensity, calm emotional treatment. Through the use of music as our emotional priming method, we found that participants induced with fear were on average more risk-seeking than those induced with excitement and calm emotions. This deviates from the findings of previous studies that made use of audio-visual treatments where those induced with fear as well as excitement, were found to be notably more risk-seeking than those induced to feel calm.

Keywords: emotions, music, priming methods, risk tolerance

SS – 08

DECONSTRUCTING THE DISASTER PREPAREDNESS AND MITIGATION PRACTICES OF THE INDIGENOUS PEOPLES AS SCIENCE-BASED INFORMATION

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Indigenous peoples both in lowlands and uplands are particularly exposed to climate-related disaster risk—they are likely to suffer higher rates of mortality, morbidity and economic damage to their livelihoods. Hence, this study aimed to deconstruct the knowledge, attitude, and practices on disaster related phenomena of the indigenous peoples in Capiz, Philippines and integrate them into science-based information. It used the qualitative research design employing grounded theory approach from June 2016 to December 2017. Informal interviews and participation, videography, and observations were conducted in interacting with the informants. The six (6) informants were chosen using the criteria of Manuel (1955) on three-generation test to triangulate the data. The knowledge, attitude and practices on environment of the indigenous peoples play the vital role in the resiliency towards the occurrence of any disaster phenomena in their places. Their unique way of communicating with the flora and fauna and all parts of the nature serve as their *duna* (natural endowment) that guides them in their daily way of living and coping with environmental stress. Their KAP systems are their very simple way of explaining indigenous science-based practices and information that can be integrated to modern classroom instruction on disaster preparedness and mitigation. The indigenous peoples have developed the capacity and propensity to co-exist with other stakeholders in the forest environment. Being keen to the behavior of plants and animals is always a plus factor in responding to environmental stress.

Keywords: cultural ethnography, disaster risk reduction practices

SS – 09

FOOD INFLATION, JOB MISERY, AND HUNGER INCIDENCE IN THE PHILIPPINES: A PANEL DATA ANALYSIS

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Food prices spiked in 2018, after a period of relatively low and stable price regime in 2015 to 2017. Data from the Philippine Statistics Authority (PSA) show that during the first ten (10) months of the 2018, food inflation averaged to 6.8 percent, compared to just 3.05 percent full year average in 2017. The October 2018 food inflation rate was recorded at 9.7 percent. The increase in food inflation was mainly due to the increasing prices of rice and fish. Higher food prices hurt the poor more since a large percentage of their expenditures is allotted to food. It is not surprising, therefore, that Self-Rated Hunger Incidence, as reported by the Social Weather Stations (SWS) increased to 13.3 percent of all families during the 3rd quarter of 2018, from 9.4 percent in the 2nd Quarter, for a significant 3.9 percentage-points quarter-to-quarter increase. This paper looked at the impact of food inflation and job misery index, defined as the sum of unemployment and underemployment rates, on hunger incidence in the country using panel data. The paper analyzed the impact of food prices and job misery on self-rated hunger using the sub-national panel of the SWS, namely: National Capital Region, Balanced Luzon, Visayas and Mindanao. The paper employed the dynamic panel models suggested by Arellano and Bond. The results showed that food inflation explains most of the increase in self-rated hunger incidence during the 3rd quarter, with job misery index explaining a small, but significant, increase in hunger incidence. Further, the study showed the need to improve government policies in making sure that food prices, particularly rice and fish, are manageable and within the reach of poor families for higher food prices hurt the welfare of the poor families.

Keywords: hunger incidence, food inflation, job misery index, dynamic panel models

SS – 10

THE INDIGENOUS PRACTICES OF THE RURAL FOLKS WITH REGARD TO WEATHER-RELATED DISEASES IN THE PROVINCE OF ILOCOS NORTE

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Through time humans have developed measures on how to adapt to disasters in life especially in extreme or hot weather conditions. These conditions can aggravate already existing diseases especially cardiovascular diseases (CVD) and respiratory diseases. Yet their indigenous practices about the intricacies in life have helped them adapt to such environments. Barangays from municipalities in the Province of Ilocos Norte were the study sites. Interviews using a semi-structured questionnaire were employed in gathering data. Respondents who have cardiovascular diseases were culled out from the master list of the Rural Health Unit (RHU). Respiratory diseases were also inquired along with the common illnesses encountered throughout hot weather. The number of respondents was selected randomly at 5% equal distribution from the master list. Respondents tallying to 605 were interviewed. Dialogues with the respondents showed that the indigenous practices commonly employed for cardiovascular diseases were consuming garlic (562) religiously taken in 3-4 cloves. Drinking lots of water (547) was also practiced and consumed as “agua tyempo” (whenever necessary). Additional practices were eating “malunggay” (348), taking a sip of vinegar, and taking a slice of raw ginger. For respiratory diseases, “lagundi” leaves (506) was taken orally followed by consuming juiced “ampalaya”, “herba buena” (449), and guava decoction. Common diseases such as cough was treated with “lagundi” (598) or “anonang” leaves (287) taken by decoction. Dengue fever was also experienced and managed by neem and papaya leaves decoction. Respondents had their own indigenous practices of managing ailments experienced during hot weather. Likewise, it was observed that materials used are endemic in their locality and actually possess health benefits.

Keywords: indigenous practices, weather, diseases

SS – 11

ACADEMIC PERFORMANCE AND EXPERIENCES OF THE JUNIOR HIGH SCHOOLS LEARNERS UNDER THE SPECIALIZATION PROGRAM SCHEDULE IN SCIENCE

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Spiral Progression approach has greatly influenced the science curriculum particularly the content and transitions of four the disciplines in science, namely, Earth Science, Biology, Chemistry and Physics. Teachers of varied specializations in college are adapting to the new curriculum which demands in-depth content training to master all the disciplines. It is difficult to teach something, in which one does not have the necessary mastery. The proposed intervention is the Specialization Program Schedule where teachers would only teach his specialization following the schedule from grade 7 to 10. The study was experimental in nature and employed quantitative and qualitative research. There were two assigned groups, the experimental group under the Specialization Program Schedule in Science and the control group followed the usual scheduling from Grade 7 to Grade 10. A pretest and posttest were administered which served as quarter examinations. The period of observation was from first quarter to second quarter transitions only. Applying independent t-test, the mean scores of the two groups from grade 7 to 10 had significant differences. The proposed intervention had an effect on the performance of the learners as reflected in the mean percentage scores. Learners perform academically better under the Specialization Program Schedule. Using Pearson correlation, only the performance of the Grade 9 from first to second quarter had a significant relationship. Other grade levels had no significant relationship. Students and teachers had varied experiences in terms of delivery of content, execution of strategies and availability of resources. Furthermore, Specialization Program Schedule must be monitored carefully to ensure its impact on the academic performance of the learners.

Keywords: academic performance, experiences, specialization program

SS – 12

**PREVALENT FACTORS THAT AFFECT THE JOB
SATISFACTION OF JUNIOR HIGH SCHOOL
TECHNOLOGY AND LIVELIHOOD EDUCATION
TEACHERS IN PUBLIC SECONDARY SCHOOL IN
DISTRICT 1 OF MARIKINA CITY**

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The objective of this study is to examine the prevalent factors that affect the job satisfaction of Technology and Livelihood Education Junior High School teachers in Public Secondary School in District 1 of Marikina City. Descriptive statistics showed that teachers were agreed in four aspects. However, teachers' responses in Job Characteristics aspect were at least satisfied. Moreover, independent t-test and ANOVA were utilized by the researchers to reveal the significant differences of teachers' job satisfaction in relation to gender, age and type of schools. Furthermore, bivariate correlation was used by the researchers to determine the significant relationship between each aspect. Lastly, regression method was used to examine what aspect of Job Satisfaction is the predictor of teachers' intention to remain on the job. Results showed that Meaningfulness of the Job and Social Benefits are the predictors of the teachers' intention to remain on the job. With these findings, the study recommends to include other educational stakeholders to have a comparison in terms of Job Satisfaction. Administration should provide teachers the clear content and nature of their assigned tasks and give full support to their teachers. Further studies are needed to fully identify the factors that affect the level of satisfaction of teachers.

Keywords: Intention, Job Satisfaction, Motivation, Multiple Linear Regression, Marikina City

SS – 13

ANALYSIS OF RELATIONSHIPS OF APPROACHES TO HAPPINESS AND JOB SATISFACTION TO JOB PERFORMANCE OF PUBLIC SECONDARY SCHOOL TEACHERS IN SELECTED SCHOOLS IN THE DIVISION OF CAVITE

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The study analyzed the relationships of approaches to happiness and job satisfaction to job performance. This research endeavors to educate and inspire public academic institutions to focus on the happiness and job satisfaction of their teaching staff and see if it will bring out high job performance rate. A sample of two hundred and eighty-three (283) public secondary school teachers was taken from selected schools in the division of Cavite calculated based on Cochran's formula and using simple random sampling technique. The researchers used descriptive statistics such as frequency distribution and weighted mean to present the data. Pearson Product Moment Correlation Coefficient r and multiple linear regressions (MLR) model were used to determine the association and test statistical significance between all studied parameters. Data analysis was done using Statistical Package for the Social Sciences (SPSS). The findings of this study indicated that the extent of correlation between the approaches to happiness and job performance and between the job satisfaction and job performance are both significant. When these variables are linked with job performance, the outcome revealed that higher degrees of happiness—in terms of pleasant life, good life, and meaningful life—and job satisfaction lead to very satisfactory job performance.

Keywords: happiness, job satisfaction & performance, division of Cavite

SS – 14

MASUSING PAGSUSURI SA KURIKULUM NG FILIPINO SA IBA'T IBANG SANGAY NG PHILIPPINE SCIENCE HIGH SCHOOL

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Ang pangunahing layunin ng pag-aral na ito ay masusing masuri ang kurikulum sa pagtuturo ng Filipino sa iba't ibang sangay ng Philippine Science High School at ang kaugnayan nito sa Kurikulum K + 12. Sinikap na matugunan ang anim (6) na layunin kaangkop ang mga suliranin ayon sa nilalaman ng kurikulum sa luma at bagong kurikulum na may kinalaman sa: a) Nilalaman (***Content/Topic***); b) Pangkalahatan at Tiyak na mga Kasanayan sa Pagkatuto (***Desired Learning Competencies***); c) Mungkahing Istratehiyang Pagtuturo (***Suggested Instructional Strategies***); d) Mungkahing Pagtataya (***Suggested Assessment Strategies***); e) Sanggunian (***Learning Resources***) f) Oras/Panahon (***Time Frame***). Binigyang pansin din ang mga kahinaan at kalakasan ng kurikulum, pagkakatulad at pagkakaiba, pagpapahalaga sa limang (5) makrong kasanayan sa pinag-isang kurikulum sa Filipino? at pagtataya ng mga guro sa iba't ibang sangay ng Philippine Science High School System na may kinalaman sa: a) Kabisaan ng kurikulum; b) Kahusayan ng kurikulum; c) Kalakasan ng kurikulum; d) Kahinaan ng kurikulum; at d) Pagtanggap ng mga guro sa pinag-isang kurikulum. Ginamit ng mananaliksik ang deskriptibo, ebalwatib, at pangangalap ng katugunan sa talatanungan (***questionnaire***). Pinagsamang ***purposive*** at ***theoretical sampling*** ang ginamit sa paraan ng pag-aaral at pananaliksik. Sa kabuuan naging gabay ang nasabing pananaliksik para sa pagbuo ng mas makabuluhan pang kurikulum higit lalo na sa araling Filipino.

Susing Salita: masusi, pagsusuri, pagsipat

SS – 15

SCOLYTID BEETLE (*Coccotrypes rhizophorae* Hopkins) AND ASSISTED NATURAL REGENERATION APPROACH REGULATE THE ECOLOGICAL CARRYING CAPACITY OF PROTECTED MANGROVE FOREST IN RIZAL, GUBAT, SORSOGON

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Mangroves are important non-renewable resources and coastal resource management is a complex problem across subtropical and tropical regions. In the Philippines, natural disturbances and anthropological interventions have irreversibly damaged the ecological functions of mangrove ecosystems. This situation has prompted government institutions to rehabilitate and restore denuded intertidal zones without critical understanding of potential impacts on associated biotic factors. For example, the unregulated harvesting and mono-specific planting of *Rhizophora* species may have direct effects on vegetation structure and associated biotic interactions on existing mangrove community. This study has conducted numerical simulation to determine the impact of *Rhizophora* sp.-*C. rhizophorae* interaction on host plant population structure and regeneration potential. Numerical simulations based on data generated from a three-year field monitoring and evaluation conducted in Rizal Mangrove Forest (RMF), Gubat, Sorsogon, Philippines showed that *C. rhizophorae* infestation at endemic level is sufficient to ensure that the forest has *Rhizophora* trees of varying growth stages. On the other hand, at epidemic level, it is necessary to gather and destroy infested propagules and seedlings to minimize damage on the succeeding reproductive cycles. Canopy gaps during typhoons or death of mature trees favour rapid regeneration rate of healthy propagules. Subsequently, however, mangrove forests need proper human assistance to continuously benefit from its environmental services. Hence, in the absence of destructive interventions such as deforestation, pollution and land-use, conversion mangroves could adapt and withstand biotic stresses while sustaining their ecological carrying capacity.

Keywords: *Coccotrypes rhizophorae*, *Rhizophora*, carrying capacity

SS – 16

ONLINE GAMER'S STORIES AND IMPACT

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Advanced Information Communication Technology has brought splendid online games into the world of the teenagers. Despite of the ordinances being implemented to regulate computer gaming shops the addiction to such online games had pushed them into a situation where they themselves would justify the end results. The study is qualitative in nature. The tracking was done from grade 8 and now these students were in grade 10. Purposive sampling coupled with focused group discussion and observation was employed among the chosen respondents. The twenty Grade 10 brave boys opened up their stories and following the theme on impact to home relationships, effect on studies and lessons learned. Anecdotal records of these students revealed that the frequency of being called in the office of the prefect of discipline was lessened as they stepped up in higher grade level. Responses given were clustered thematically. It was pointed out that a gap, and worst conflict leading to constant confrontation were commonly experienced. A brief interview with some parents also revealed that, they should be strong enough to face them and never give up on them. Attendance in the school was not affected. They considered the school as their comfort zone. However, most of their assignments and projects were delayed. Grades were just average. Participation in class discussion was active because they became vigilant in expressing their ideas. Lesson learned from online games were having strategies in the battle field, sportsmanship and team coordination. Such was evident when they were grouped into a performance tasks. Finally, the challenge at this point was to have a balance of managing their tasks in school and bear in mind discipline as the key to attain harmonious relationship at home. Furthermore, online games should integrate science, mathematics, history concepts and virtues in order bring the gamers closer to what they were learning in the classroom.

Keywords: impact, online games, lesson learned

SS – 17

TEACHING STRATEGIES IN SCIENCE: INPUT FOR INSTRUCTIONAL PLANNING

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This descriptive research aimed to explore the different teaching strategies used by science teachers of four public secondary schools in Zambales, Philippines. A total of 20 junior high school science teachers served as the respondents which were taken using purposive sampling. The study used survey questionnaires as the main instrument for data gathering. This study determined the common teaching strategies used by science teachers in terms of individualized, grouped and ICT-Based. Findings revealed that a typical respondent is aged 46 and above, female, married, Teacher 1, specialized in Biological Science, BS/AB holder, and teaching below 5 years. The science teachers sometimes use individualized (M=3.08), grouped (M=2.98) and ICT-Based teaching strategy (M=2.63) with Individualized teaching strategy as the most commonly used. There is no significant difference between the teaching strategy used by science teachers and their profile variables. The results of the study served as a basis for an enhanced instructional plan in Science across grade levels in junior high school.

Keywords: teaching strategies, instructional planning, Science teaching, science education, pedagogy

SS – 18

**MARKET ACCEPTABILITY OF THE DESIGNED
PACKAGING MATERIAL FOR DRIED UBE
(*Dioscorea alata*) USING THE AUTOMATED MULTI
COMMODITY HEAT PUMP DRYER (AMCHPD)**

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Packaging has been developing because it is one of the main attributes a product has. Innovations are everywhere for the consumers to be more attracted and have the interest to buy a specific product. Purple yam (*Dioscorea alata*) is commercially grown in the Philippines which is the only supplier in the world market. Thus, the crop is considered one of the important export banner crops. Generally, the study determined the acceptability of the packaging material developed for the AMCHPD-Dried Ube among college students. Specifically: a) How does the packaging affect the customer's interest in buying the product? b) Does it increase the acceptability in the market? The study used descriptive design and questionnaires were distributed to 100 college students from a population of 5,000. Descriptive statistics was used to analyze the results. Students wrote their own perceptions on the color, imagery, attractiveness and other attributes of the designed package. Results of the survey showed that the most chosen packaging 1 was delightful to look at and attractive for its colors, with nutritional information highlighted. Packaging 3 was chosen next because of its simplicity and attractive slanted cover at the top. The least chosen packaging was the one with a handle.

Keywords: packaging material, ube, automated multi commodity heat pum dryer

SS – 19

MOTOR VEHICLE SAFETY PROMOTION PROGRAM: ITS EFFECTS ON THE KNOWLEDGE, ATTITUDE, AND BEHAVIOR OF DRIVERS

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This study determined the effects of a motor vehicle safety promotion program among male drivers. It utilized the quasi-experimental design, using two group pretest-posttest designs. The participants are late adolescent and middle-aged adult male vehicular drivers particularly from ages 18 to 60 years in Barangay Tartaria at Silang Cavite. Forty participants were assigned in each of the study groups. The experimental group was exposed to an intervention program for a period of one month. At baseline, the experimental and control group had a failing mark on knowledge. Both study groups had *positive* attitude and a *good* driving behavior was also noted in both groups. At the endline, the participants from the experimental group had a passing mark in knowledge. Although the attitude and driving behavior remained to be *positive* and *good* respectively, the experimental group showed an improvement in these aspects. However, the control group still had a failing mark in knowledge and retained a *positive* attitude and *good* behavior towards motor vehicle safety. An increase in the gain score was also noted in knowledge, attitude, and driving behavior of the respondents from the experimental group was observed, which was not noted in the control group participants. There was no significant difference in the gain score considering age, monthly income, educational attainment, and number of years driving with a license in both experimental and control groups. However, when vehicle type and personality traits were considered, there was a significant difference in the gain score of the experimental group. The results of the study suggest that the intervention program was effective in enhancing the knowledge, attitude, and driving behaviors related to motor vehicle safety among male drivers.

Keywords: motor vehicle safety, knowledge, attitude, behavior

SS – 20

**ECOTOURISM CARRYING CAPACITY ASSESSMENT
FOR THE AGUSAN MARSH WILDLIFE SANCTUARY:
THE CASE OF SITIO PANLABUHAN FLOATING
VILLAGE, LORETO, AGUSAN DEL SUR, PHILIPPINES**

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Sitio Panlabuhan Floating Village located within the boundary of the Agusan Marsh Wildlife Sanctuary (AMWS) is promoted by LGU-Loreto Agusan del Sur as a local prime ecotourism destination. Currently, ecotourism activity is managed by a local people organization – the Tribong Manobo of Sitio Panlabuhan Agusan Marsh Organization (TMOSPLAMO). This study generally aimed to assess the carrying capacity of the Sitio Panlabuhan using Limit of Acceptable Change (LAC) and Boullon's Carrying Capacity Mathematical Model (BCCMM). The Real Carrying Capacity calculation revealed a total average of 42 individuals per day. However, when tourists opt to stay at the floating village, only a total of 12 persons per day are allowed due to limiting factors such as accommodation facilities, availability of basic services like electric current and domestic and drinking water, and the availability of transportation. The results of this study would provide baseline information to promote community-based sustainable ecotourism as a tool to ensure the protection and conservation of natural resources against future expansion in Sitio Panlabuhan.

Keywords: ecotourism, carrying capacity, Limit of Acceptable Change (LAC), Boullon's Carrying Capacity Mathematical Model (BCCMM), Real Carrying Capacity (RCC)

SS – 21

**FACTORS INFLUENCING ADOPTION OF
MARICULTURE BY SMALL-SCALE FISHERFOLK:
THE CASE OF PADRE BURGOS MARICULTURE ZONE,
QUEZON, PHILIPPINES**

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The establishment of mariculture parks in the Philippines provides an opportunity for marginalized fishing communities as an alternative source of income. However, the high cost of mariculture operation has prevented local fisherfolk from participating in mariculture as investor-operators. This study determined the factors that significantly influenced the participation of local fisherfolk in Padre Burgos Mariculture Zone (PBMZ). Socio-economic characteristics, access to skills and training, access to capital and credit facilities, and membership in fisherfolk association were the independent variables used in the analysis. A total of 313 fisherfolk households were interviewed in four (4) barangays in the municipality of Padre Burgos, Quezon. Two types of survey were conducted, the fisherfolk survey and cooperator survey. With a total of ten (10) investors currently operating in the PBMZ, only 2 were local investors, a fisherfolk organization and a multi-purpose cooperative. Less than 5% of the local fishing household members were employed since the establishment of mariculture zone. This study adopted the logistic regression model. Results showed that the decision to participate in mariculture zone is a function of age, gender, education, number of household members, access to training and access to credit. Cost-benefit analysis showed the profitability of mariculture operation in the municipality.

Keywords: mariculture, marginalized, adoption

SS – 22

EVALUATION OF GENDER DIFFERENCES IN TECHNICAL EFFICIENCY OF TILAPIA FARMING IN THE PHILIPPINES

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Gender mainstreaming has been identified as a major issue in the development of tilapia producing society group. The role of women, in particular, has been recognized despite their limited access to tilapia production due to tradition and other socio-cultural constraints. The purpose of the study was to evaluate gender differences in the technical efficiency of tilapia farmers in the Philippines using the stochastic frontier production function analysis. Data were collected from randomly selected tilapia farms using a face-to-face survey method with the aid of a structured questionnaire of 70 respondents of men and women tilapia farmers. The results indicate that male tilapia farmers are more efficient technically than female farmers with mean technical efficient indices of 0.47 and 0.29 respectively. It was found that the yield level in tilapia production among male and female farmers can be raised if the use of major variable inputs such as focus pond area/cage and stocking rate influencing in the output could be increased. The analysis also indicates that access to government facilities/services, use of aerator and the culture method used of farmers have positive significant influence on the level of technical efficiency. This study recommends that the government should guide and provide training on farm management skills which will enable the farmers to maximally utilize their variable inputs focusing on efficiency as their goal. The increase in economic productivity of the fish farmers in the country is largely about enabling women to realize their full potential and improve their own and their families' quality of life.

Keywords: technical efficiency, tilapia, gender differences

SS – 23

SOCIO-DEMOGRAPHIC CHARACTERISTICS AS DETERMINANTS OF FAMILY DYNAMICS AND ENGAGEMENT IN THE PALAYAMANAN SYSTEM APPROACH AMONG AGTAS IN BICOL

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Agtas are considered to be one of the Indigenous Peoples (IPs) residing in the mountainous parts of Luzon and some can be found in the Bicol Region. They are still dependent on agriculture in order to generate income and sustain their basic needs. The family dynamics of the Agta farming families were assessed through the tool FACES IV by David Olson. Results of the study showed that there were unbalanced cohesion and unbalanced adaptability level within the family system. On the other hand, communication and satisfaction of the Agta farming families respondents were high. Agta farming families are said to be already engaging in the *Palayamanan* System Approach but their knowledge and skills are still needed to be enhanced to fully maximize the benefits that they can gain from the said approach. Agricultural technologies are said to be not present in the community but according to the data collected, if they are given the opportunity to adapt, they would consider it. Based on the evaluated socio-demographic characteristics of the respondents, gender and educational attainment showed a strong correlation to family cohesion and engagement in the PSA, respectively, therefore, both factors could be considered for effective development interventions to take place. Overall, the Agta communities' geographical condition, culture and beliefs, sources of information have affected their way of living, farm practices, and farm-decision making. There have been very limited studies regarding indigenous people and communities in the Philippines. Thus, this study would serve as an entry point to further understand them and would guide in the formulation of appropriate strategies that will help improve and enhance their lives.

Keywords: family dynamics, *Palayamanan* System Approach, farm decision-making, indigenous people

SS – 24

**WILLINGNESS TO PAY TOWARDS THE PROTECTION
OF PINANDAGATAN FALLS AS ECOTOURISM SITE
WITHIN ANDANAN WATERSHED FOREST
RESERVE AREA, PHILIPPINES**

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The operationalization of ecotourism in protected areas would provide both ecological and economic benefits. Pinandagatan Falls located in the eastern portion of the Andanan Watershed Forest Reserve (AWFR) is a potential site for ecotourism development. Before ecotourism activities commence, the economic valuation and the willingness to pay (WTP) of the residents for the conservation of Pinandagatan Falls should be determined. Face-to-face interview with 153 household respondents was administered to obtain information on the socioeconomic profile and willingness to pay for the protection of the Pinandagatan Falls. The respondents were female (70%) and married (86%), with average age of 39 years old. Their source of income was farming (86%) and most of the respondents' education was at elementary level. Multiple linear regression analysis was used to compute the mean WTP of the respondents. Overall, 96% of the respondents were willing to pay for an entrance fee amounting to ₱38.33 per person that could serve as a fund for the protection and conservation of the Pinandagatan Falls. Variable years residing in the barangay were highly significant at 9% level. The findings revealed that gender, ethnicity of the respondents, number of years in the barangay, and marital status were the factors affecting their WTP. Establishing an entrance fee for the protection of Pinandagatan Falls is very vital for a better management and utilization of resources. The results of the study provide good information for an appropriate plan for the conservation and development, particularly ecotourism efforts, within the Andanan Watershed Forest Reserve.

Keywords: contingent valuation, Pinandagatan falls, Andanan Watershed Forest Reserve

SS – 25

APPRAISAL OF FARMING HOUSEHOLDS IN MARGINAL AREAS IN BOTOLAN, ZAMBALES, PHILIPPINES

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Farming households in barangays Carael and San Juan, Botolan, Zambales were studied to determine farm performance, management practices and income years after the eruption of the Mt. Pinatubo in 1991 and the massive flooding in 2009 that further marginalized the areas. Survey of 120 farm households was done in 2017. Permit was secured from local officials prior to personal interview. Socio-economic data, farm management practices, production and income per household were gathered, pooled and analysed using SPSS software. As of 2018, farming was the main source of household income despite land being marginalized and production area decreased. However, income from agriculture diminished by about 20% after the calamities resulting into lower productivity. Rice is still the dominant crop grown but only 44% of the area planted during dry season. Rice yield and income were relatively low due to unfavourable soil and weather condition, absence of irrigation, and occurrence of pests and diseases, and farmers lack of knowledge on appropriate technologies. Farmers were willing to rehabilitate land and learn appropriate technologies for crop production. This appraisal provides an important basis in future efforts to develop technologies, make the marginalized land productive and be a source of employment and income.

Keywords: lahar, agriculture, rehabilitation, productivity, income

SS – 26

CHILDREN'S SEARCH BEHAVIOR AND STRATEGIES USING IMAGE SEARCH INFORMATION SYSTEM

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Most libraries commonly use text-based search engines which are not yet usable for young age. This research was initiated to determine children's book search behavior and strategies using a child-friendly visual-based information retrieval system. Children between 5-8 years old were asked to conduct a book search task using a group of illustrations in a visualized search engine. The performed activities were silently observed, logged and recorded. In-depth interview was also conducted to find out their exhibited search behavior and strategies during the search task. Using image as a search query in a visualized search platform has a potential for effective information retrieval system for children. They tend to recall the appearance and images in children's book instead of remembering the title and formulating keywords.

Keywords: visualized search interface, searching behavior, searching strategies

SS – 27

COGNITIVE INSIGHT AND COGNITIVE AFFECTIVE VULNERABILITY FACTOR OF PERSON LIVING WITH HIV AND USING ANTIRETROVIRAL THERAPY

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The Philippines has been experiencing a marked rise in the number of HIV cases in the past years. The HIV incidence in the Philippines has increased by more than 140% between 2010 and 2016, even though the annual number of new cases in Asia-Pacific countries has declined by 13% over the same period of time (UNAIDS Report on the Global AIDS Epidemic, 2016). People with chronic and acute illnesses experience uncertainty about their prognoses, potential treatments, social relationships, and identity concerns. The present study sought to investigate the cognitive insight and cognitive affective vulnerability factors of people living with HIV and using antiretroviral therapy. Participants were 40 gay men aged 20-32 years, diagnosed with HIV and who have undergone medication for at least one year. Results show that persons with HIV tend to have poor cognitive insight. They have also difficulties in regulating emotions and engaging goal-directed behaviors. In spite of having medication, gay men living with HIV are still in the process of reconstructing or reframing their lives. As such, support should be given including developing an active or self-advocating orientation, reframing supportive interactions, withdrawing from nonproductive social situations, selectively allowing others to be support persons, and maintaining boundaries.

Keywords: People living with HIV, cognitive insight, cognitive affective vulnerability factors, antiretroviral therapy

SS – 28

FROM VICTIMS TO SURVIVOR: A DESCRIPTIVE STUDY ON SEXUALLY EXPLOITED CHILDREN IN RESIDENTIAL TREATMENT

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Child sexual exploitation is a form of child abuse, and it can happen to boys and girls from any background or community. It has also long-term effects on young people's social integration and economic well-being and may adversely affect their life chances (NSPCC). This qualitative study used interpretative phenomenological lens to explore the plight of sexually exploited children. Interpretative phenomenological analysis (IPA) is a qualitative approach which aims to provide detailed examination of personal lived experience and recognizes that this is an interpretative endeavor because humans are sense-making organism (Osborn & Smith 2015). Participants were five (5) child sexual exploitation survivors. Data were gathered through a series of focus group discussion, recorded, transcribed and analyze using IPA lens. Four superordinate themes arose from the analysis that captured the lived experiences of the child sexual exploitation survivors. The first theme is on the experiences of keeping the situation undisclosed which further explain isolation from family or friends, hanging-out with other vulnerable peers, association with other young people involved in sexual exploitation and being withdrawn. The second superordinate theme connected to the unusual behavior they experience such as being fearful of certain people or situation, changes in physical appearance and showing sexual behavior that is inappropriate for their age. The third theme is associated with the distress caused by disclosing the situation and this relates to self-harm, depression, sleeping problems and fear of rejection. The last theme is connected to the recovery experiences they have. This includes accepting the situation, faith in God and *pagpapatawad* (forgiveness). However, the recovery process entails a long journey for the survivors.

Keywords: IPA, focus group discussion, child sexual exploitation

SS – 29

PERSONALITY AND MOTIVATIONAL PATTERNS OF INCARCERATED WOMEN INVOLVED IN DRUG USE

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This study analyzed the personality and motivational patterns of 175 purposively selected incarcerated women who violated RA 9165 and were detained at a jail facility in Lucena City, Quezon. It also attempted to determine their demographic profile and explore its association with their personality and motivational patterns. This employed causal-comparative and correlational approaches. The *Panukat ng Ugali at Pagkato* (PUP) by V. G. Enriquez was used to measure personality traits and Marijuana Motives Measure (MMM) by K. B. Carey for the motivational pattern. Results showed: 34.3% of the respondents during the commission of crime were 28-37 years old; 61% of them were high school graduates; 77.1% were from nuclear families; 64% had PhP 7,980 monthly family income; 40.6% were wage and salary earners; and 80.6% had no verdict yet regarding their cases. The PUP revealed that in terms of extraversion, 49.71% of the respondents had below average *lakas ng loob* while in terms of agreeableness, 42.86% were above average in *pagkamagalang*. With other personality traits, majority of the respondents were gauged within average level. The MMM revealed that 70.3% of the respondents used illicit drugs to cope with certain situations. Using chi-square, associations revealed are the following: between agreeableness and educational attainment ($\chi^2=38.81$; $p=0.003$) and family background ($\chi^2=14.008$; $p=0.03$); conscientiousness and age during commission of the crime ($\chi^2=28.682$; $p=0.094$); emotional stability and educational attainment ($\chi^2=15.502$; $p=0.078$) and family background ($\chi^2=7.022$; $p=0.071$); and openness to experience and previous occupation ($\chi^2=16.8$; $p=0.032$). Meanwhile, the respondents' motives were associated with educational attainment ($\chi^2=27.085$; $p=0.008$) and status of the case ($\chi^2=8.707$; $p=0.069$). A correlation between emotional stability and motivational pattern ($\chi^2=19.278$; $p=0.082$) was observed. Programs that promote rehabilitation and well-being of the incarcerated women were recommended.

Keywords: personality traits, motivation, incarcerated women, drug use

SS – 30

SUICIDE PROPENSITY OF LESBIAN AND GAY ADOLESCENTS: A MESOSYSTEMIC PERSPECTIVE ON FAMILY AND PEER EXPERIENCES

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The transition into adolescent may be a risky period. In particular, peer status and parental acceptance during this developmental period can influence the development of problem behavior such as suicide. Suicide is the third leading cause of death for people aged 15 to 24 with more than 4,000 dying each year (Liu & Mustanski, 2015). In this regard, this study sought to determine how family and peer acceptance plays important role on suicide propensity among lesbian and gay youth. A cross-sectional sample (35 gay and 15 lesbian) was assessed. Results showed the level of their suicidal ideation are considered as “very often”. In terms of the relationship of the foresaid variables, family acceptance in adolescence is associated with their level of suicidal ideation. Moreover, lesbians and gay youths who are accepted in their family have lower levels of suicidal ideation. Secondly, peer acceptance is also correlated to the level of suicidal ideation of lesbian and gay youth. Like family acceptance, acceptance of lesbian or gay youth by their peers lowers the risk of suicidal ideation.

Keywords: Family acceptance, peer status, lesbian, gay, adolescent

SS – 31

NEGOTIATED CO-DESIGN OF AN INFORMATION SYSTEM FOR EARLY WARNING ON DEEP-SEATED LANDSLIDES: CASE STUDY IN BRGY. UMINGAN, ALIMODIAN, ILOILO

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Previous catastrophic deep-seated landslides in the Philippines proved the need for a sustainable early warning system for such hazard. While a monitoring and warning generation system is existing, it uses information and communication technologies (ICTs) and is centrally-operated. Hence, co-design of a proposed community-based early warning system for deep-seated landslides (CBEWS-L) was conducted to empower local communities with limited technology resources. Negotiation techniques were applied to the participatory design (PD) methodology to ensure that the information system (IS) that will support the CBEWS-L fits the interests of all stakeholders. Workshops were conducted to a) understand the process and information needs of a local community in Brgy. Umingan, Alimodian, Iloilo; b) decide on technical and non-technical requirements for their IS; and c) evaluate a prototype in terms of functionality and usability. The community's need for direct participation and the local government's need for centralizing data processing resulted in a multi-stakeholder IS design. Data were collected from the community, processed at the municipal level, and mirrored to a central national system. A mix of ICTs and indigenous monitoring and communication practices were identified as components of the IS. Local authorities and community members designed paper prototypes for the ICT components which were converted into mid-fidelity prototypes for testing. Evaluation results showed that because the stakeholders themselves formulated the IS requirements, the resulting prototype was highly usable and functional. Co-design, through negotiation, is therefore a promising method in developing an IS for CBEWS-L that is both efficient and empowering.

Keywords: early warning system, participatory design, negotiation

National Academy of Science and Technology, Philippines (NAST PHL)
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