

BIOLOGICAL SCIENCES

BS-01

**POPULATION ASSESSMENT OF
BUTTERFLY HOST PLANTS IN SELECTED SITES
NEAR MT. BANAHAW DE LUCBAN,
LUCBAN, QUEZON, PHILIPPINES**

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This study investigates the population of butterfly host plants thriving in Mt. Banahaw de Lucban Botanical Garden and the College of Agriculture campus in Lucban Quezon, primarily as a prerequisite for the conservation of endemic butterfly fauna and its host plants through butterfly farming. Quadrat method of sampling techniques was utilized in the study. Ten quadrats of 20m x 20m were established in Mt. Banahaw Botanical Garden and ten 10m x 50m quadrats in the College of Agriculture. Results revealed 36 species of host plants belonging to 21 families thriving in the Botanical Garden and 39 species belonging to 21 families comprised the host plant population on campus. Family Fabaceae had the highest representation with 4 species followed by Annonaceae, Euphorbiaceae and Rutaceae with 3 species each. Majority of the host plants in the study sites were not randomly distributed and had low density and frequency values ranging from 0.00003 to 0.0008/m² mostly represented by 1-3 individuals. Percent abundance ranged from 0.0789 to 0.2368%. Most plant species were associated with 2 or more species of butterflies for nectar feeding and/or as hosts of butterfly larva while some butterflies depended on one species of plant as its larval host. The results reflect the rarity of host plants in the study sites suggesting the inability to support the food requirements for a butterfly breeding project, perhaps even the wild population of butterflies. It is recommended that a nursery for host plants be established in both sites, an enhancement planting of endemic host plants be implemented and similar study of the same be conducted in the other areas of Mt. Banahaw.

Keywords: butterfly farming, population assessment, host plants

BS-02

FLORISTIC COMPOSITION AND PHYSIOGNOMY OF MANGROVE FOREST IN PAGBILAO, QUEZON, PHILIPPINES

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The species composition and physiognomy of the mangrove forest in Pagbilao, Quezon Province were studied. Vegetation analysis was done within a 20 x 20 m-quadrat established in each of the three zones (landward, middleward and seaward) of the mangrove forest. A total of 37 species were identified in all zones comprising 744 individuals belonging to 28 genera and 18 families. Using Shannon Index of diversity (H'), the landward zone had the highest diversity ($H' = 2.70$) followed by the seaward zone ($H' = 2.56$). The least diverse was the middleward zone ($H' = 1.47$). There was a similar trend in the proportion of various tree heights and diameters in the seaward, middleward and landward zones. The density of small trees was higher than those of the large ones. In terms of diameter at breast height (dbh) classes, there are 237 individuals belonging to 3-30 cm, no individual belonging to 31-40 cm and 2 individuals with 41 cm and above. The height classes of 2.5 m have 177 individuals, 61 individuals belonging to 6-15 m and only one individual with height class of 16 m and above. The Importance Value (I.V.) of the species varied within each zone. In the order of decreasing I.V., *Avicennia marina* > *Aegiceras floridum* > *Sonneratia alba* in the seaward zone. In the middleward zone, *Avicennia officinalis* > *Ceriops decandra* > *Scyphiphora hydrophyllacea*. At the landward zone, *Xylocarpus granatum* > *A. officinalis* > *Rhizophora mucronata* > *A. marina* var. *rumphiana*. The current floristic composition of Pagbilao mangrove indicates that this ecosystem is still diverse.

Keywords: mangrove, floristic composition, physiognomy, species composition, importance value

BS-03

**SPECIES DIVERSITY OF LIZARDS ALONG
ELEVATIONAL BANDS OF MT. HILONG-HILONG,
DIWATA RANGE, AGUSAN DEL NORTE**

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This study aimed to determine species diversity of lizards along elevational bands of Mt. Hilong-hilong, Agusan del Norte. Specially, it aimed to: compare the diversity of lizards along the elevational bands of Mt. Hilong-hilong, describe lizard species, determine the distribution of lizards along elevational bands and assess the status of lizards of Mt. Hilong-hilong. Only the adult forms of lizards were considered in this study. Sampling and collection methods used were transect, opportunistic and random collection techniques, refuge examination and pitfall traps along the seven elevational bands established in mossy (1,500-1,900 masl) and montane forest (1,200-1,500 masl). Alpha Index of Diversity was highest on fifth (1,600-1,700 masl) elevational band and lowest on the rest of the elevational bands. *Sphenomorphus mindanensis* was the only species that was aggregated. *S. coxi coxi* is the most dominant species. *S. coxi coxi* is the most abundant of the 7 species collected since it can be found in most of the elevational bands (second, fourth, fifth, sixth and seventh elevational bands). Results revealed 2 families with 1 genus, *Luperosaurus* which the species remains to be identified, 7 species and 25 individuals. Every species differs slightly with their SVL, tail length and weight which suggest that every species has its distinctive feature. Elevational bands 1,700-1,800 masl and 1,800-1,900 masl had higher similarity indices on lizard species composition compared to other elevational bands. For the ecological status, Philippine endemic species were *S. decepiens* and *S. cf. jagori* and the Mindanao faunal region endemic were *S. mindanensis*, *S. coxi coxi*, *S. cf. diwata* and *S. cf. abdictus abdictus*.

Keywords: species diversity, lizards, elevational bands, Mt. Hilong-hilong, Diwata Range

BS-04

**BIODIVERSITY ASSESSMENT OF
MT. BANAHAW DE DOLORES**

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A study was conducted to assess the diversity of biological communities in Mt. Banahaw de Dolores, Sitio Kinabuhayan, Sta. Lucia, Dolores, Quezon from 700masl to its peak at 2155masl. The area was characterized by identifying the forest trees and wildlife, their species richness and diversity, and dominance. This study is the first biodiversity assessment conducted in the site after a 5-year moratorium on visitation. The forest tree and wildlife inventory including insect collection were conducted and analyzed using Shannon-Weiner, Evenness and Dominance Indices. Result revealed a total of 455 trees representing 92 species and 37 families. For wildlife, a total of 30 species of birds representing 16 families, 5 species of bats, 3 species of amphibians and 2 reptiles were recorded. There were a total of 285 insects identified representing more than 104 families and 17 orders. High values for Shannon-Weiner index (H), and Evenness index (e) and low values of dominance (C) index indicated even distribution of individuals among the species and high species variation and diversity.

Keywords: Mt. Banahaw de Dolores, biodiversity, Mt. Banahaw, species richness, Shannon-Weiner index

BS-05**SPECIES COMPOSITION AND VEGETATION ANALYSIS
OF MANGROVE FORESTS ALONG BUTUAN BAY,
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Mangrove forests along Butuan Bay, Philippines have deep cultural significance to the Butuanons for a thousand years. Habitat destruction has continued to threaten the existence of remaining mangroves. There was no reported inventory of mangrove loss in the area. This study attempts to determine the species composition of mangroves in the four coastal barangays along Butuan Bay. Vegetation analysis was also conducted using sampling plots in the study sites. A total of 16 sampling plots with an area of 100 m² were non-randomly established. Within the main plots were 3 smaller 1m x 1m regeneration plots distributed equally for the counting of saplings and seedlings. There were a total of 28 species of mangroves belonging to 11 different families recorded. The highest number of species was observed in Abilan with 27 species while Pagatpatan had the lowest with 9 species. Vegetation analysis showed that *Avicennia rumphiana* has the highest density, frequency, dominance and importance value (IV). The species *A. rumphiana*, *Rhizophora mucronata* and *R. stylosa* have the highest regeneration of saplings and seedlings. The data generated from the study could be used as baseline information for mangrove conservation.

Keywords: density, frequency, dominance, importance value, Butuanons

BS-06**DIVERSITY OF BATS IN THE MONTANE FOREST OF
MT. HILONG-HILONG, DIWATA RANGE, AGUSAN DEL
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The study describes the diversity of bats in the montane forest of Mt. Hilong-hilong, Diwata Range, Agusan del Norte. Specifically, it aimed to: a) compare the species diversity of bats captured in three net heights, b) determine species richness of bats, c) assess the conservation and ecological status of bats; and d) describe the different species of bats sampled in the montane forest of Mt. Hilong-hilong. The sampling was done on October 22-29, 2006 within the montane forest of Mt. Hilong-hilong, Diwata Range, Agusan del Norte. This study used netting and harp trapping techniques for capturing bat species. Mist nets were set in three net heights: the low net (0-4 high), medium net (4-8 high) and high net (8-12 high). Mist nets were established for the determination of species diversity and harp traps were established to increase the species richness. The study revealed the presence of 137 individual of bats belonging to three (3) families (Pteropodidae, Vespertilionidae and Rhinolophidae) at the total of twelve (12) species. Species diversity of bats was found highest in low net (2.197) as compared to high net (1.792) and medium net traps. Four (4) of the captured bats were Philippine endemic (*Ptenochirus jagori*, *Haplonycteris fischeri*, *Hipposideros obscures*, *Rhinolophus inops*, and *R. virgo*) and one (1) was Mindanao endemic (*P. minor*), some were nearly threatened (*Hipposideros obscures* and *R. virgo*), of least concern (*Kerivoula pellucida* and *K. hardwickii*) and vulnerable (*P. jagori*, *P. minor*, *H. fischeri*, and *Roussetus amplexicaudatus*). Local status showed that most Megachiropteran species were common and Microchiropteran species were rare. Morphometry and diagnostic characters were used to identify the species of bats. Furthermore, the study shows that most species of bats have low flying activity (0-4 m high) above the ground.

Keywords: Diversity, bats, montane forest, Mt. Hilong-hilong, Diwata Range

BS-07**HABITAT DETERMINANTS OF PHILIPPINE-ENDEMIC AND MINDANAO-ENDEMIC BIRD COMMUNITIES ON CANTICOL AND MT. HILONG-HILONG, PHILIPPINES**

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The study focused on the richness, abundance, diversity and habitat use of Philippine-endemic and Mindanao-endemic birds of two mountains in Agusan del Norte – Canticol, Tubay and Mt. Hilong-hilong, RTR from September to November, 2008. Birds were surveyed using eight-minute fixed-radius point counts. Habitat variables estimated included vegetation structure, elevation, slope and the degree of anthropogenic disturbance. Non-linear regression analysis was used to determine the habitat variables that influenced the richness and abundance of endemics in the two sites. Canticol had lower mean density of large and medium trees and higher degree of anthropogenic disturbance than Mt. Hilong-hilong. There were 32 Philippine-endemic birds (five threatened) and three Mindanao-endemics (one threatened) on Canticol while there were 40 Philippine-endemics (eight threatened) and five Mindanao-endemics (three threatened) on Mt. Hilong-hilong. The diversity of endemics was significantly higher on Mt. Hilong-hilong ($H' = 2.31$). Vegetation structure and elevation had greatest influence on the endemic bird communities in the two sites. The study suggests that the two sites need conservation attention to prevent forest loss and endangerment of the threatened endemics. Equally important, adequate regeneration of the disturbed sites in the region must also be prioritized as part of a long-term management strategy.

Keywords: anthropogenic disturbance, Philippine-endemics, Mindanao-endemics, birds, diversity

BS-08

**AQUATIC INSECTS' DIVERSITY AT TAYTAY FALLS IN
BARANGAY TAYTAY, MAJAYJAY, LAGUNA:
INDICATOR OF WATER QUALITY**

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The aquatic insects thriving at Taytay Falls were identified and classified accordingly to its Orders and Families. Assessment of the presence of indicator species was done to determine the water quality of the falls based on the tolerance value and scale of aquatic insects to pollution adopted from Bouchard, 2004. Descriptive method of research was used in the study. Two sampling sites were established using GPS. Three sampling methods of collection were utilized namely; D-net and surber sampler for larvae and naiads and light traps for the adults. Collected insects were brought to the Museum of Natural History for identification. Insect diversity was analyzed using Shannon-Weaver Diversity Index. Findings revealed 22 species of aquatic insects belonging to 19 families distributed in seven Orders were found thriving in the falls. Family Philopotamidae got the highest number of individuals for both sites. Upstreams has the higher number of intolerant species to pollution compared to the downstreams. The presence of species from Orders Plecoptera, Ephemeroptera, Trichoptera and Coleoptera from both sites reflect that the water in Taytay Falls is still in good quality since these indicator species require high dissolved oxygen level in order to survive. The diversity index was high with a value of 3.09.

Keywords: indicator species, d-net, surber sampler, diversity index

BS-09

NICKEL TOLERANCE OF THREE ISOLATES OF ECTOMYCORRHIZAL FUNGUS *Pisolithus* INOCULATED ONTO *Eucalyptus urophylla* S.T. Blake SEEDLINGS

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Nickel is one of the toxic heavy metals common in soils of ultramafic origin in the Philippines, which is seriously affecting plantation establishment and tree growth. Ectomycorrhizal fungi such as *Pisolithus* are found worldwide, and are known to have tolerance to heavy metals. Three isolates of *Pisolithus* collected under eucalypts growing in Western Australia, Philippines and in a mining residue in New Caledonia, were compared for their ability to increase the growth of *Eucalyptus urophylla* seedlings in the presence of nickel (Ni) in pots in a glasshouse. Seedlings, aseptically infected with mycorrhizal fungi and uninoculated, were transplanted into pots containing 3 kg steam-pasteurized yellow sand amended with five rates (0, 6, 12, 24 and 48 mg Ni kg⁻¹ soil, coded as Ni-0, Ni-6, Ni-12, Ni-24 and Ni-48, respectively) of Ni (as NiCl₂). A few days after transplanting, all seedlings subjected to Ni rates greater than Ni-12 died. After 12 weeks, uninoculated Ni-6 and Ni-12 seedlings had reduced root growth and exhibited severe toxicity symptoms (chlorosis on young leaves and shoot tips). Ni-12 reduced the length of roots colonized by *Pisolithus*. However, *Pisolithus* infected seedlings grew better at Ni-6 and Ni-12 than the uninoculated counterpart. Inorganic plant analyses revealed that inoculation increased plant growth through improved P uptake but did not prevent Ni uptake. Ni toxicity, however, was minimized by dilution due to an increase in plant biomass. Inoculation partially overcame depression of Fe uptake to the shoot at Ni-6 but not at Ni-12. In conclusion, the three isolates of *Pisolithus* differed in their tolerance to Ni and that the New Caledonian isolate from a Ni mine site was the best and may have greater potential to improve the growth and survival of *E. urophylla* seedlings in ultramafic soils in the Philippines.

Keywords: ectomycorrhizas, *Eucalyptus urophylla*, heavy metals, nickel, ultramafic

BS-10

DETERMINING THE EFFICIENCY OF *Talinum paniculatum* (Jacq) Wild AS A PHYTOREMEDIATOR AND ITS MORPHO-ANATOMICAL RESPONSES TO IRON IN LATERITIC SOILS

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Mining sites in the Philippines may pose possible deleterious effects to society both in the economic and health sector due to water and soil contamination, thus decontamination of polluted soil and water is necessary. This study aims to evaluate the effectiveness of *Talinum paniculatum*, commonly called “Jewels of Opar”, as a phytoremediator for Fe in lateritic soil from Brooks Point, Palawan. This study will also establish its leaf anatomy and its morpho-anatomical effects on the leaves using different histological techniques for tissue processing, and determine the uptake of Fe in leaf through plant tissue analysis. Data gathered was statistically tested using repeated Analysis of Variance (ANOVA). Five soil treatments (garden soil, 25%, 50%, 75% and 100% lateritic soil) with *T. paniculatum* cuttings were set up. For morphological responses, leaf color was approximately at 3 (medium green), with the use of the leaf color chart, which indicated neither deficiency nor over-dosage of Fe. The number of leaves and nodes, plant height, and leaf surface area were relatively high (13 leaves, 9 nodes, 107 mm in height and 279.7 mm leaf surface area) in 75% lateritic soil. . The leaf anatomy is of the “Kranz” type, and it exhibited the typical anatomy of the leaf, which implies normal metabolism and chlorophyll functioning due to Fe. Uptake of Fe in the leaves showed that amounts of Fe in garden soil are 2555 ppm, 2338 ppm for 25% lateritic soils, 1485ppm for 50% lateritic soils, 3720 ppm for 75% lateritic soils, and 4232ppm for 100% lateritic soils. These signify higher amounts of Fe in the leaves grown in 75% and 100% lateritic soil. This study will add to the baseline information in anatomy and its potential use as phytoremediator and as guide to consumers since the leaves are edible in certain parts of the world.

Keywords: iron, *Talinum paniculatum*, lateritic soils, morpho-anatomy, phytoremediation, Kranz leaf anatomy

BS-11

**GROWTH PERFORMANCE AND PHYTOREMEDIATION
POTENTIAL OF *Pongamia pinnata* (L.) Pierre,
Samanea saman (Jacq.) Merr. AND *Vitex parviflora* Juss
IN COPPER-CONTAMINATED SOILS
AMENDED WITH ZEOLITE AND VAM**

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A pot experiment was conducted to investigate the growth performance and phytoremediation potential of *Pongamia pinnata*, *Samanea saman*, and *Vitex parviflora* in a Cu contaminated soil obtained from an abandoned mined out area amended with VA mycorrhiza and zeolite. Best growth response among the species varies in the following order: *P. pinnata* > *S. saman* > *V. parviflora*. Addition of zeolite and VAM were not significant to enhance height, diameter and biomass production of the three species indicating their practical applicability in reclaiming copper contaminated soils. The exposure, however, causes retardation of root growth as large proportion of the total biomass yield was observed in the shoots. Even so, root to shoot ratio values are generally within the ideal ratio of healthy or quality seedlings. Beneficial effects of zeolites were observed in the uptake of soil Cu but vary with species. The phytoremediation benefits from VAM are not yet clear because of the very low root infection observed in the study. Interestingly, despite the very low percent Cu uptake, both *V. parviflora* and *S. saman* have the ability to transport Cu at an average of 37.0 and 78.25 µg g⁻¹ dry wt, respectively, from roots to shoots beyond the toxicity threshold (20-30 µg g⁻¹ dry wt) indicating their high level of tolerance to Cu toxicity. All the three species limited high amounts of Cu translocation within the roots; hence, are highly suited for phytostabilization or for delimiting areas with Cu contamination.

Keywords: vesicular arbuscular mycorrhiza, zeolite, bioremediation, heavy metals

BS-12**BIOREMEDIATION PERFORMANCE OF *Arachis pinto*
(MANI -MANI) UNDER GREENHOUSE CONDITION**

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Phytoremediation is the use of plant to mitigate environmental problems like soil contamination. This is less expensive, less-disruptive to the environment and one of the most effective methods in soil remediation because it has the potential to treat sites with more than one type of pollutant. The study aimed to evaluate the bioremediation performance of *Arachis pinto* under greenhouse condition. This study was initiated by obtaining soil from the Laoag sanitary landfill and subjected to Cd, Cu, Pb and Zn analysis. Using three (3) types of soil media namely: landfill soil without amendment(LSw/oA), landfill soil with amendment (LSw/A) and garden soil (GS), performance of the plant was observed in terms of % survival, growth responses and biomass production. Results showed that *A. pinto* survived in any of the soil media. However, its growth and biomass production were better in the sanitary landfill soil with amendment with greater number of leaves and branches(19.32 and 5.17), greater size (Sd=2.51mm, Rd=1.95mm, RI=12.11cm, H=23.93cm) and greater total biomass (57.77g).While, its growth and biomass production in LSw/oA (Sd=2.31mm, Rd=1.28mm, RI=7.87cm, H=18.47cm, biomass=42.22g) was as good as in GS Sd=2.46mm, Rd=1.27mm, RI=9.55cm, H=20.40cm, biomass=46.57). After 60 days, plant tissues were analyzed for metal uptake by AAS. Results showed that absorption is more efficient in the landfill soil with amendment than in landfill soil without amendment. Bioaccumulation Coefficient (BAC) analysis in the plant tissues showed that metal accumulation is most efficient in the roots, followed by the stems and least in the leaves. Based from the BAC values determined, *A. pinto* is capable of metal accumulation and is evaluated to be a moderate accumulator of Cd, Pb, Zn and Cu.

Keywords: Phytoremediation, heavy metal accumulation, Bioaccumulation Coefficient, *Arachis pinto*

BS-13

BIOREMEDIATION POTENTIAL OF BACTERIAL ISOLATES FROM THE LAOAG CITY SANITARY LANDFILL

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Bioremediation addresses the use of microorganisms to remove ground soil contaminants that remain in place during the clean up. The challenge has been to enhance the activity of these microorganisms and develop a means to bring the contaminant into direct contact with the organisms to achieve optimal bioremediation. The study aimed to isolate and characterize bacteria from the Laoag City Sanitary Landfill and evaluate their potential to bioremediate lead-contaminated soil. In conducting the study, four (4) treatments (100, 120, 140 and 160 ppm) were made with different concentrations of lead nitrate to determine the potential of bacterial isolates in cleaning up lead. Based from their morphological characteristics and gram staining affinity, there were four (4) bacteria isolated from the sanitary landfill soil namely Isolates A, B, C and D. Isolate A is a gram positive, undulate, smooth, irregular, umbonate and filiform rod. Both B and C were undulate, smooth, irregular, umbonate rod bacteria but B was gram positive while C was gram negative. Isolate D was circular, convex, entire, smooth, effuse gram positive coccus. All the isolates were able to survive (100%) and grow in culture media containing 45 ppm-160 ppm lead nitrate. Comparatively however, Isolate D exhibited the narrowest tolerance having the least mean number of colonies of 10 CFUs when grown in media containing 160 ppm lead while Isolates A, B and C had 56.6, 33.3 and 16.6 CFUs respectively. These indicate that all the bacterial isolates from the sanitary landfill soil have the potential to bioremediate lead-contaminated soil with Isolate A exhibiting the greatest potential as lead accumulator.

Keywords: bioremediation, lead accumulation, lead tolerance, bacteria, sanitary landfill

BS-14**CYTOLOGIC AND MITOGENIC EFFECT OF TOPICAL MINOXIDIL ON THE SKIN OF *Mus musculus***Doreen D. Domingo¹ and Majal Rani O. Espiritu²¹Mariano Marcos State University Batac; dr_dhee_dee@yahoo.com²Saint Louis University, Baguio City

Mice and humans share the same gene for growing and shedding hair. But when it is faulty, hair doesn't grow back normally and over time people go bald, to varying degrees. Hence, topical application of minoxidil had guaranteed many users for hair growth without necessarily looking at the effect it may contribute to the skin. To evaluate the effect of minoxidil on the (skin) epidermal cells of white mice, cytologic and mitogenic characteristics were considered. Findings revealed that skin epidermal cells' width and length in the MTM-minoxidil treated mice {male: \bar{x} = 3.85 μm (w); 3.95 μm (l) / female: \bar{x} = 4.14 μm (w); 4.02 μm (l)} were comparable in size with the MUM- minoxidil untreated mice, {male: \bar{x} = 4.45 μm (w); 4.66 μm (l) / female: \bar{x} = 4.90 μm (w); 4.77 μm (l)}. However, the size of the epidermal cell nucleus in the MTM (male: \bar{x} = 2.32 μm ; female: \bar{x} = 2.38 μm) were smaller compared to the MUM (male: \bar{x} = 2.86 μm ; female: \bar{x} = 2.65 μm). Considering the hair follicles in the skin of MTM(male), the hair follicles significantly showed higher values in width (\bar{x} = 23.67 μm) and length (\bar{x} = 87.17 μm) as compared to the control (width \bar{x} = 6.85 μm and length \bar{x} = 15.17 μm). Moreover, increase in hair diameter (male: \bar{x} = 6.16 μm ; female: \bar{x} = 5.04 μm) was also observed in the MTM. As regards mitotic index, MTM obtained lesser values (male: \bar{x} = 0.44; female: \bar{x} = 0.52) as compared to MUM, (male: \bar{x} = 0.61; female: \bar{x} = 0.79). Indeed, topical minoxidil had explicitly shown cytologic and mitogenic impact on skin (epidermal) cells of female and male mice.

Keywords: cytologic, mitogenic, minoxidil, skin, white mice

BS-15

HISTOCHEMICAL STUDY ON *Hibiscus rosa-sinensis* L. (GUMAMELA) FLOWER AND THE EFFECT OF ITS EXTRACT ON WHITE MICE FETUS

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Hibiscus rosa-sinensis L. (gumamela) has been valued for its medicinal uses. There are however reports of it being abortifacient. This study determined the presence of phytochemicals in the flower and evaluated the effect of gumamela flower extract on the morphological development of white mice fetus. The following were the treatments replicated five times in a Completely Randomized Design (CRD): T1 (2g/ml aqueous extract); T2 (1g/ml aqueous extract); Negative control (distilled water); Positive control (5.5mg/ml tetracycline). The treatments were administered to pregnant mice orally at 0.2 ml for two weeks. Results of histochemical tests revealed the presence of alkaloids, arbutin, tartaric acid, fats and oils in the epidermis, vascular bundle and cortex of the petals of gumamela flower. Morphological examination of the fetuses showed no abnormalities except for the significantly smaller body weight in T2 (0.36 g) and T1 (0.50 g) compared to the negative control (1.26 g). The fetuses of the treated pregnant mice also had smaller body length of 1.6 cm compared to the negative control with 2.2 cm. The computed implantation index was highest in the negative control (8.8) and least in T1(5.8). It is concluded that the gumamela petal extract has a potential detrimental effect on the fetus of white mice.

Keywords: *Hibiscus rosa-sinensis* L., gumamela, white mice, pregnancy, histochemical test

BS-16

**CELLULAR PHONE RADIATION EFFECTS ON THE
FETUS OF WHITE MICE**

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Cellular phones are considered indispensable by man nowadays. The side effect of its use however remains to be seen. This study aimed to determine whether cellular phones have effects on the development of white mice. Eighteen pregnant white mice were divided into three groups subjected to the following treatments: T_0 - control/unexposed to cellphone radiation; T_1 - 18 hours exposure/day for 10 days; T_2 - 18 hours exposure/day for 20 days. After 20 days, all treatment mice were sacrificed by cervical dislocation and the fetuses examined. Body weight, body length and morphology of each fetus were determined. Implantation and gestation indices were also computed. Data were analysed using Kruskal-Wallis Test. Results showed that the fetuses of exposed pregnant mice had significantly ($K= 15.00$, $P = 0.0006$) lesser body weight than the control. T_0 had an average body weight of 1.15g while T_1 and T_2 had 0.51g and 0.36g respectively. They had significantly ($K= 14.44$, $P = 0.0007$) shorter body length than the control. T_0 had an average body length of 2.22 cm while T_1 and T_2 had 1.48 cm and 1.39 cm, respectively. Morphological examination of the fetuses revealed no difference in terms of the number of eye slits, ears, legs and digits. The treated mice however appeared to have less developed organs than the control. The treated mice also had slightly lower implantation indices. It is concluded that cellular phone radiation at Specific Absorption Rate (SAR) of 1.24 W/kg caused growth retardation in white mice fetus.

Keywords: cellular phone, radiation, white mice, pregnancy, growth retardation

BS-17

TERATOGENIC EFFECT OF *Datura metel* LEAF AQUEOUS EXTRACT ON THE EMBRYO OF *Danio rerio*

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Gross morphological observation was done on the embryos of *Danio rerio* (zebrafish) treated with leaf aqueous extract of *Datura metel* (talampunay or talong-punai). Since talampunay has been known for its medicinal importance as well as its narcotics effect, its teratogenic effect was evaluated using zebrafish embryo. The embryos were subjected to leaf decoction with a ratio of 1 gram of leaves to 1 ml of water. Treatments were 0.01%, 0.05%, 0.1%, 0.5%, 1%, 5%, 10% and a negative control. The experiment was done in two replicates with ten embryos per treatment. After five days of observing and examining the gross morphology and development, it was found out that it greatly affected the development of the embryos as the concentration increases by delaying its maturity by 75% or even kill the embryos (all embryos at the 10% concentration). Thus, *D. metel*, especially the leaves, is a potential teratogen. This study may be useful in evaluating potential teratogens as well as the development of new therapeutic drugs safe for pregnancy.

Keywords: teratogen, teratogenicity, talampunay, *Datura metel*, zebrafish embryos

ASSESSMENT OF RESILIENCY OF INTERTIDAL MANGROVE COMMUNITIES TO NUTRIENT FLUXES AND CLIMATE CHANGE

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This study investigated the effects of the different factors such as variations in the amount of sunlight, ambient temperature, soil and water nutrients (sodium, potassium, and phosphorus), rainfall, and tidal events which potentially affect productivity and resiliency in intertidal mangrove communities. The following study sites were selected: Site 1: intertidal zone affected by nutrient discharges of proximate agricultural activities and hardly rinsed by tidal waterlogging; Site 2: primeval/pristine intertidal community recurrently rinsed by tidal inundation; Site 3: intertidal zone receiving nutrient loads from residential communities but instantaneously dispatching nutrients in recurrent tidal flooding. The study evidently indicated that variability in light (100 to 5,000 fc), temperature (25-32°C), and relative humidity (30-50%) caused very minute effects in chlorophyll production in *Avicennia marina* mangroves. The mangroves' productivity, growth and development (estimated from O₂ production ~ ranged from 16.5 to 36.3 μ moles/l/hr) turned out to be resilient to the effects of humidity, temperature, and light. Rainfall events caused potassium surges in certain areas. Increase in the amount of rainfall did not upsurge soil nitrate and phosphorus concentrations in almost all of the sites. Likewise, fluctuations and outpouring of potassium and nitrate ions did not emerge to be the limiting or supplementing factor in the primary productivity of the mangrove community. The lone variable that established significant effects on chlorophyll production/photosynthetic activity was the soil phosphorus concentration. Seasonal reserve storage of phosphorus by mangroves during phosphorus outpouring in the rainy season has been established to intensify resiliency of the intertidal community by ensuring availability of phosphorus throughout episodes of phosphorus depletion during tidal waterlogging.

Keywords: intertidal zone, resiliency, nutrient fluxes, *Avicennia marina*, mangroves

BS-19

ECOLOGICAL ASSESSMENT OF MANGROVE COASTAL AREAS OF MULANAY, QUEZON, PHILIPPINES

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Mangroves are productive coastal ecosystems threatened worldwide. Rehabilitation of these mangroves is a priority of Mulanay municipality. Since there is no baseline information available to guide land managers and policy makers in implementing proper rehabilitation initiatives, this research aims to assess the species diversity, population density, species importance value, degree and type of impact and physico-chemical properties of the mangrove areas in Mulanay. Results revealed eleven species of mangroves belonging to five families. Dominant species is *Avicennia marina* (0.28). Three species from Patabog have higher importance value (IV), *Ceriops decandra* (1.97), *Rhizophora apiculata* (1.80), and *A. marina* (1.48). Six coastal barangays were disturbed by anthropogenic activities. Two showing rather high impact, one showing moderate impact. Soil analysis revealed that eight sites have 0.01- 0.02% nitrogen, 0.4 – 6 ppm phosphorus. Soil potassium ranges from 0.9-3.4 ppm and electrical conductivity from 2.92-11.15 mmhos/cm, respectively on all barangays. Sta. Rosa had the highest organic carbon (0.42 %)/organic matter (0.72 %). Ibabang Yuni had the lowest (0.11 %)/(0.19 %). Sagongon and Butanyog had the highest pH (8.6), Patabog had the lowest (7.8). Coastal water monitoring showed that July had the highest temperature ranging from 29.9 - 32.3°C while January had the lowest (25.3 – 28.5°C). These results provide the information Mulanay needs on proper rehabilitation of mangroves. Currently, local government units adhere to the serious implementation of environmental laws for proper protection and conservation of mangroves.

Keywords: mangroves, diversity, conservation, rehabilitation, ecological assessment

BS-20**VEGETATION AND LAND-USE OF MAK-BAN
GEOTHERMAL AREA, PHILIPPINES**

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CHEVRON Geothermal Philippines, Inc. (CGPHI) and Aboitiz Power Renewable Inc. (APRI) are operating within the areas that are supporting multiple uses other than geothermal generation. Within their areas of operations are perennial crop-based agricultural areas, forest reserve, resorts, industrial and residential areas. One important aspect of generating geothermal power is taking care of watershed areas that are essential in protecting and maintaining healthy water recharge system and undertaking active conservation and rehabilitation efforts. The objectives of the study were to ground validate the cover areas identified as potential critical areas such as headwaters, riparian areas, areas with existing high canopy density and areas with biodiversity conservation potential and measure forest canopy density, list forest or perennial crop cover and assess land management practices. A total of 26 sample plots were established and measured within the project site. A greater proportion (from 67% to 91%) of the ecological influence areas are covered with vegetation canopies ranging from low to high density. The vegetation cover and land use in the area include intact natural forests (mossy forest, lowland dipterocarp forest), secondary forests, coconut plantations, fruit orchards, banana plantations, as well as grassland areas. All sub-watershed areas are more than 60% vegetation cover. Low vegetation density and built-up areas are concentrated on the lowland areas, which are privately owned. Overall, the lowland areas are dominantly coconut-based farms that are either multi-story or mono-perennial.

Keywords: critical areas, land-use, headwaters, perennial crop-based agricultural areas, riparian areas

BS-21

ECOLOGICAL STATUS OF CAMATIAN RIVER IN LUCBAN, QUEZON: A TRIBUTARY TO LAGUNA DE BAY

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Lucban, Quezon has seven rivers that drain to Laguna de Bay; Camatian River is one of them. The increasing population in the vicinity makes it and other tributaries exposed to rising environmental impacts due to domestic and agricultural wastes. This study was conducted to assess the ecological health of Camatian River which is hope to serve as an awakening call to the people of the consequent total impairment of this resource and public health problems. Epilithic algae were collected from three sampling stations from June to November 2008 and were analyzed for species abundance and diversity. Water samples were analyzed for physico-chemical parameters and fecal coliform. Biological indices were also determined. Results showed high levels of fecal coliform bacteria (1.4×10^7 MPN/100 ml sample), total dissolved solids (291 μ S/cm), $\text{NO}_3\text{-N}$ (1.63mg/L) and dissolved $\text{PO}_4\text{-}$ (0.98 mg/L) but low level of dissolved oxygen (4.46 mg/L). Microscopic analysis revealed that of the 32 algal species in Camatian River, seven were moderately to highly pollution tolerant with *Nitzschia palea* as the most dominant. For biological indices, it has high algal pollution index (16-28) and low Shannon diversity index (1.404-2.349). Parameters imply that Camatian River is moderately to heavily polluted. The quality of water falls under Class D according to National Standards and threatens the remaining aquatic organisms present. Data obtained were presented to the Local Government Unit as baseline information for the development of a comprehensive rehabilitation, conservation and monitoring program for Camatian River.

Keywords: ecological assessment, Lucban, Quezon, epilithic algae, water quality, algal pollution index

BS-22**ENVIRONMENTAL CONDITIONS INFLUENCING
DAYTIME ABUNDANCE OF MESOZOOPLANKTON AND
ICHTHYOPLANKTON IN MARINE RESERVES IN ILIGAN
BAY, NORTHERN MINDANAO, PHILIPPINES**

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Coral reef associated zooplankton provide nourishment to larvae and juveniles of resident fish and invertebrate species. Eggs, larvae and juveniles of many reef species of prime ecological and economic importance recruit in the zooplankton. The clean waters of marine reserves are assumed to contain nutritious zooplankton, but the ecology of reef zooplankton in marine reserves is rarely studied. This study utilised multivariate redundancy analysis in order to discern possible relationship between selected environmental conditions and zooplankton abundance in five established marine reserves in Iligan Bay. Daytime quantitative sampling of zooplankton and environmental variables were conducted in marine reserves located in Initao, Dalipuga, Buruun, Kauswagan and Bacolod. We found statistically significant relationships in all five reserves, and evaluation of the importance of various environmental conditions using a Monte Carlo permutation yielded significant values for chlorophyll *a*, depth, pH, time and tide. For instance, peaks in abundance of fish eggs and fish prey copepods coincided with high chlorophyll *a* values, deeper depths, rising tides, and sampling times close to sunset (1700H). However, this was not explicitly shown by peaks in fish larvae abundance as unstudied variables like predation and hydrodynamics may be most important explanatory variables. In conclusion, this study demonstrates the usefulness of multivariate analysis in ascertaining environmental variables that influence peaks of abundance of mesozooplankton and fish eggs and larvae which are important indicators of the role and status of marine reserves.

Keywords: marine reserves, Iligan Bay, ichthyoplankton, ecology, zooplankton

BS-23

ASSESSMENT OF MANGROVES IN ENCLARO, BINALBAGAN, NEGROS OCCIDENTAL

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This study was a descriptive survey on the assessment of mangroves conducted to identify the mangrove structures in the coastal areas of Barangay Enclaro. There were four sampling sites namely: Sitio Serena, Sitio Vietnam Rose, Sitio Alo and Sitio Tap-ok. The mangroves were assessed in terms of species, diversity, abundance, density and stages of life cycle. The quadrat method and the transect plots were used to perform floristic inventory of mangrove stands. There were 10, 4, 6 and 6 species of mangroves in Serena, Vietnam Rose, Alo and Tap-ok sites, respectively. *Rhizophora mucronata* comprised 55.22% of the total stands in Serena and *Avicennia marina* which covered 72.21% in Vietnam Rose, 81.19% in Alo and 40% in Tap-ok. Serena had the most diverse mangrove species. *A. marina* was the most abundant and dominant mangrove species which covered 66.47% of the total population. The mangroves in Vietnam Rose had the highest density of 15.94 mangroves/m². The stages of mangroves' life cycle were 50.67% seedlings, saplings comprised 25.20% and mature mangroves composed 24.13% of the total population. Sitio Alo had the least mangrove stand and the results of this study would serve as baseline information for the local government units for mangroves and coastal ecosystems' conservation, management and development.

Keywords: ecological mangroves assessment, species, abundance, density, diversity stages of life cycle

BS-24

POLLUTERS AND WATER QUALITY OF CEBU CITY RIVERS

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The study was conducted to determine the water quality of the Palma river in Cebu City and the main causes of the river's severe water pollution. Laboratory technique and Contingent Valuation Method (CVM) were used in this study, with the Barangay officials and purok leaders as trained respondents. The findings revealed that the waters of the river had opaque to black color emitting bad odor; a pH value of 7.4; Dissolved Oxygen at zero (0); BOD at 150 mg/L; TSS at 27 mg/L; temperature at 29°C. Soil of the river bed is black. Waste disposal practices of riverbank residents (95%) and industries and commercial establishments (5%) within the runoff area were the causes of pollution of river water. The major source of waste water discharges that directly drains into the river were residential, commercial, and industrial effluence. Sickness occurrence per year per were fever (22% of the households); cough and colds (27%); allergies (9%); asthma (8%). Respondents were not aware (80%) on what a waste treatment facility is. Respondents were willing to pay an amount of PhP50.00 a month as charge per household for wastewater treatment fee based on the volume of water consumption gauged on Metropolitan Cebu Water District meter system. Policy for the tariff system shall be necessary.

Keywords: pollutants, environment, contingent valuation method

BS-25

ASSESSING WATER QUALITY AND LARVAL MOSQUITO ABUNDANCE IN CALOOCAN CITY, PHILIPPINES

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This study aims to examine the relation of the water quality parameters of the breeding habitats of mosquitoes from randomly selected communities of Caloocan City, Philippines to the abundance of the larval mosquitoes inhabiting these breeding habitats. Water samples obtained from the breeding habitats were assessed for dissolved oxygen, pH, conductance, and salinity. Mosquito larva surveys were conducted in all breeding habitats. The 4th instar mosquito larvae obtained were identified at the genera level. The relationship between the abiotic variables (dissolved oxygen, pH, conductance, and salinity) and the abundance of mosquito larvae was investigated through a regression analysis. Results showed that there are three common genera of mosquito larvae surveyed in all the breeding habitats: *Aedes sp.*, *Anopheles sp.*, and *Culex sp.* Among the three genera, *Aedes* was the most common genus among the larval mosquitoes identified. All water samples obtained from the breeding habitats were within the water quality standards. Results of the multiple regression analysis suggest that dissolved oxygen is the best predictor variable associated with the abundance of mosquito larvae ($Y = -37.92 + 8.00 [\text{DO}]$, $r^2 = 0.145$, $P < 0.05$). The dissolved oxygen in the waters plays an important role in the abundance of larval mosquitoes in breeding habitats.

Keywords: mosquito larva, water quality, abundance, dissolved oxygen

BS-26

**ULTRASTRUCTURAL PREDATORY ACTIVITY OF
Arthrobotrys oligospora ON PARASITIC JUVENILE STAGES
OF CITRUS NEMATODE, *Tylenchus semipenetrans***

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This experiment tried to harness nematode trapping fungi as biological control agent against the causal organism of citrus decline, *Tylenchus semipenetrans*. *Arthrobotrys oligospora* was taxonomically characterized and they belong to a group of nematode-trapping fungi, which possessed specialized structures in the form of rings, which are extensions of the mycelium to capture, kill and digest nematodes. Initial population density (IPD) was recorded and population build up started on the month of February and reach the peak in the month of May and eventually declined in August. The time of effective parasitism was noted between 4 to 8 days after inoculation. *T. semipenetrans* starts to capture 24 hours after inoculation. Ultramicroscopic study revealed that the presence of ring-nets, adhesive conidia and hyphae are the structures for predaceous ability of *A. oligospora* against *T. semipenetrans*. *In vitro* and *in vivo* study proved that there was a significant reduction of juvenile stage of *T. semipenetrans* when a nematode-trapping fungus was used.

Keywords: predatory activity, *Arthrobotrys oligospora*, *Tylenchus semipenetrans*, parasitic juvenile stage

BS-27

STATUS OF BUTTERFLIES IN DINAGAT, PHILIPPINES**Alma B. Mohagan** and Dave P. MohaganDepartment of Biology, Central Mindanao University, Bukidnon
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Information on the status of butterflies in the three habitat types of Dinagat is herewith provided. Belt transect, light and malaise traps and time constraint samplings were employed in the three mountains namely: Mt. Paragua, Mt. Redondo and Mt. Kimbinliw. Data revealed 102 species of butterflies. Of these, 72 or 71% were endemic: ten rare Philippine endemic, 18 common Philippine endemic, 1 very rare Philippine endemic, 3 rare Mindanao endemic, 6 common endemic and 2 rare Dinagat Island endemic. Three of the species are new record to the Philippines, 4 new record to Mindanao namely: *Cephrenes ocalle chrysozona*, *Hyarotis iadera*, *Tagiades gana elegans* and *Taractrocera luzonensis luzonensis*, 58 new record to Dinagat and 28 recorded species in Dinagat islands in the previous study. The 102 species with 71% endemism and the presence of newly recorded and possible new species to science are noteworthy for conservation. Fifty percent of the species found in each habitat are disconcordant and most of the endemics were found in the forest habitats. These simply suggest that forests are important in sustaining the lives of the endemic butterflies in the area.

Keywords: diversity, butterflies, Dinagat Islands

BS-28

MYCOCHEMICAL ANALYSIS, NUTRITIONAL CHARACTERIZATION AND TOXICITY OF *Lentinus tigrinus*, A PHILIPPINE EDIBLE MUSHROOM

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Lentinus tigrinus is a wood-rotting fungus that is usually found growing on fallen logs during the onset and middle part of the rainy season where moisture is abundant. This mushroom has a great potential for cultivation. Its relative, *Lentinula edodes* was introduced in the country due to its aroma and applicability for gourmet purposes. Though most preferred, cultivation of *L. edodes* in the country is being delimited due primarily to its semi-temperate requirement for growth. One of the best alternatives is to search a nutritious local counterpart. In this study, we determined the proximate nutritional and mycochemical contents of fruiting bodies of *L. tigrinus* harvested in the formulation of rice straw-sawdust based substrate. The lyophilized extract of *L. tigrinus* was tested in female ICR mice following the single dose toxicity test by oral gavage for its biosafety. Both air-dried pileus and stipe of *L. tigrinus* hold promising nutritional contents. The pileus had higher amount of crude protein (25.90%), crude fat (2.12%), ash (7.41%) and moisture (12.20%), while the stipe had higher amount of carbohydrates (43.02%) and crude fiber (24.74). Moreover, flavonoid was the only chemical constituent detected in the hot water extract. Acute single oral toxicity test in mice confirmed that *L. tigrinus* is toxicologically safe. Altogether, *L. tigrinus* is an addition to the newly recorded safe, edible and nutritious mushroom of the Philippines

Keywords: *Lentinus tigrinus*, mycochemical, nutritive, toxicity, edibility

BS-29

**IDENTIFICATION AND CHARACTERIZATION OF THE
CHALCONE SYNTHASE GENE (CHS) IN *Curcuma longa* L.
AND *Curcuma zedoaria* Rosc. RHIZOMES**

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Chalcone synthase catalyzes the production of a number of secondary metabolites in *Curcuma longa* L. and *C. zedoaria* Rosc. The objective of this research is to identify the chalcone synthase gene which encodes for Chalcone synthase enzyme. Gene specific primers for chalcone synthase (CHS) gene were designed using the software VectorNTI. The sense primer has the sequence 5' –CAAGGACCTGGCGGAGAACA-3' and the antisense primer 5' -CGCTTCCTCACCTCGTCCAT-3'. Both primers have 20 base pairs with an optimum melting temperature of 57°C. Genomic DNA of *C. longa* L. and *C. zedoaria* Rosc. were extracted. PCR amplification settings were optimized. Different DNA template dilutions of 1:20, 1:50 and 1:100 were used. At 60°C melting temperature (denaturation 1:00; annealing 1:00; elongation 2:00), there were no distinct PCR products that were produced. In the second PCR trial, 61°C was used as the melting temperature (denaturation 0:30; annealing 0:30; elongation 1:00). Faint bands were observed at the 1:100 dilutions for both *C. longa* L. and *C. zedoaria* Rosc. The 1:100 dilution was subjected to MgCl₂ gradient concentration. Different concentrations of MgCl₂ (0.5 mM, 1.00mM, 2.00 mM and 2.5 mM) were used. Distinct bands emerged in the agarose gel after electrophoresis at the 2.00 mM and 2.5 mM MgCl₂ for *C. longa* L. and 2.00 mM MgCl₂ for *C. zedoaria* Rosc. The primers designed were able to amplify the chalcone synthase gene (CHS) gene in *C. longa* L. and *C. zedoaria* Rosc. at the optimum PCR profile and the optimized concentration of MgCl₂ in the second PCR trial. Hence, the chalcone synthase gene for *C. longa* and *C. zedoaria* was identified using a gene specific primer.

Keywords: Chalcone synthase gene, Zingiberaceae, *Curcuma*, *C. longa*, *C. zedoaria*

BS-30

**MOLECULAR SEQUENCE CHARACTERIZATION
OF THE GLYCOLYTIC REGULATORY ENZYME,
PHOSPHOFRUCTOKINASE IN *Cocos nucifera* L.****Reggie Yadao-dela Cruz**

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Normal coconut and mutant *makapuno* endosperms profoundly differ in their carbon metabolism. In an attempt to explore the makapuno phenomenon, the most important regulatory enzyme of glycolysis, phosphofructokinase (PFK), was cloned and characterized. cDNA from isolated total RNA was used as a template during PCR with the designed primers. The cloned *cnpfk* partial sequence is composed of 1230 bp and found most similar to a bamboo *Phyllostachys edulis* cDNA clone (FP093159.1) with 80% maximum identity (= 1070 bits; E=0.0) upon BLASTn analysis. It has 79% maximum identity (E=0.0) to sequences of *Vitis vinifera*, *Oryza sativa*, *Ricinus communis*, *Sorghum bicolor* and *Zea mays*. The 1230-bp sequence designated as *cnpfk* is 59.6% of the 2067-bp *P. edulis* cDNA clone and 62% of the 1988-bp sequence of the *R. communis* phosphofructokinase (XM_002514143.1). It codes for a 410-amino acid protein sequence with conserved domains characteristic of the PFK superfamily. The translated protein has several active sites, binding sites for fructose-1,6-biphosphate, binding sites for ADP/pyrophosphate binding, allosteric effector sites and a dimerization interface. BLASTP analysis of the translated protein revealed its highest homology (736 bits; E=0.0) to *R. communis* phosphofructokinase. High homology was also seen with similar sequences from *V. vinifera* (733 bits; E= 0.0); *Arabidopsis thaliana* (733 bits; E= 0.0); *O. sativa* (723 bits; E= 0.0) and *Z. mays* (715 bits ; E= 0.0). BLAST analyses of five other genes involved in carbon metabolism from previous studies - enolase, glyceraldehyde-3-phosphate dehydrogenase(GAPD), pyruvate kinase, beta-ketoacyl carrier protein synthase I (KASI) and pyruvate decarboxylase - were carried out. Results pointed to *R. communis* as another oil-storing plant whose data can be used as basis for further studies on coconut molecular genetics and physiology and most especially in exploring the molecular basis of the makapuno phenomenon.

BS-31

PRELIMINARY ESTIMATION OF GENETIC VARIATION THROUGH ISOZYME ANALYSIS IN FRESHWATER SARDINES, *Sardinella tawilis* (Herre), FROM TWO DIFFERENT SITES NEAR TAAL LAKE: LEMERY AND TALISAY, BATANGAS

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Genetic variation in freshwater sardines, *Sardinella tawilis* (Herre), from two sites near Taal Lake: Lemery and Talisay, was determined through isozyme analysis using four enzyme systems: acid phosphatase (ACP), alkaline phosphatase (ALP), esterase (EST), and malic enzyme (ME). The eye, heart, and muscle tissues were collected. Results revealed four presumptive loci in both populations (ACP-1, ALP-1, EST-1, ME-1). An interpopulation variation was noted between the eye and muscle tissues of the two populations in terms of EST-1. The degree of genetic variability within each population was determined by calculating the proportion of polymorphic loci (P), average number of alleles (A), and average heterozygosity (H). The genetic variation between organs and between populations was assessed through the estimates of genetic identity (IN), genetic distance (D), and genotypic similarity (IH). Among the organs, the heart showed the highest genetic variability based on the P (0.75), A (1.75), and H (0.369-0.371) values in both populations. Isozyme variation in the organs could be attributed to the differences in their physiological functions. The computed IN, D, and IH showed the same trend in the two populations, wherein the eye tissues had greater relatedness with muscle tissues. The two populations when compared revealed the same values for P (0.75) and A (1.75). However, the average heterozygosity was slightly higher in the Talisay population (H=0.291) than the Lemery population (H=0.249). The computed values for IN (0.929), D (0.074), and IH (0.869) implied high relatedness between the two populations showing that the geographical distance between Lemery and Talisay is not enough to produce significant isozyme variation based on the enzyme systems used.

Keywords: *Sardinella tawilis*, isozymes, starch-gel electrophoresis, genetic variation, isozyme polymorphism

BS-32**EVALUATION OF THE IMMUNOMODULATORY
ACTIVITY OF *Macaranga mappa* (EUPHORBIACEAE)
ETHANOL EXTRACTS IN BALB/C MICE****Melissa C. Alcantara** and Elena S. CatapInstitute of Biology, College of Science,
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Plant bioactive products have been used as medicine for as long as man's history, from being a cure to the common cold to being chemopreventive agents. This study focuses on the immunomodulatory activity of the ethanolic extract of *Macaranga mappa*, in immunosuppressed Balb/C mice. Thirty-six mice were divided into three groups, and treatments were orally administered through gavage for seven (7) days. The negative control group was treated with phosphate-buffered saline (PBS), while the positive control group was treated with cyclophosphamide (CP), an immunosuppressant. The mice in the plant extract group (M + CP) were gavaged with CP at days 1, 4 and 7 at one hour post-administration of the plant extract, which was done daily at 50 mg/kgBW. Lymphocyte proliferation, reactive oxygen species (ROS) production, and plasma lysozyme levels were measured at day 8 of the experiment. Cell proliferation was significantly higher in the CP + M group compared with the positive control group (with LPS, $p=0.003$; ConA, $p=0.000$). However, the addition of the mitogens, lipopolysaccharide and concanavalin A, specific for B and T lymphocytes, respectively, had minimal effects in cell proliferation. ROS production was likewise highest in the plant extract group (CP + M, $0.57 \text{ nmol O}_2^-/2.5 \times 10^5 \text{ cells}/30 \text{ min}$) but the difference was not statistically significant. The plasma lysozyme level in the plant extract group was only comparable to that of the positive control group. This suggests that ROS production is the preferred pathway for bacterial killing instead of cell lysis via lysozyme, and further indicates the antimicrobial activity of the plant extract. Overall, the results show that *M. mappa* could be an effective microbicidal agent, and has potential immunostimulatory actions, but further screening of the plant's bioactive products are required to validate these effects.

Keywords: *Macaranga mappa*, immunomodulation, Balb/C mice, antioxidant, cyclophosphamide

BS-33

**THE EFFECTS OF *Tabernaemontana pandacaqui* POIR.
LEAF EXTRACT ON SOME NONSPECIFIC IMMUNE
RESPONSE OF CYCLOPHOSPHAMIDE-TREATED
BALB/C MICE**

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The immunomodulatory effects of *Tabernaemontana pandacaqui* POIR. ethanolic leaf extract were determined in immunosuppressed Balb/C mice using nonspecific immune assays. Thirty-six (36) mice were grouped into: (1) negative control mice, given with sterile phosphate-buffered saline, 50 mL/kgBW; (2) positive control mice, injected with cyclophosphamide as immunosuppressant, 30 mg/kgBW, at days 1, 4, and 7 of the treatment period; and (3) plant-extract treated mice, orally-gavaged (5 mg/kgBW) daily for 7 days, and injected with cyclophosphamide one hour after the extract administration at days 1, 4 and 7 of the treatment period. Production of reactive oxygen species (ROS) or superoxide anion, proliferation of T and B lymphocytes and plasma lysozyme level were determined in the three groups of mice. Results showed that the plant extract-treated mice exhibited the lowest ROS production ($0.1181 \text{ nmol O}_2\text{-}/2 \times 10^5 \text{ cells}/30 \text{ min}$) after 30 min incubation of macrophages. This suggests that the leaf extract inhibited this response which could indicate its potential as antioxidant. The plant extract-treated mice had the least percentage of cell proliferation with the addition of either lipopolysaccharides (LPS, 80% < control) and concanavalin A (ConA, 60% < control). The mitogens failed to stimulate the proliferation of T and B lymphocytes, which means that the plant extract has a potential anti-inflammatory and anti-cell proliferation. For the lysozyme activity assay, the plant extract had higher activity than the cyclophosphamide-treated mice but it was not significantly different. In general, the leaf extracts of *T. pandacaqui* had immunosuppressive effects on Balb/C, which were consistent with reported studies on the genus *Tabernaemontana*. It is recommended that further studies be undertaken to determine effective dose and modulatory effects of the plant by using other immune response assays.

Keywords: *Tabernaemontana pandacaqui*, immunomodulation, Balb/C mice, immunosuppression, cyclophosphamide

BS-34**DIFFERENT LEVELS OF CONFINEMENT STRESS: ITS EFFECT TO THE IMMUNE SYSTEM OF *Mus musculus*****Doreen D. Domingo**¹, and Asuncion C. Saguid²¹Mariano Marcos State University Batac; dr_dhee_dee@yahoo.com²Saint Louis University, Baguio City

Stress response occurs in an animal if it perceives an external condition (stressor) that threatens to compromise its well being. This involves: (1) release of catecholamines, associated with sympathetic stimulation causing physiological response called the fight-or-flight response; and (2) release of glucocorticoids, giving suppressive effects on the immune system specifically the white blood cell count. To demonstrate how different levels of confinement stress can affect the immune system of white mice, differential white blood cell (WBC) count was performed considering with (experimental) and without (control) application of confinement stress to male and female mice using different PVC pipes with different chamber diameters: 2.0 in., 1.75 in, 1.5 in, and 1.25 in. As a result, lymphocytes decrease in number (male: \bar{x} = 38.00, 35.00, 33.50, 25.00, female: \bar{x} = 45.50, 44.00, 33.50, 29.50) as the diameter of the confinement chambers decrease (from 2.0 in, 1.75 in, 1.5 in, 1.25 in). High magnitude of stress is shown in the smallest diameter (1.25 in) of confinement chamber. Ironically, the number of neutrophils increases (male: \bar{x} = 17.00, 23.50, 32.50, 40.00, female: \bar{x} = 17.50, 21.50, 32.50, 39.50) as the diameter of the chambers decreases. Hence, as lymphocytes decrease, the neutrophil count increases in both male and female mice. The effect of the different levels of confinement chambers between male and female mice was comparable. Hence, confinement stress has a role impact on the immune system as demonstrated in the differential WBC of white mice.

Keywords: confinement, differential WBC, stress, white mice, neutrophil, lymphocyte

BS-35

MICROBIAL ENUMERATION AND DETECTION OF *Staphylococcus aureus* FROM THE SELECTED DRIED FISHERY PRODUCTS

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Taboan Market in Cebu City, Philippines is the most famous source of dried *danggit*, *pusit* and *mangsi* which serve as *pasalubong* for local and foreign tourists in Cebu City. The Cebu Technological University researchers visited the dried processing firms located near the coastal areas of Cebu City and Talisay City, Cebu. The study revealed that the processors were not aware of good manufacturing practices for fish drying. Samples of the top three best seller dried products at Taboan Market were analyzed as to bacterial and fungal total plate count with the detection of *Staphylococcus aureus*, in colony forming unit, using 3M-Petriefilm and pour plate method. The pH and water activity levels of the products were determined. The dried *danggit*, *pusit* and *mangsi* had bacterial total plate count of 1.0×10^4 cfu/g, 2.5×10^4 cfu/g and 5.0×10^4 cfu/g, respectively; mold count of 2.3×10^1 cfu/g, 2.0×10^1 cfu/g, and 1.5×10^1 cfu/g. The *S. aureus* count of 30, 50 and 100 cfu/g sample for dried *danggit*, *pusit* and *mangsi*, were within the acceptable standards of Bureau of Food and Drug Administration. The pH level of dried fish samples was within 6.1 to 6.5, while the water activity of the dried products is 0.98 based on Lupin's water activity (A_w) mathematical calculation. Continuing studies on packaging and good manufacturing practices of dried fish products will be conducted to ensure microbial reduction.

Keywords: microbiology, dried products, water activity, *danggit*, *pusit* *mangsi*

BS-36

**MOLECULAR DIVERSITY OF RUMEN METHANOGENS
IN CARABAO AND CATTLE IN RESPONSE TO DIETARY
TANNIN**

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The molecular diversity of rumen methanogens in domesticated carabao and cattle fed tannin – containing banana leaves or supplemented with commercial tannin extract was assessed using polymerase chain reaction – denaturing gradient gel electrophoresis (PCR-DGGE). Primer set 0357 F- GC and 0691 R was used to amplify the methanogenic archaeal community of the rumen. A total of 26 DNA fragments were excised from DGGE gels and their nucleotide sequences were successfully determined. PCR-DGGE band profile and nucleotide sequence analysis revealed that domesticated carabao harbors fewer methanogens compared to cattle. Methanogen resembling *Methanobrevibacter sp.* YE288 is the predominant methanogen in carabao while *Methanobrevibacter thaueri* strain CW and *Methanobrevibacter millerae* strain ZA-10 are the predominant ones in cattle. Feeding of tannin–containing banana leaves remarkably altered the methanogen composition of both carabao and cattle more than commercial tannin extract supplementation in the diet.

Keywords: methanogens, cattle, tannin, banana leaves

BS-37

APPLICATION OF *Salmonella* DAS™ KIT FOR RAPID MONITORING OF *Salmonella* spp. IN COMPOSTS AND OTHER ENVIRONMENTAL SAMPLES

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The suitability of organic composts as soil conditioners and fertilizers in agriculture should be evaluated in terms of hygienic status and microbial quality prior to their application to avoid potential hazards to consumers. This study was conducted to test the applicability of the PCR-based *Salmonella* DAS™ kit developed at BIOTECH in monitoring *Salmonella* in various compost samples. Samples that include manure composts, water, and soil samples were artificially-spiked with *Salmonella typhimurium* BIOTECH 1826, and evaluated using the DAS™ kit and the conventional culture plating method. The established protocol that involved two enrichment stages of 20h+3h previously applied for foods and feeds was applied to manure and environmental samples. Collaborative study with Philippine National Collection of Microorganisms yielded 97.3% agreement between the two methods used. To further improve the agreement value, the protocol was modified by extending the second enrichment stage from 3h to 6h which resulted to 100% agreement value. Therefore, the PCR-based *Salmonella* DAS™ kit could be used in monitoring *Salmonella* in manure composts and other environmental samples by employing the modified 20h+6h two-stage enrichment protocol. This PCR-based detection kit is more effective, more sensitive and more rapid with fewer manipulations for 28h compared with the culture plating that takes 5-7 days to complete.

Keywords: composts, manure, PCR-based, *Salmonella* DAS™ kit, *Salmonella typhimurium*

BS-38**USE OF *Salmonella* DAS™ KIT FOR DETECTION OF *Salmonella* spp. IN SWABS OF CONTACT SURFACES**

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Pathogenic bacteria, like *Salmonella*, should be routinely monitored in contact surfaces of food production plants, establishments and laboratories to ensure hygienic status and microbial quality of products for consumers. This study was conducted to test the applicability of the PCR-based *Salmonella* DAS™ kit developed at BIOTECH in monitoring *Salmonella* on contact surfaces of equipment, utensils, work place and workers' hands. Collaboration with Lipa Quality Control Center (LQCC) and Peter Paul Corporation was conducted to validate the *Salmonella* DAS™ kit. *Salmonella* monitoring was subjected to two detection protocols- the *Salmonella* DAS™ kit protocol and the culture method using Bismuth Sulfite Agar. Results showed that the protocol of *Salmonella* DAS™ kit recommended and validated for foods and feeds can be used to monitor *Salmonella* in swabs of contact surfaces. In 58 samples analyzed, a relatively high 89.65% agreement between the two methods was obtained. However, more contact surfaces samples of different food processing establishments/ companies have to be tested to further improve method agreement.

Keywords: contact surface, percent agreement, PCR-based, *Salmonella*, *Salmonella* DAS™ kit

BS-39

**MOLECULAR DETECTION AND PHYLOTYPING
ANALYSIS OF *Ralstonia solanacearum* ISOLATED FROM
WHITE POTATO AND REDUCTION OF ITS POPULATION
BY BIOFUMIGATION**

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Ralstonia solanacearum strains infecting *Solanum tuberosum* (white potato) in the Philippines were analyzed for genetic variation at the level of phylotype and pathogenicity on tomato or potato. Isolates were confirmed *R. solanacearum* by polymerase chain reaction using the 759/760 primer pair specific to *R. solanacearum* which generated a 280 bp diagnostic fragment. Phylotype analysis divided the isolates into two phylotypes, phylotype I and phylotype II, that corresponds to two genetic groups based on the ITS region. Variation in phylotypes was associated with elevation of the geographic origin of the isolates. Phylotype II which contains the race 3 potato pathogen and isolated primarily from America, was observed among the isolates collected from the highlands in Benguet and one site in Bukidnon while phylotype I, which includes all strains isolated primarily from Asia, was mainly observed among the isolates collected from Bukidnon, Davao del Sur and one site in Benguet with a low elevation. This is the first report of the presence of *R. solanacearum* phylotype II identified from white potato in the Philippines and strains belonging to phylotype I that are pathogenic to potato. Moreover, management of *R. solanacearum* was also explored using radish and sunflower plant under greenhouse condition to determine its effect on population as well as the subsequent reduction in tomato wilting incidence and severity. Bacterial populations in sunflower- and radish-treated soil were significantly lower than the untreated soil one (1) month after incorporation. Likewise, there was a significant reduction in disease incidence and severity of wilting in plants treated with radish (34.50-40.50%) and sunflower (10-40%) relative to the control (75%). The results revealed suppression of the bacterium in the soil that consequently lowered the disease incidence.

Keywords: *Ralstonia solanacearum*, white potato, phylotypes, polymerase chain reaction, biofumigation

BS-40

**PERITHECIAL AND ASCOSPORES DEVELOPMENT OF
Haematonectria haematococca CAUSES TWIG BLIGHT
DISEASE OF CITRUS IN THE PHILIPPINES**

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This is the first report of a teleomorph stage of *Fusarium solani* that infect citrus in the Philippines. *Haematonectria haematococca* isolated from twigs of citrus plants with twig blight disease proved to be the ascoma stage of *F. solani*. A single ascospores culture produced sporodochia with masses of brown macroconidia and microconidia. Ascospores were didymospore with thallic conidiogenesis, bitunicate, septated hyphae and germinated bipolarly. The ascoma was orange in color containing asci and ascospores. The asci were bitunicate operculate and the the ascus apex is extremely thick and pierced by a narrow canal. The asci vary in shape from cylindrical to spherical. Each ascus contains four 2-celled hyaline spores. Ascoma was produced 22 days after inoculation and conidia with few paraphyses were seen on the ostiole portion at 25 days after inoculation. Matured conidia were released from the ascoma at 27 days after inoculation and started to disperse for the next cycle of infection.

Keywords: perithecia, ascospores, *Haematonectria haematococca*, twig blight disease, teleomorph

BS-41

MORPHOGENESIS OF *Lentinus sajor-caju* Fr.

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Lentinus sajor-caju is commonly known as white rot fungus and one of the wood decaying fungi that usually grows in clusters on fallen logs during the onset and middle part of rainy season. It is tough with a well developed central stalk or stipe with whitish to grey fan shaped mushroom and become brown and curled when it is totally matured. The CLSU Mushroom Center has domesticated this species of mushroom from the wild. With the desire to develop production technology for the commercial cultivation, we studied the morphogenesis of this mushroom on different indigenous culture media and physical factors. Corn grit decoction recorded the highest spore germination with a mean of 76.66% while sweet sorghum decoction had the lowest spore germination with a mean of 46.66% after 10 hours. Among the physical factors evaluated pH 8.0, air condition temperature (23°C) and total light recorded the highest spore germination. The basidiospores have unusual type of germination. The spore coat was retained which ultimately become part of the hypha and later grew and developed to a fully grown basidiocarp. The process of spore germination of *L. sajor-caju* consisted of five major stages, namely: liberation of the basidiospores from the basidiocarp; swelling of the basidiospore (after 7 hours); elongation of the hypha (after 10 hours); septation of the hypha (after 16 hours) and; branching of the monokaryotic primary mycelia (after 20 hours).

Keywords: *Lentinus sajor-caju*, morphogenesis, indigenous culture media, basidiospores, physical factors

BS-42**GENE SILENCING OF VP9: A NOVEL NONSTRUCTURAL PROTEIN FROM WHITE SPOT SYNDROME VIRUS AND ITS ROLE IN SHRIMP-VIRUS INTERACTION**

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White Spot Syndrome Virus (WSSV) remains the most widespread and devastating infectious agent that hit the shrimp aquaculture industry worldwide. To date, there are no available cost-effective remedies yet for WSSV infection. Hence, functional studies on genes critical for viral infection, is essential in elucidating shrimp-virus interaction. Here we report, a newly identified WSSV gene, VP9, a non-structural protein predicted to have possible involvement in viral transcription. This study utilized gene knock-down technology through RNA Interference, to elucidate the function of VP9 in shrimp-virus interaction. Three set-up using twenty-two (22) *Macrobrachium rosenbergii daqueti* shrimps were prepared for treatment of dsRNA-VP9, dsRNA-GFP, and Phosphate Buffer Saline (PBS). Each shrimp was challenged with WSSV and survival rate was recorded. Three (3) shrimps were sampled on day 0, 1, 3, and 7 post-infection for gene expression analysis by RT-PCR. The VP9- and GFP-dsRNA injected shrimps showed a significant survival rate at 60 and 50 percent survival, respectively, compared to that of the PBS injected shrimp. Silencing of specific WSSV genes was observed as early as day 1 post infection, which further corroborates our challenge test data. Results showed that VP9 is critical in WSSV infectivity to the shrimp host. Therefore, silencing of VP9 might pave the way in preventing WSSV infection in shrimp.

Keywords: Gene silencing, double-stranded RNA interference, white spot syndrome virus

BS-43

A pCAMBIA EXPRESSION VECTOR CONTAINING THE BUNCHY TOP VIRUS NUCLEAR SHUTTLE PROTEIN (NSP) GENE

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The nuclear shuttle protein (NSP) in the nanoviruses is responsible for the transfer of the viral genomic DNA from the nucleus, where replication occurs, to the cell periphery. NSP is an important component of the virus life cycle and works together with the movement protein which facilitates transport of virus particles from cell to cell. The study aims to isolate, clone and elucidate this viral component. The Banana bunchy top virus nuclear shuttle protein gene (BBTV DNA-N) was isolated, subcloned for propagation in bacteria and cloned into a plant expression vector. PCR amplification was used to isolate BBTV DNA-N using total genomic DNA from BBTV infected abaca leaves as template and BBTV6F_ *Bgl*III/BBTV6R_ *Bst*EII primer pair. The 479 bp PCR product was cloned into pGEM® T-easy vector and transformed into *E. coli* DH5α cells. Positive bacterial colonies with the 479 bp product via PCR colony screen was selected for plasmid extraction and sequencing. Sequencing analysis revealed 99% nucleotide similarity to BBTV DNA-6 or DNA-N. After restriction endonuclease digestion with *Bgl*III and *Bst*EII, the released insert BBTV DNA-N and the cut plant expression vector, pCAMBIA 1302 was ligated and subsequently transformed in *E. coli* DH5α cells. Using the plant vector specific primers CaMV35SF and NosTerR, positive colonies showed a 643 bp PCR product. The pCAMBIA BBTV DNA-N construct was then extracted and sequenced. Sequence analysis showed 99% nucleotide similarity to BBTV DNA-6 or DNA-N.

Keywords: abaca, banana bunchy top virus (BBTV), cloning, nuclear shuttle protein gene (DNA-N), nuclear shuttle protein (NSP), pCAMBIA

BS-44

A pCAMBIA EXPRESSION VECTOR CONTAINING THE BUNCHY TOP VIRUS MOVEMENT PROTEIN (MP) GENE

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Among nanoviruses such as the bunchy top viruses of both abaca and banana, the movement protein facilitates the transfer and movement of viral genome or particles from cell to cell. The protein is restricted to the cell periphery and increases the size-exclusion limit of the plasmodesmata. Exogenous expression of such protein in abaca may control virus infection and disease through pathogen-derived resistance (PDR). In this study, the movement protein (MP) gene of the Banana bunchy top virus (BBTV) is cloned into a plant expression vector. Primers specific for the MP gene were designed and appended with restriction endonuclease sites. PCR amplification of genomic DNA from BBTV-infected abaca plants from Bicol yielded an approximately 380bp product. The amplified product was subsequently cloned in pCR2.1®-TOPO® vector and was shown to have 95% sequence identity to the BBTV MP gene. The pCR2.1®-TOPO®-MP construct was digested with *Bgl*III and *Bst*EII and yielded the 380bp digest of interest. This was ligated with pCAMBIA 1302 treated with the same restriction endonucleases. The pCAMBIA 1302-MP construct was transformed into DH5α *E. coli* for selection and propagation. PCR amplification using pCAMBIA 1302-specific primers yielded an approximately 600bp product for three clones MP4, MP5 and MP10. Plasmids extracted from these clones all contained a 350bp region with 99% sequence identity to the BBTV MP gene.

Keywords: abaca, banana bunchy top virus (BBTV), movement protein (MP), molecular cloning, vector construction, pCAMBIA 1302

BS-45

**ISOLATION AND IDENTIFICATION OF CDNA
ENCODING A MIDGUT TRYPSIN-LIKE ENZYME IN
THE CIGARETTE BEETLE *Lasioderma serricorne* Fabricius
(COLEOPTERA: ANOBIIDAE)**

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The use of enzyme inhibitors either from direct processing of natural sources or from transgenic crops has become promising in the biological control of stored product pests. This strategy however requires knowledge of the target enzymes because of their diversity and relative activities in different species of pest arthropods providing a range of specific responses that may influence the success or failure of the control strategy. The current study aims to explore a digestive trypsin-like enzyme in the gut of the cigarette beetle *Lasioderma serricorne*, an important emerging pest of agricultural commodities. The study involves isolation of mRNA from the insect gut, complementary DNA (cDNA) synthesis, isolation of the target enzyme cDNA using CODEHOP-PCR technique. Total RNA was isolated from the midgut dissected from the fourth instar larvae of *L. serricorne*. Reverse transcription-polymerase chain reaction (RT-PCR) was conducted to convert mRNA into cDNAs. The cDNAs were subjected to cDNA-ends amplification using CODEHOP-PCR and designed degenerate primers based on the conserved sequence of homologous protein sequences of the target enzyme. A 3'-end DNA fragment of ~828 bp was generated and cloned in p-GEM-T easy vector and sequenced. The result suggests that *L. serricorne* may have a single digestive trypsin-like enzyme relatively ideal for biological control.

Keywords: midgut trypsin-like enzyme, *Lasioderma serricorne*, mRNA, cDNA, cDNA synthesis, reverse-transcription-polymerase chain reaction (RT-PCR), cDNA-ends amplification, CODEHOP-PCR

BS-46

GEOGRAPHIC VARIATION IN VEGETATIVE AND FLOWER MORPHOMETRY AMONG POPULATIONS OF *Lilium philippinense* Baker (LILIACEAE), AN ENDEMIC SPECIES IN THE PHILIPPINES

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Lilium philippinense is an endemic species with a narrow geographic distribution along the southwestern part of the Cordillera Central Range, Luzon, Philippines. Recently, its population is decreasing due to over collection and habitat loss. This study aims to establish if the populations of this species represents a single population. Morphometric analyses of vegetative and floral characteristics were studied in 23 populations of *L. philippinense*. Morphometric features of the vegetative and floral organs were measured from five plants that were randomly collected from each of the 23 populations. Correlation analysis reveals that most morphometric traits are correlated among the 23 populations. This is supported by principal component analysis suggesting that there is morphometric association among the populations. Elevation significantly correlates with corolla diameter. Using analysis of variance with post hoc tests on the four clusters showed that the populations significantly differ only in corolla diameter and leaf length. Generally, statistical analyses suggest that the 23 *L. philippinense* populations are closely associated with each other and probably represent a single population. The variation in leaf width and corolla diameter can be considered as a start of differentiation among the populations possibly implying selection on these two traits.

Keywords: Cordillera Central Range, geographic variation, morphometry, Luzon, Philippines, *Lilium philippinense*

BS-47

MANDIBULAR SHAPE VARIATION IN THE ANTS
Diacamma rugosum* AND *Pheidologeton diversus philippinus

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This study was conducted to determine mandibular shape variation in two species of ants that vary in their life history and social adaptation patterns. These include the ant *Diacamma rugosum* which still retains the primitive faculties as solitary hunter and the ant *Pheidologeton diversus* which lives in a caste system complete with a queen and various types of workers. The specimens used in this study were collected from Initao National Park, Initao, Misamis Oriental and stored in 70% ethyl alcohol solution. Body size measurements of each worker were taken. The mandibles of the ants were dissected from 150 randomly selected worker ants and photographed prior to Geometric Morphometric analyses. A total of 100 points were digitized from images of the mandibles using TpsDig ver. 2.12. The X and Y coordinates of the outline points were saved in Matlab format and were subjected to Relative Warp Analysis to remove non-shape components. Results showed that size-dependent shape variation was observable only in the eusocial ant *P. diversus* and not in the solitary species *D. rugosom*. Plots of the effective principal components for *P. diversus* showed that forty-seven percent of the shape variation could be attributed to allometry and that minor workers have slender sharp mandibles while the major workers and soldiers have thicker and more robust club. Pearson correlation values for shape variables against body size in *D. rugosom* ranged only from $r=0.006$ to 0.197 . These results show that age- and size- related changes in the shapes of the mandible may accompany task partitioning in ants and may be important in studying the evolution of sociogenesis in ants.

Keywords: eusocial ants, *Diacamma rugosom*, *Pheidologeton diversus*, solitary ant, mandible

BS-48

**FOLIAR ANATOMY OF JADE VINE,
Strongylodon macrobotrys A. Gray (FABACEAE):
IMPLICATIONS OF GROUND AND VASCULAR TISSUE
ORGANIZATION TO GROWTH AND DEVELOPMENT**

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Foliar anatomy of threatened tropical vine *Strongylodon macrobotrys* was investigated, focusing on its stem, petiole and leaflets. Leaves and stems of the vine were collected from Lucban, Quezon. Tissue sections of stems and leaves were processed and their structures were observed under light microscope. Findings reveal that ground and vascular tissue characteristics have implications to the growth and development of the vine. The stem has thin uniseriate epidermis, compact mesophyll and wide pith, with large isodiametric cells. The vascular cylinder is very distinct, with well developed xylem tissue. Firm xylem tissue in young stem of *S. macrobotrys* is of great mechanical advantage for its twinning habit since the vine is lacking of other support structures. Transverse sections of *S. macrobotrys* petiole revealed one distinct ridge vascular bundle which runs from the medial to the distal region of the petiole before reaching the attachment of the first two leaflets. It is suggested that this vasculature pattern has anatomical implications to the plant's trifoliar leaf development. Leaves are dorsiventral with collateral midvein. Four to eight layers of large isodiametric to polyhedral transition parenchyma cells are sandwiched between the palisade and spongy parenchyma which houses most of the lateral veins. The ground tissue organization of the leaves that can be related to the plant's physiology (*i.e.* metabolism and water storage) is uncommon in the family. It is concluded that the foliar anatomy of *S. macrobotrys* generally conforms to the anatomy of other plants under Fabaceae. Several anatomical features of the vine have implications to its growth and development, reflecting morphological adaptations, particularly for mechanical support.

Keywords: Fabaceae, foliar anatomy, included vascular bundle, transition parenchyma, *Strongylodon macrobotrys*

BS-49

COMPOSITIONAL ANALYSIS OF BANANA STALKS DEGRADED BY *Pleurotus ostreatus* UNDER SOLID STATE FERMENTATION

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Fungal bioprocessing of lignocellulosic biomass is an important agent responsible for the environmental carbon circulation. Higher fungi like basidiomycetes (*e.g. Pleurotus ostreatus*) have unique oxidative systems which together with ligninolytic enzymes are responsible to decompose cellulose, hemicellulose, and lignin to lower molecule components. Hence, an environment-friendly pre-treatment process for lignocellulose residues. Biodegraded products from the biomass can be refined to bioethanol and other biobased materials like fiber and biochemicals. Banana stalk was inoculated with *P. ostreatus* under solid state fermentation (SSF) at ambient conditions for 45 days. Dried banana stalks ground to 40 mesh was wetted at 6:1 water to biomass ratio. The biodegradation activity of the fungi was compared in substrates with or without sugar additive. Sugar composition was determined by HPLC, Acid soluble (ASL) by UV Spectrophotometer, and acid insoluble lignin (AIL) by gravimetric method, following standard protocols. *P. ostreatus* grew progressively in the substrates with time until the whitish hyphae covered the whole biomass in 45 days. Addition of sugar in the biomass did not show a distinct advantage over the substrate with no sugar in terms of growth and activity of the fungi. Dry solid yields were increased by 9% from the original weight due to fungal hyphae biomass. ASL and AIL were significantly decreased by about 50% compared to the original lignin of the material (11.55%). The ash content of the fungal-treated biomass was higher (0.9039-1.75%) than the untreated sample (0.6217%). Glucose (33.75-34.17 %) and Xylose (20.67-22.30 %) contents of the fungal-treated samples were lower compared to the control at 44.37% and 30.67 % glucose and xylose contents, respectively. Mannose sugar (4.89-5.45%) was comparable with the untreated biomass. Sugar composition of the washings of the fungal-treated banana stalks should be analyzed to account the sugar released from the biomass during the biodegradation process.

Keywords: Bioprocessing, bioethanol, ligninolytic enzyme, SSF, biodegradation

BS-50**LAWN CULTURE OF *Schizophyllum commune* Fr. ON
SELECTED TROPICAL FRUIT SUBSTRATES**

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Schizophyllum commune Fr. is a wild edible mushroom that usually grows in decomposing logs during rainy season. This mushroom is known to produce an extracellular polysaccharide called schizophyllan which has been proven to have several pharmaceutical properties. Mycelial production of this mushroom is coupled with the production of schizophyllan. In our desire to produce the mycelia and schizophyllan we evaluated the mycelial performance of three strains of *S. commune* on coconut water and selected tropical fruit extract such as pineapple, watermelon, tomato, papaya and mango juice in lawn culture. Lawn culture is a technique in which the growth of mycelia is on the surface of the medium which leads to the formation of mycelial mat in lawn form. Regardless of fruit extract used, wild strain 1 recorded the shortest number of days to total mycelial ramification with a mean of 7 days, while ATCC 38548 strain had the longest number of days with a mean of 13 days. No significant differences in mycelial weight, volume loss of the fruit extract, final pH and total soluble solids (TSS) were noted. Among the different fruit extracts evaluated, watermelon extract produced the heaviest mycelial weight (67.58 mg), highest final pH (7.85) and the highest TSS loss (3.83 % Brix). Moreover, statistical analysis revealed that the volume loss of the fruit extract was comparable with each other.

Keywords: *Schizophyllum commune*, broth culture, tropical fruits, schizophyllan, mycelia

BS-51

CAROTENOID CONTENT OF CANISTEL OR TIESA (*Pouteria campachiana* (HB.K) Baehni)

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Extraction and isolation of carotenoids from biological sources is of current interest to researchers. Canistel is an underutilized crop that is rich in carotenoids. This study was done to investigate the carotenoid content of canistel at various maturity stages. Different maturity stages of canistel were obtained based on peel color. Samples were immediately analyzed for firmness, flesh color, soluble solids and pH. Total carotenoid concentration was estimated by comparing the sample absorbance to a standard curve of β -carotene at 476 nm. Firmness decreased from 1.33 to 178mm as the canistel increased in maturity. Firmness of overripe canistel decreased almost three times compared to the ripe canistel. No significant differences ($P>0.05$) were observed between immature and half-mature canistel. Lightness (L^*) of the sample were not significantly different ($P>0.05$) for the first three stages of maturity (L^* 57 to 60). Significant ($P<0.05$) change was observed when the fruit became overripe (L^* 53). The redness (a^*) of the sample on the other hand increased as the fruit reached senescence (a^* 7 to 14) while the yellowness (b^*) had its maximum value (b^* 61) during the ripe stage. Soluble solids increased as the fruit develops while no significant difference ($P>0.05$) in pH was observed across all samples. Carotenoid concentration was at its maximum during the immature stage and decreased as the fruit reached senescence (180 to 54 ppm). Carotenoids partially identified were a mixture of hydrocarbons and xanthophylls. Ten carotenoids were identified based on spectral maxima that include neoxanthin, violaxanthin, α -carotene, ϵ -carotene, neurosporene, lutein, α -zeaxanthin, cis-luteoxanthin, β -zeaxanthin and β -carotene-5,6,5',6'-diepoxide. Increased utilization of canistel as natural source of carotenoids should be explored as possible substitute for synthetic food colorants to meet consumer's desire for natural carotenoids.

Keywords: Canistel, carotenoids, maturity, firmness, color

BS-52

**PEDICULICIDAL ACTIVITY OF A SHAMPOO
FORMULATED FROM THE CRUDE ETHANOLIC
EXTRACT OF *Tinospora rumphii* Boerl
(MENISPERMACEAE) STEMS**

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This study involves the formulation of a pediculicidal shampoo from the *Tinospora rumphii* Boerl ethanolic extract using compatible excipients and the determination of its activity using Permethrin (Kwell) as positive control. Stems of the plant *T. rumphii* Boerl was percolated with 80% ethanol and was formulated together with a base to determine its pediculocidal effect. No apparent irritation was noted after 72 hours of application on rabbits. *In vitro* study was also conducted to determine its lice-killing activity. Preliminary clinical studies were also employed to five (5) respondents to test for the possibility of hypersensitivity and to further test its effectivity on human subjects. Single-Factor ANOVA showed a significant difference between the mean killing time of the adult lice using the *Tinospora* shampoo, Permethrin and the shampoo base ($p < 0.001$). Human patch test result in thirty (30) subjects showed no significant irritation with the *Tinospora* shampoo. ANOVA for Repeated Measures showed no significant interaction effect between the treatment used and the duration it was applied – amount of adult lice ($p = 0.077$), nits ($p = 0.580$) and pruritus (0.519). Also, there was no significant difference on the number of adult lice ($p = 0.233$) and nits (0.580) killed but a significant difference in pruritus ($p < 0.001$) in regards to the treatment. However, in regards to the duration of treatment, there was no significant difference on the decrease of the number of adult lice ($p < 0.001$) and pruritus ($p = 0.071$) but a significant difference on the nits killed ($0 = 0.02$). Therefore, the shampoo formulated with the crude ethanolic extract from *T. rumphii* has equal efficacy as that of the commercially available positive control (Permethrin).

Keywords: *Tinospora*, pediculocide, excipients, formulation, permethrin

BS-53

A 10% CREAM PREPARATION FROM THE CRUDE ETHANOLIC EXTRACT OF THE DRIED SEEDS OF TONKIN (*Ipomoea muricata*): FORMULATION AND ITS QUALITY CONTROL

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Ipomoea muricata (L.) Jacq. (Convolvulaceae) has been proven to possess antimicrobial activity against *Staphylococcus aureus*. The study aimed to formulate a topical cream from the dried seeds of the plant. The crude ethanolic extract was subjected to drug-excipient compatibility testing using a ratio of 1:1 and stored at 40°C for four weeks. The excipients that are compatible with the crude ethanolic extract were used in the formulation of cream. *S. aureus* was tested for its susceptibility against the formulated cream preparations using Disk Diffusion Method. The formulated cream that produced the biggest zone of inhibition was chosen to be the best formulation and was also subjected to quality control tests. The quality control tests include the organoleptic characteristics, pH, and viscosity and antimicrobial activity. The extract was found to be compatible with acacia, glycerin, sodium lauryl sulfate, methyl paraben, propylene glycol, stearyl alcohol, white petrolatum and not compatible with benzalkonium chloride and yellow soft paraffin. The excipients were used in the formulation of three cream preparations. Using t-test at $p < 0.05$, formulation 3, which is a creamy white, tamarind-like odor cream with a pH of 6.45, viscosity of 57,000 cp and zone of inhibition of 23.5 mm, exhibited the best antimicrobial activity. Based on ANOVA, there is no significant difference in the quality control parameters of two batches of Formulation 3. The cream should be stored at a temperature not exceeding 40°C because changes in pH, viscosity and antimicrobial activity are temperature dependent. The antimicrobial activity of the formulated cream is comparable to the commercially available Fucidin cream. The cream of *I. muricata* can be manufactured in large scale so as to provide the nation with another source of antibacterial drug.

Keywords: *Ipomoea muricata*, tonkin, cream, quality control, formulation

BS-54

PHYTOCHEMICAL STUDIES ON TWO PHILIPPINE ENDEMIC RUBIACEAE SPECIES - *Gardenia merrelli* AND *Villaria odorata*

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The family Rubiaceae is the fourth largest flora which is distributed worldwide. Phytochemical studies on Rubiaceae species have elaborated the presence of various classes of natural products with interesting biological activities. In our interest of identifying biologically-active secondary metabolites from the endemic Philippine Rubiaceae plants, this research aims to isolate, purify and elucidate the exudates from the leaves of *Gardenia merrelli* and *Villaria odorata*. The crude extracts of the two plant species obtained from the air-dried leaves were subjected respectively to polarity partitioning. The obtained semi-polar CHCl₃ sub-extracts were further purified by several chromatographic techniques (TLC, gravity column chromatography, vacuum liquid chromatography). From the leaves of *G. merrelli*, three ¹H-NMR pure compounds (GmD-1, GmD-2, GmD-3) were isolated. GmD-1 was identified as *p*-hydroxybenzaldehyde based on ¹H- and ¹³C-NMR and in comparison with the literature. Structure analyses of GmD-2 and GmD-3 is currently in progress. The leaves of *V. odorata* yielded six ¹H-NMR pure compounds, namely, Vo-1 to Vo-6. Vo-1 was identified as vomifoliol by extensive 1D and 2D NMR and MS analyses and comparison with the literature. The biological evaluation of the pure compounds is underway. The structure elucidation of compounds Vo-2 to Vo-6 is currently in progress. This study represents the first phytochemical work on the endemic species *G. merrelli* and *V. odorata*. Moreover, this is the first isolation of vomifoliol from the genus *Villaria* and the first isolation of *p*-hydroxybenzaldehyde from the genus *Gardenia*.

Keywords: Rubiaceae, *Gardenia*, *Villaria*, Vomifoliol, *p*-hydroxybenzaldehyde

BS-55

EVALUATION OF POLYETHYLENIMINE/ CARRAGEENAN MULTI-LAYER FOR ANTIBACTERIAL ACTIVITY OF PATHOGENIC BACTERIA

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The purpose of this study is to investigate the antibacterial activity of multi-layer of polyethylenimine (PEI) and carrageenan (κ , ι , λ) for potential use as coating on biomaterial surface. The multi-layer of PEI/carrageenan was formed using the layer-by-layer assembly absorption technique and was monitored by atomic force microscopy (AFM) and biomolecular interaction analysis. All samples were prepared in phosphate buffer solution and applied to mica disk alternately. The micrographs showed the formation of bi-layer of polyethylenimine and carrageenan (κ , ι , λ) as observed in the change of height of the layer and surface morphology. The bimolecular binding of carrageenan with polyethylenimine was also investigated using a biosensor. The sensorgram showed that PEI interacted molecularly with carrageenan. Results were: 1,916.08 pg/nm² for κ *appa* type; 1,844.1 pg/nm² for ι *ota* type and 6,074.24 pg/nm² for λ *ambda* type. The multi-layer showed antibacterial activity against *Enterobacter cloacae*, *Staphylococcus aureus* and enterococcal strains (*Enterococcus faecalis* (EF) 29212 and 29505).

Keywords: carrageenan, polyethylenimine, atomic force microscopy, antibacterial, multi-layer

BS-56

**ABIOTIC STRESSES TO ENHANCE BIOACTIVE
POTENTIAL OF PEANUT KERNELS**

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Polyphenolic compounds, including resveratrol, were recognized for their antioxidant properties, great abundance in our diet, and prevention of various diseases associated with oxidative stress such as cancer, cardiovascular and neurodegenerative diseases. Peanuts contain resveratrol in amounts next to red wines and grapes, among food sources. Abiotic stresses increased the levels of polyphenols in certain plants. This study aims to apply abiotic stresses such as wounding, exposure to ultraviolet light (UV), ultrasound (US), and combined US-UV to enhance the bioactive potential of peanuts. Raw peanuts were washed, sanitized, imbibed, sliced to about 7 mm, exposed to UV, US, and combined US-UV, and incubated at 25°C for 24-48 hours. Results showed that slicing increased resveratrol by 19-fold from 0.02 microgram (mcg)/g in controls to 0.37 mcg/g in sliced peanuts. UV increased resveratrol of sliced peanuts by 9-fold or 3.3 mcg/g whereas US resulted in 17-fold increase or 6.35 mcg/g indicating that US is more effective than UV in enhancing resveratrol synthesis. Chopped peanuts after exposing to US achieved lower resveratrol of 2.88 mcg/g whereas whole US-treated peanuts had the lowest at 0.99 mcg/g indicating that moderate wounding of peanuts by slicing is necessary for enhanced resveratrol synthesis. Exposure of US-treated sliced peanuts to UV further increased resveratrol to 7.1 mcg/g. Wounding, UV, US, and combined US-UV also increased total phenolics, antioxidant capacities expressed as trolox equivalent antioxidant capacity (TEAC) and oxygen radical absorbance capacity (ORAC), and other beneficial phenolic compounds including piceid, and coumaric, caffeic, and ferulic acids. Application of abiotic stresses in peanuts increased its bioactive potential which can provide health benefits to consumers and value-added products to food manufacturers.

Keywords: Peanuts, abiotic stress, wounding, UV light, ultrasound, resveratrol, polyphenolic compounds, antioxidants

BS-57

**CORRELATION OF FRUIT VARIABLES TO THE
PHYSICO-CHEMICAL AND BIOCHEMICAL ATTRIBUTES
OF THE COCONUT (*Cocos nucifera* L.) LIQUID
ENDOSPERM**

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A correlation study was conducted to show the relationships of the variables concerning the coconut fruit and its liquid endosperm. Variables in this study were: fruit maturity; longitudinal and transverse circumferences; gross weight and; weight of the liquid endosperm. Fruit maturities were estimated by counting the number of inflorescence starting from sampled bunch up to the bunch with fertilized pistillate flowers. This count is multiplied by 21 or 31 days, the established flowering rates of dwarf and tall coconuts respectively. Electrolytes (K^{+1} , Na^{+1} , Ca^{+2} , Mg^{+2} and Cl^{-1}), glucose, protein, pH, specific gravity, and soluble solids were the physico-chemical and biochemical attributes measured. Aromatic Dwarf (AROD), Catigan Dwarf (CATD) and Laguna Tall (LAGT) varieties were included in the study. Fruit maturity showed positive correlations (Pearson's coefficient) with sodium content (0.49-0.84) and pH (0.37-0.80). The weight of the fruit (0.44-0.88) also had positive correlations to fruit transverse circumference. Potassium levels of coconut water increase with maturity for AROD (0.407) and LAGT (0.430). The reverse is observed with CATD (-0.639). The differences in the correlations of the three varieties suggest the biochemical "uniqueness" and significance of each variety in new beverage formulation. This could also suggest physiological and nutritional differences of the trees in general.

Keywords: heatmap, correlation, coconut water, electrolyte, biochemical profiles

INFLORESCENCE AND LEAF MORPHOLOGY OF SOME WILD GINGERS (ZINGIBERACEAE) RECORDED FROM EASTERN MINDANAO, PHILIPPINES

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The family Zingiberaceae is the largest family of the Order Zingiberales and is composed of important ornamental as well as medicinal species which are utilized by the local people. However, the family is poorly taxonomically known. The inflorescences and leaves of some gingers were studied morphologically. Further, leaf epidermal features were described using clearing technique to expose the anatomical details. These were supplemented with botanical field studies to Mt. Hamiguitan, Davao Oriental, Bislig Experimental Forest, Surigao del Sur and Hinatuan logged-over forest, Surigao del Sur. Herbarium studies to UPLB Herbarium, Philippine National Herbarium and Singapore Botanical Gardens Herbarium were done to identify the species using herbarium materials and the protologues. Results of the study showed the presence of *Amomum microchiela* (Ridl.) Merr., *A. muricarpum* Elm., *Etlingera dalican* (Elm.) Poulsen, *E. philippinensis* (Ridl.) R.M. Smith, *Geocharis fusiformis* (Ridl.) R.M. Smith and *Hornstedtia conoidea* Ridl. The important characters which were diagnostic in the identification of the species were the texture and size of floral bracts, characteristic of the labellum and calyx and shape of the inflorescence. The shape, texture and length of ligule, length of petiole of leaves were also useful in the delineation of species. Results of this study support the taxonomic transfer of these Philippine species from genus *Amomum* to the present generic placements.

Keywords: Zingiberaceae, inflorescence, *Amomum*, *Etlingera*, *Hornstedtia*, bracts, labellum

BS-59

A NOVEL ENDEMIC PHILIPPINE SPECIES OF *Bikkia* Reinw. (RUBIACEAE) INFERRED FROM MULTIPLE DNA SEQUENCING DATA, WITH IMPLICATION ON ITS CONSERVATION STATUS AND BIOLOGICAL ACTIVITIES

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Based on molecular data, the genus *Bikkia* Reinw. (coffee family) was formerly subdivided into two groups with contrasting habitat and corolla shape. Subsequently, one group was transferred to a genus of its own the *Thiollierea* (inland forest) leaving the *Bikkia* (coastal species) with 10 species worldwide. In the Philippines, only one *Bikkia* species (*B. philippinensis*) is known found in the coastal areas of Siargao Island. Recent observation of herbarium specimens at Central Mindanao University revealed a diverging *Bikkia* species collected in the inland forest of Mt. Redondo, Dinagat Island. This raises questions on the identity of this *Bikkia* as well as its contradicting habitat. Comparative evaluation was conducted using morphology and molecular data from nuclear rDNA (ITS region) and cpDNA (rps16 & trnL-F regions). Genomic DNA from two isolates of *B. philippinensis* and four isolates of *Bikkia* sp. (Mt. Redondo) was sequenced and analyzed. Eighteen sequences of Philippine *Bikkia* from the three molecular markers are newly generated in this study. Surprisingly, the separate and combined parsimonious trees showed that the inland forest *Bikkia* sp. is nested within the purely coastal species of *Bikkia* (BS=90%) but did not group with the *B. philippinensis*. This molecular result is supported by morphology as they differ mainly in the size and shape of calyces and fruits. Therefore, we proposed a new species of Philippine *Bikkia* (*B. redondoensis*). *B. redondoensis* is critically endangered due to its restricted distribution and < 250 mature individual population size. The first phytochemical screening of this new species including the Microplate Alamar Blue Assay is here reported.

Keywords: *Bikkia*, conservation, cpDNA, nrDNA, Philippine endemic

BS-60

FOUR NEW SPECIES OF *Nepenthes* IN TWO MOUNTAIN ECOSYSTEMS IN SOUTHERN PHILIPPINES

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Plants of *Nepenthes* are carnivorous which form specialized pitcher leaves that attract, capture, kill and digest insects and other small animals. Thus far, 23 species were reported in the Philippines, of which 23 are endemic to the country. A survey conducted in Mt. Kiamo, Kibalabag, Bukidnon and Mt. Hamiguitan, Davao Oriental revealed four species of *Nepenthes* new to science. With these 4 new species, the Philippines will now have 27 species of *Nepenthes* making the Philippines third with the greatest number of species worldwide. The new species of *Nepenthes* include: *N. ceciliae*, *N. pulchra*, *N. micramphora* and *N. hamiguitanensis*. *N. ceciliae* and *N. pulchra* are presently known only from Mount Kiamo where these grow terrestrially on ultramafic soils at altitudes from 1300–1800m. On the otherhand *N. hamiguitanensis* and *N. micramphora* were found in Mount Hamiguitan in southern Mindanao, where these occur from approximately 1000–1635 m altitude. Of the four new species, *N. micramphora* and *N. hamiguitanensis* are critically endangered while *N. pulchra* and *N. ceciliae* are endangered and vulnerable status, respectively.

Keywords: Pitcher plants, threatened, Mt. Kiamo, Mt. Hamiguitan, Mindanao

BS-61

**CONTRIBUTING TO THE PHILIPPINES' BIODIVERSITY:
ESTABLISHMENT OF TWO PHILIPPINE RUBIACEAE
GENERA BASED ON PLASTID AND NUCLEAR DNA
INCLUDING THEIR CONSERVATION STATUS**

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The Philippine Vanguerieae is represented only by two genera: *Canthium* (20 spp.) and *Psydrax* (monotypic). Recent molecular and morphological treatments of the tribe showed that most of its representatives do not form a monophyletic assemblage. For instance, *Canthium* was restricted to plants having supraaxillary spines. This raises questions on the position of the Philippine *Canthium* as members are without spines. In this first molecular study of two Philippine *Canthium* (*C. monstrosum* and *C. ramosii*), trnL-F and ITS regions were sequenced, assembled and aligned manually using Se-AL v2.0 and subsequently analyzed using MrBayes 3.1.2. Interestingly, the majority-rule consensus tree revealed that the two Philippine species were nested in two different clades with high support; *C. monstrosum* within the *Keetia* clade (PP= 0.98) while *C. ramosii* grouped with the *Pyrostria* clade (PP= 1.00). Therefore, we proposed two new combinations, the *Keetia monstrosa* (A.Rich.) Arriola & Alejandro and *Pyrostria ramosii* (Merr.) Arriola & Alejandro. This study establishes for the first time the two genera (*Keetia* and *Pyrostria*) in the Philippines. The IUCN Red List declared that conservation status of *Keetia* and *Pyrostria* were from vulnerable to critically endangered. Hence, sustainable conservation is urged which requires further studies on its reproductive biology, biogeography, and economic importance.

Keywords: *Canthium*, ITS (nrDNA), *Keetia*, Philippine endemic, *Pyrostria*, trnL-F (cpDNA)

BS-62

**MOLECULAR DETECTION AND CLASSIFICATION OF A
NEW *Theileria* SPECIES IN THE PHILIPPINES**

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Theileriosis is a tick-borne disease of domestic and wild animals that cause devastating economic loss in livestock all over the world. Theileriosis is not yet documented in the Philippines as compared to babesiosis and anaplasmosis which are considered major tick-borne diseases that infect livestock in the country and contribute major losses to the livestock industry. The study was aimed to detect *Theileria sp.* at genus level in blood samples of cattle using polymerase chain reaction (PCR) assay. Specifically, it determined the phylogenetic relationship of *Theileria* species affecting cattle in the Philippines to other *Theileria* species registered in the GenBank. A total of 292 blood samples of cattle that were previously collected from Laguna (147 samples), Pangasinan (40 samples), Cebu (77 samples), and Bohol (28 samples) were used. *Theileria sp.* was detected in 43/292 from the cattle blood samples using PCR assay targeting the major piroplasm surface protein (MPSP) gene. DNA sequence showed high similarity (90-99%) among the reported *Theileria sp.* isolates in the GenBank and the Philippine *Theileria* isolates. Phylogenetic tree construction using nucleotide sequence classified the Philippine *Theileria* isolate as benign. However, nucleotide polymorphism was observed in the new isolate based on nucleotide sequence alignment. It revealed that the new isolate can be a new species of *Theileria* that also possessed nucleotides similar to virulent strain of *Theileria* species. The findings suggest that there is high possibility of mutation events turning this new species into a virulent strain.

Keywords: *Theileria sp.*, Cattle, PCR, MPSP, Philippines

BS-63

WHY NEW HATS ARE BETTER: TWO NEW ENDEMIC SPECIES OF PHILIPPINE *Gynochthodes* Blume AND MOLECULAR SUPPORT ON THE RE-CLASSIFICATION OF *Morinda elliptifolia* Quisumb. & Merr. (MORINDEAE-RUBIACEAE)

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Recent phylogenetic works on the systematics of Morindeae (Rubiaceae) have proposed new generic delimitations of the tribe and the adoption of a narrow circumscription of the nutraceutical genus *Morinda* known as “noni”. The proposed transfer of all lianescent *Morinda* species including the Philippine endemic *M. elliptifolia* to its conglomerate *Gynochthodes* have raised the question whether this taxonomic amendment is supported by molecular dataset. To address this, samples of *M. elliptifolia* and two *Gynochthodes* cf. specimens were collected in the island of Palawan. A total of 53 trnT-F (cpDNA) sequences was utilized for cladistic analysis. Bayesian inference (BI) of the plastidial data supports the generic transfer of *M. elliptifolia* to *Gynochthodes* proposed by Razafimandimbison & Bremer with strong posterior probabilities (PP=1.00). *Gynochthodes* is united by marginal hairs along stipules and bracts; axillary, racemose or cymose inflorescences with white and shortly pedunculate flowers; recurved calyx tubes; and corollas with long hairs within the tubes and on the adaxial side of the lobes. Furthermore, the two sampled *Gynochthodes* cf. nestled on the basal polytomy of *Gynochthodes* subclade proving their generic affinity (PP=1.00). Comparisons between the Malesian *Gynochthodes* and these specimens have shed light to the proposal of two new endemic *Gynochthodes* species. In relation to these taxonomic breakthroughs; implications on Philippine biodiversity, and the industrial and medicinal applications of *Gynochthodes* are presented.

Keywords: biodiversity, cpDNA, *Gynochthodes*, *Morinda*, Philippines

BS-64

**TAXONOMIC AND ECOLOGICAL STUDY OF
MICROALGAE IN LAKE BUHI, CAMARINES SUR****Erwin P. Elazegui**College of Science, Technological University of the Philippines Manila
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A plankton study of Lake Buhi, Camarines Sur was conducted for classification and identification purposes. Three stations were established and were based on the presence and distribution of sinarapan (*Mistichthys luzonensis*), the world's smallest fish that can only be found in the lake. Plankton collection was done vertically and collected water samples were placed in a container preserved with 5% formalin. Plankton species were analyzed using the Sedgewick Rafter Counting Chamber and a binocular microscope. Photographs were also taken for verification. The study obtained 4 divisions of microalgae that include Cyanophyta, Chlorophyta, Chrysophyta and Euglenophyta. There are 11 Orders of phytoplanktons observed: Centrales, Chlorococcales, Chroococcales, Charales, Cladophorales, Dinophyceae, Eulenales, Oscillatoriales, Pennales, Tetraporales, Zygnematales. Eighteen families, 20 genera and 24 species of phytoplanktons were also noted. *Synedra acus*, *Synechocystis aquatilis* and *Synedra tabulata* were the three most abundant species. It belongs to Family Fragilariaceae and Family Chroococcaceae. Physico-chemical parameters such as temperature, pH, and turbidity were recorded and correlated with the number of planktons counted.

Keywords: Lake Buhi, Phytoplanktons, Sinarapan, Taxonomic

BS-65

**TAXONOMY OF THE GENUS *Sargassum*
(SARGASSACEAE, PHAEOPHYTA) FROM
CAMOTES ISLAND, CEBU**

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The taxonomy of the genus *Sargassum* in the country is poorly known and studied owing largely to its complex and highly variable morphology. In fact, the most recent treatment on the genus *Sargassum* in the country was done by Trono (1992) more than a decade ago. We attempt herein to add to the body of knowledge on the taxonomy and distribution of the genus by examining *Sargassum* specimens collected from Camotes Island, Cebu. Morphological characteristics of fertile specimens, primarily the nature of holdfast, shape and nature of branches, vesicles, leaves, and nature and form of receptacles, were studied. Specimens were identified, whenever possible, to species level using the key by Trono (1992). Three species were recognized, namely, *S. polycystum* C.A. Agardh, *S. siliquosum* J. Agardh and *S. paniculatum* J. Agardh.

Keywords: *Sargassum*, seaweeds, taxonomy, Cebu, Philippines

GENETIC IDENTIFICATION OF SELECTED LACTIC ACID BACTERIA AND STRUCTURAL GENE ELUCIDATION OF THEIR BACTERIOCINS

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In our continuing search for probiotic microorganisms that produce bioactive compounds, we have isolated nine (9) bacteriocinogenic lactic acid bacteria from various sources in the Philippines. Their identities and bacteriocin genes were elucidated through 16S rRNA gene and bacteriocin gene sequencing, respectively, followed by NCBI-BLAST homology search. Four (4) isolates were identified as *Pediococcus acidilactici*, three (3) *Lactobacillus plantarum*, one (1) *Enterococcus durans* and one (1) *Enterococcus faecium*. PCR-based screening using primers for the structural genes of Pediocin AcH or PA-1; Plantaricins A, 423 and NC8 and Enterocins A and B were done. All four *P. acidilactici* isolates were positive for the Pediocin gene while only one *L. plantarum* was positive for the Plantaricin A gene. The bacteriocins generated were at least 98% homologous to the nearest nucleotide sequence of similar bacteriocin in the NCBI-BLAST database. The culture supernatants of *P. acidilactici* 3G8 and 3G3, assayed against standard indicator strains, showed strong antilisterial activities.

Keywords: lactic acid bacteria, 16S rRNA sequencing, bacteriocin, *Pediococcus acidilactici*, *Lactobacillus plantarum*, *Enterococcus durans*, *Enterococcus faecium*

BS-67

GENOMIC SEQUENCE IDENTITY OF *Haematonectria haematococca* CAUSING TWIG BLIGHT DISEASE OF CITRUS IN THE PHILIPPINES

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The nucleotide sequence of phytopathogenic fungus *Haematonectria haematococca* was identified using the internal transcribed spacer region of the ribosomal RNA gene (rDNA-ITS). The cultured fungus produced 1-celled microconidia and multiple, canoe-shaped macroconidia highly resembling *Fusarium spp.* The inoculated plants kept in a screenhouse started showing the initial twig dieback symptoms in all inoculated branches at 37 days post inoculation (dpi). The appearance of pink perithecia of *H. haematococca* was observed at 45 dpi, similar to those observed in the field. No symptoms were observed on branches treated with water only. *H. haematococca* was re-isolated from the symptomatic twigs and displayed similar characteristics as the original strain. There were about 710 bases were identified and sequence analysis of the 5.8S and partial 18S internal transcribed spacers of rDNA amplified with ITS1 and ITS4 primers was deposited at National Center for Biotechnology Information (NCBI) and coded as GenBank Accession No. HQ696788.1 displayed a strong similarity to *Fusarium solani* (Mart.) Sacc. (Teleomorph: *Haematonectria haematococca*). This is the first identification and confirmation of *H. haematococca* causing citrus twig blight in the Philippines.

Keywords: genomic sequence, teleomorph, *Haematonectria haematococca*, *Fusarium solani*, twig blight disease

BS-68

IDENTIFICATION OF *Chryseobacterium indologenes* FROM SALT USING THE ANALYTICAL PROFILE INDEX API 20E

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Salt is one of the most important seasonings of Filipino cuisines whether eaten as cooked or as raw food. Some of the available salt in the market are produced locally while others are manufactured and packaged carefully. This study is focused on the determination of microbial load of salt sampled from various sources and on the identification of the isolate using API 20E Identification System. The samples were inoculated into sterile Sea Water Complex Medium and incubated overnight at ambient temperature. Results show that only one type of bacterium was able to grow and survive in the medium used. The isolate is a halophile that could tolerate up to 39% salt concentration. It is a Gram negative rod with its colony form as circular, elevation as pulvinate and margin as entire. Its slant growth type is echinulate. The isolate is identified as *Chryseobacterium indologenes* using API 20E. Surprisingly, this is a pathogen associated with Urinary Tract Infection (UTI) as well as non-catheter related bacteremia. It is a very rare pathogen. Results indicate the possibility of salt samples as sources on infection of humans from the food that they eat either cooked or raw with salt as seasoning.

Keywords: API, salt, halophile, *Chryseobacterium*

BS-69

***Proteus* SPECIES IDENTIFIED USING THE ANALYTICAL
PROFILE INDEX API 20E: POTENTIAL BIOLOGICAL
CONTROL FROM BORER INFESTING SWEET
SORGHUM**

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Previous studies on sweet sorghum production in the Philippines show that it is affected by insect pests like borer. This insect attacks both the leaves and the stalks of the plant thus causing a decrease in juice yield for ethanol production. It is also observed that some larvae of borer attacking sweet sorghum varieties die prior to pupation even without the application of insecticides. This phenomenon is postulated to be due to bacteria harbored by the larvae in their gut. Bacterial isolates then from the gut of the larvae of the borer were obtained and characterized. They were identified using API 20E. Results show that borer attacking both leaves and stalks harbor the same bacteria. They both have *Proteus vulgaris* and *P. mirabilis*. Both isolates are positive in the protease and hemolysin tests indicative of their being pathogens. They employ protease and hemolysin as virulence factors. The characterized and identified flora of the gut of borers must have the potential as biological control of insects attacking sweet sorghum

Keywords: *Proteus*, borer, sweet sorghum, API

BS-70

**ACTIVATION OF ENDOGENOUS BANANA STREAK
BADNAVIRUS (eBSV) IN *Musa* GENOTYPES UNDER
DROUGHT CONDITION**

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Banana streak badnavirus (BSV) is the most serious virus threat in *Musa* breeding program and germplasm movement. Viral sequences naturally integrated into the banana genome, called endogenous BSV (eBSV), can be activated into episomal BSV which are infectious and causes the destructive banana leaf streak disease. Factors that triggered activation include tissue-culture. In a changing climate scenario, abiotic stress specifically drought condition continuously affects crop productivity and susceptibility to diseases, hence it is deemed necessary to determine if drought condition in terms of water stress can trigger the activation of eBSV into infectious episomal form. Two treatments were put-up under glasshouse condition: drought imposed (water-stressed) and well-watered (control). Using BSV F1/R2 primers, IC-PCR detected 8 out of 18 banana cultivars with episomal BSV at 3 weeks after drought imposition (WADI). At 3 WADI, BSV incidence per genotype ranged from 5.56 – 33.33%. In addition, episomal BSV was expressed on ‘Pelipia’ at 8 WADI but not on 3 WADI. Statistical analysis indicated that activation of BSV, as influenced by water stress condition, occurs only in specific *Musa* cultivars, whether they have the A, AB, or B genome. However, under glasshouse condition, drought did not contribute to symptom expression of BSV infection even on episomal BSV-infected plants at 3 and 8 WADI.

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

BS-71

**STRUCTURAL AND ULTRASTRUCTURAL
CHARACTERISTICS OF THE TESTES OF THE INVASIVE
SUCKERMOUTH SAILFIN CATFISH *Pterygoplichthys spp.*
Gill 1858 (SILURIFORMES: LORICARIIDAE) FROM THE
MARIKINA RIVER SYSTEM, PHILIPPINES**

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The suckermouth sailfin catfish (*Pterygoplichthys pardalis*) is one of the many loricariid species regarded as highly invasive posing serious threat to many freshwater systems worldwide. Although several loricariid features had been described to contribute to its invasive spread potential, studies on its early development has yet to be described. In this study, mature female *P. pardalis* were subjected to spawning induction using human chorionic gonadotropin (HCG) to study the developmental stages from fertilization until yolk resorption. Females subjected to a single exposure by HCG responded positively to treatment (97%) with higher fertilization success (88.33%) compared to the untreated females (20.89%). Nonetheless, HCG-induced fertilized eggs had a low hatching success (48.56%). From the free-living embryos successfully hatched, a high number (90.44%) had survived to become juveniles. Embryonic development in *P. pardalis* was completed 168 h and 30 min after fertilization with total yolk resorption completed on the 8th day post hatching during which the suckermouth gradually shifts from rostral to ventral position to commence the loricariid algae-scraping feeding mode. *P. pardalis* has the propensity to thrive in hardy water and does not undergo true larval metamorphosis between the free swimming embryo and the juvenile stage, hence, a definitive adult phenotype develop directly. These results provide essential information of the early developmental features of this invasive species whose spawning and early developmental strategies were difficult to observe in the field.

Keywords: janitor fish, invasive fish species, loricariids, development

BS-72

ECTOPARASITES OF CAVE-DWELLING BATS IN MARINDUQUE ISLAND, PHILIPPINES

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This paper constitutes the first ectoparasite faunal survey of bats for Marinduque Island, Philippines. From June 1 to 12, 2010, 150 individual bats comprising of eleven species were captured in eleven caves in Marinduque Island. Each bat was sampled for ectoparasitic arthropods, and a total of 587 individuals representing twenty two species and belonging to five families (Argasidae, Spinturnicidae, Nycteribiidae, Streblidae, and Ischnopsyllidae) were collected. A total of twenty five new country host records for ten ectoparasitic arthropods were documented. The degree of the host specificity of the ectoparasitic arthropods on bats in this island ranges from monoxeny (as seen in *Brachytarsina megadermae* which infests *Megaderma spasma*) up to varying extent of oligoxeny (as exhibited by genus *Nycteribia* infesting the genera *Hipposideros*, *Megaderma*, *Rhinolophus* and *Miniopterus*).

Keywords: cave, bats, ectoparasites, Marinduque, Philippines