AGRICULTURAL SCIENCES DIVISION

ASD-1

GUILD STRUCTURE IN MT. MAKILING FOREST RESERVE: ITS IMPLICATIONS TO SILVICULTURE AND NATURAL RESOURCES MANAGEMENT

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The project research site was located in a matured secondary forest near Mudspring area in Mt. Makiling Forest Reserve (MFR). The study revealed that a 4-ha permanent plot in the MFR had a complex and diverse forest community composed of forest trees and palms belonging to 44 families, 126 genera and 179 species. The area has an average density of 192 tree/ha and average basal area was 43m^3/ha. The highest diameter at breast height (dbh) is seen in *Octomeles sumatrana, Ficus minahassae* and *Litsea garciae*. Based on population structure, 17% of the total number of trees were *Celtis luzonica,* followed by *Diplodiscus paniculatus* and *Chisocheton cumingianus* (8 and 4%, respectively of the total population.) Based on canopy classes, *C. luzonica* was composed of 20%, 13% and 67% canopy, sub-canopy and understories, respectively. Based on mortalities, the higher values are noted for *Caryota cumingii* (45%), *Macaranga bicolor* (42%), *Ficus minahassae* (40%) and *L. garciae* (37%). *D. paniculatus* and *C. luzonica* have mortalities of 12% and 11% respectively. To enhance succession in the area, it should be subjected to enrichment using the autogenic and allogenic succession principles where shade-loving trees should be planted in the natural gaps while intolerant trees should be planted in the Chablis. To enhance watershed values of the forest, it is suggested that 3-canopy levels be maintained, the natural values and induced gap areas be regenerated and the forest litter be maintained.

Keywords: guild structure, autogenic, allogenic, succession

ASD-2

PERMANENT FIELD LABORATORY AREAS IN MT. MAKILING FOREST RESERVE: A MODEL FOR SUSTAINABLE NATURAL RESOURCE MANAGEMENT

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The Permanent Field Laboratory Areas (PFLA) was established in Mt. Makiling Forest Reserve (MFR) in 2002 as part of long-term objective of the College of Forestry and natural Resources to actively use (MFR) as a training laboratory to produce highly capable and well-grounded graduates of forests and natural resources science and management. Institutionalization of PFLA allowed the conduct of centrally coordinated activities in the establishment, development, use and maintenance of a network of permanent field laboratory/demonstration area in Mt. Makiling. The project aims to generate basic data and to develop a system of managing and using results of actual field and laboratory exercises, undergraduate and graduate thesis and dissertation researches. *Parashorea malaanonan*, *Celtis luzonica* and *Diplodiscus paniculatus* predominate in the plot. To quantify ecological parameters of tree populations and forest dynamics, tree censuses diameter at breast height (dbh) e" 5cm) and saplings/seedlings censuses (dbh $\leq$ 5 cm) were conducted in the three 1-ha plot. Recent typhoon caused uprooting and stem breakage. Typhoon is considered one of the natural disturbances with a major impact on forest dynamics and long-term observation is needed to evaluate basic parameters.

Keywords: PFLA, tree populations, tree dynamics

ASD-3

CARBON SEQUESTRATION POTENTIAL OF LARGE LEAF MAHOGANY (*Swietenia macrophylla* King) AND DIPTEROCARP PLANTATIONS IN MAKILING FOREST RESERVE

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The amount of carbon accumulated was determined in the biomass of both large leaf Mahogany and Dipterocarp plantations in the Mt. Makiling Forest Reserve (MFR). The carbon pools investigated included: above-ground biomass (tree and understorey/herbaceous vegetation), ground-biomass (litter and course woody debris), and below-ground biomass (roots and soil).

Results showed that the large leaf Mahogany stand had a total biomass production of 605.25 tons ha^{-1} while the Dipterocarp stand amounted to 563.93 tons ha^{-1}. Converting the biomass accumulation to total carbon stored, these amounted to 542.05 tons C ha^{-1} and 639.81 tons C ha^{-1} for large leaf Mahogany and Dipterocarp stands, respectively.

Based on the three carbon pools investigated, the results are as follows: for the large leaf Mahogany stand: above-ground, 246.63 tons C ha^{-1}; ground biomass, 20.02 tons C ha^{-1}; and below-ground biomass, 275.40 tons C ha^{-1}. While the Dipterocarp stand, the results are as follows: above-ground, 248.08 tons C ha^{-1}; ground biomass, 20.46 tons C ha^{-1}; and below-ground biomass, 371.27 tons C ha^{-1}.

Out of the three carbon pools studied, the below-ground biomass had the highest carbon deposits primarily contributed by its soil component. Both plantations exhibited the same order in terms of the amount of C stored in its different carbon sinks. Specifically, the actual amount of carbon stored per carbon pool for large leaf Mahogany and Dipterocarp stand, respectively, were determined to be in the following order: SOC (253.36 tons C ha^{-1}; 326.61 tons C ha^{-1}), tree biomass (245.48 tons C ha^{-1}; 245.51 tons C ha^{-1}), roots (22.04 tons C ha^{-1}; 44.66 tons C ha^{-1}), ground litter (18.35 tons C ha^{-1}; 17.39 tons C ha^{-1}), CWD (1.67 tons C ha^{-1}; 3.07 tons C ha^{-1}), understorey/ herbaceous vegetation (1.15 tons C ha^{-1}; 2.57 tons C ha^{-1}).

Results of the study further showed that both plantations exhibited higher carbon content compared to a natural forest, a secondary forest, some fast growing plantations and agroforestry farms based on previous studies conducted in the country. On the average, the amount of carbon stored from both plantations is equal to 590.93 tons C ha^{-1} as against that of a natural forest (392.96 tons C ha^{-1}), secondary forests (ave. of 337.68 tons C ha^{-1}), fast growing plantations (ave. of 253.89 tons C ha^{-1}) and agro forestry systems (ave. of 106.94 tons C ha^{-1}).

Therefore, it can be concluded that the potential of forest plantations to sequester carbon can be maximized by considering species-site compatibility, appropriate silvicultural practices, minimizing anthropogenic disturbances or impacts, and allowing the stand attain optimum physical productivity.

Keywords: carbon sequestration, mahogany, Makiling

ASD-4

POSSIBLE LINK OF ENDOMYCORRHIZAS WITH POTENTIAL BIOINVASIVE MAHOGANY (*Swietenia macrophylla* King) IN PERMANENT PLOTS OF MT. MAKILING FOREST

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Endomycorrhizal fungi associated with Mahogany wildlings from natural secondary forest (PFLA 1) and mahogany plantation (PFLA-3) were investigated to compare fungal density and diversity during dry and wet seasons. The PFLAs were assessed in terms of plant diversity, Mahogany wildling density, presence of threatened and endemic trees, and soil attributes. Ten previously established 10 x 10 m sampling plots were selected within the permanent plots and five Mahogany wildlings were randomly collected during the dry and wet seasons, including roots and soil. Endomycorrhizal spores were isolated, characterized and identified for density, diversity, and correlation with root infection and wildling density. Plant diversity in PFLA 1 (H=3.868) was higher than PFLA 3 (H = 2.932) while Mahogany wildlings was 1,910 and 7,630 per hectare, respectively. Five endomycorrhizal genera (*Glomus, Acaulospora, Gigaspora, Scutellispora*, and *Sclerocystis)* and 31 species were isolated with total density of 332 spores/100g dry soil. Spores were abundant in PFLA 3 during wet season with *Glomus* being dominant. The highest and lowest density was observed in PFLA-3 with 94 (wet season) and 72 (dry season) spores per 100 g/ dry soil and diversity of H'=2.129 (PFLA 1) and H'=1.401 (PFLA 3) during the wet season. Endomycorrhizal density was positively correlated with root infection (r2=0.6) and wildling density (r2=0.2). The results showed that diversity and density of endomycorrhizal fungi could have promoted abundance of mahogany wildlings. Further study should be conducted to conserve the threatened and endemic species that are in competition with Mahogany.

Keywords: Endomycorrhizas, Mahogany plantation, Bioinvasion

ASD-5

GROWTH AND SURVIVAL OF *Jatropha curcas* L. IN MARGINAL AND MINE SOILS AS AFFECTED BY MYCORRHIZAL INOCULATION

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Jatropha curcas has been recently very popular as alternate source of oil for biodiesel. *Jatropha* plantation establishment is targeted at unproductive areas such as the abandoned mine sites and marginal grasslands. This study aimed to determine the growth and survival of seedlings and cuttings in mine soil collected in abandoned mine sites in Mogpog, Marinduque and in Paracale, Camarines Norte. Soil was also collected from marginal grassland in Caliraya, Laguna. Seeds and cuttings of *Jatropha* were planted first in garden soil and later transferred in plastic pots filled with one kg mine or grassland soil. Inoculation with mycorrhizal fungi was done during transplanting. The experiment was done in a screenhouse following a Randomized Complete Block Design with 10 replicates. Nursery raised mycorrhizal and non-mycorrhizal seedlings were planted in an abandoned mine site in Barangay Capayang, Mogpog, Marinduque following a RCBD with four blocks.

Results show that non-mycorrhizal *Jatropha* seedlings planted in Caliraya soil died one month after transplanting. In Mogpog mine soil, all seedlings died three months after transplanting. Those inoculated with Mykovam survived longer (two months) than the other treatments (one month). On the other hand, all cuttings survived in both Caliraya and in Paracale soils. In Mogpog mine soil, cuttings died two months after transplanting. Mycorrhizal fungi indigenous mine sites promoted 348% higher seedling height than Mykovam. Likewise, mine VAM promoted higher height of cuttings grown in Caliraya and Paracale soils. In the field, mycorrhizal seedlings were taller (19.3 cm) and had bigger stem diameter (20.6 mm) than the uninoculated counterpart (13.7 cm height and 7.81 mm diameter). All mycorrhizal seedlings survived from July 2006 to December 2007 withstanding the typhoon Milenyo and Reming. By contrast, the uninoculated seedlings gave 70% survival. This indicates that *Jatropha* can be used to rehabilitate unproductive areas such as the abandoned mine sites and marginal grasslands and that mycorrhizal inoculation plays a significant role.

Keywords: *Jatropha curcas*, mine soil, abandoned mine sites, mycorrhiza

ASD-6

POTENTIAL ENDOMYCORRHIZAL PLANTS FOR REHABILITATION OF LEPANTO MINE SITE, MANKAYAN, BENGUET

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The diversity of plants and endomycorrhizas in Lepanto Mine Site was investigated in this study. Four transects and twelve sampling plots were established randomly along several ecosystems to assess the diversity of trees, intermediate and undergrowth in 10 x 10 m, 3 x 3 m, and 1 x 1 m plots, respectively. Endomycorrhizal fungi were isolated from the soil collected in each transect by wet sieving and decanting technique for morphological identification and examination under the microscope. The pH, organic matter and copper content in soil were also analyzed. Ecological parameters (density, dominance, frequency, diversity and evenness) for plants and endomycorrhiza were determined. Overall, there were 28 plant species under 28 genera and 18 families, predominating the intermediate layer. Plant diversity was very low (H' = 0.838-1.077) but evenly distributed. Indigenous (*Pipturus arborescens*, *Nauclea orientalis*, *Pinus insularis*, *Melastoma malabathricum*, *Schizostachyum spontaneum*) and introduced (*Gliricidia sepium*, *Chromolaena odorata*, *Psidium guajava*) species were commonly found, including *Dillenia philippinensis* which was cited by IUCN as threatened. Endomycorrhizal spores comprised of 8 *Glomus sp.* and 4 *Acaulospora sp.* with density of 18 – 78 spores/100 g dry soil and diversity (H' = 1.350 – 2.080) nearly similar with other mine sites in the country. The soil was generally acidic (3.67 – 3.93) to slightly acidic (5.33 – 5.67) with low organic matter (0.46 ± 0.35 %), and high copper content (64.72 ± 42.56 mg/cc). There is a need to assess accumulation of copper in plants and endomycorrhiza. The above results indicate the important function of mycorrhizal plants in rehabilitation copper-rich environment in the country.

Keywords: Endomycorrhizas, Plant Diversity, Mine Site, Copper-rich ecosystem

ASD-7

EVALUATION OF CARBON LOCKED IN THREE MANGROVE ECOSYSTEMS OF QUEZON, PHILIPPINES

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The Intergovernmental Panel for Climate Change (IPCC) defines climate change as a change in climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere in addition to natural climate variability observed over comparable time periods (IPCC, 1995). Known cause of climate change is the accumulation of greenhouse gases (GHGs) in the atmosphere such as carbon dioxide, methane, nitrous oxides and chlorofluorocarbons.

Tropical forests play key role in climate change mitigation. Forests absorb carbon dioxide from the atmosphere during the process of photosynthesis to make sugars and other organic compounds for growth and metabolism. In the Philippines, studies have shown the potential of various land uses to store and sequester carbon (Lasco et al., 2001a; Lasco et al., 2001b;Lasco and Pulhin, 2001). However, limited studies had been undertaken to assess the amount of carbon stored in the mangrove forests of the country. Thus, this study attempted to estimate the carbon locked in the three mangrove ecosystems in Quezon, Philippines namely the *Rhizophora* community, *Avicennia* community and *Rhizophora- Avicennia-Sonneratia* community. Following the ASB method, sample plots were established to measure the carbon stored in the following carbon pools: aboveground, necromass and soil. Results show that the *Rhizophora* community has biomass density of 152.99 ± 13.61 Mg while *Avicennia* and *Rhizophora- Avicennia-Sonneratia* communities have 133.68 ± 5.21 and 134.51 ± 5.55, respectively. In terms of carbon locked, the mangrove ecosystems are in the following order: *Avicennia* community > *Rhizophora* community >*Rhizophora- Avicennia-Sonneratia* community. Using the average value obtained from the study, mangrove area measuring 157 ha managed by Mirant can store to as much as 15 Gg C when fully restored.

Keywords: carbon density, mangrove forests, carbon locked

ASD-8

ALMACIGA (*Agathis philippinensis* Warb.) RESIN PRODUCTION AND MARKET OPPORTUNITY FOR UPLAND COMMUNITIES IN KARAGAN VALLEY, NEW BATAAN, PROVINCE OF COMPOSTELA VALLEY, PHILIPPINES

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Inventory was conducted of almaciga stands found within two Certificate of Ancestral Domain Title (CADT) areas, i.e., Limparongan and Maragdao covering 5 ha and 20 ha respectively. Stand and stock table for the two areas was prepared showing the number and volume of almaciga trees per hectare.

Limparongan which comprises 33% of the total CADT areas in the uplands of Karagan Valley, also served as experimental site for the initial resin tapping study. The study was carried out following Forest Products Research and Development Institute (FPRDI) procedures. The results showed that resin yield was directly proportional to diameter classes and number of cuts per tree.

The development of almaciga resin tapping as an alternative source livelihood option for forest settlers will rely heavily on the following identified strengths: a) resin from the area has very good quality as per results of the chemical analysis conducted by FPRDI chemists; b) resin supply is plentiful as validated by the resource inventory of almaciga stands and resin yield collected in the initial tapping; and c) concerned upland communities have been trained on proper methods of resin tapping.

Keywords: Almaciga, *Agathis philippinensis*, resin

ASD-9

USE OF SSR MARKERS FOR CHARACTERIZING DIFFERENT STRAINS OF 'CARABAO' MANGO

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Mango (also called manga, mangot, mangou) *Mangifera indica*, contains about 47 species. The Philippine 'Carabao' mango belongs to the Philippine race which has pale green or red new growth and polyembryonic fruit that is light green blushed yellow and elongated kidney-shaped.The 'Carabao' is the only Philippine mango export variety, and this has several strains. The National Seed Industry Council (NSIC), has put on hold the approval of new varieties of mango pending the availability of a system to distinguish the different 'Carabao' strains. Our study aims to develop a system of characterizing the different 'Carabao' strains through the application of the SSR marker technology.

The CTAB method for DNA extraction in rice was modified and a protocol for mango DNA extraction was developed using young, yellowish green leaves with PVP and mercaptoethanol. Among the 12 rice primers tested, six primers (50%) worked in mango. Sixteen (16) mango primers are now being tested in more than 80 accessions of 'Carabao' mango.

Keywords: Mango, *Mangifera indica*, SSR, strain identification

ASD-10

PROPAGATION OF LANZONES BY ROOTING OF TERMINAL STEM CUTTINGS

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Rooting of cuttings is an easier and more efficient means of plant propagation compared to marcotting or grafting. Rooting of lanzones, *Lansium domesticum* Correa, stem cuttings was unsuccessfully attempted at UP College of Agriculture in 15 trials in 1915, 1922, 1925, and at Puerto Rico in 1977.

A study was conducted to compare the rooting of semi-hardwood cuttings under mist. Treatments were: 1). wounding vs. non-wounding, in combination with 2). treatments of the basal ends with a). Water as control, b). Rootone rooting powder, c). 50 ppm indolebutyric acid {IBA} and, d). 100 ppm IBA. Each treatment combination consisting of 48 cuttings were rooted in washed river sand in one seedflat and placed on top of a bench provided with intermittent mist from 8 am to 5 pm daily. Softwood leafy terminal cuttings failed to root under mist, enclosed

frame, full sunlight and partial shade. Semi hardwood cuttings rooted 29.17% under mist and 16.67% in enclosed frame. Wounding by slicing 1 cm of bark at the base, significantly improved the number of cuttings that rooted (71.88% vs. 46.87%), number of roots (3.52 vs. 3.08) and length of roots (5.72 vs. 4.30cm), regardless of chemical treatment. Likewise, 50 ppm IBA consistently gave the best results followed by 100 ppm IBA, Rootone and Control. Chemicals improved rooting regardless of wounding. The effects of wounding and chemicals were both independent and additive. Rooting percentage ranged from 25.00% (Control) to 89.58% (wounded x 50 ppm IBA). Plants readily survived potting in a 50/50 mixture of sandy soil and coconut coir in 4-inch pots under shade and occasional misting. Statistics used was a 2x4 factorial, 4 replications, completely randomized design. Analysis of variance was made for every treatment comparison. The data clearly showed the independent, additive, and distinct advantages of wounding and chemical treatments.

A ramification of this study, more important than an efficient method of propagation by rooting of cuttings, is the theory and prospect of reducing juvenility in lanzones. Marcots may fruit in 5-6 years regardless of the size. Seeds take some 12 to 15 years to fruit. Grafts may take 10 years to fruit and it may take 2-3 more years to grow seedling rootstocks. It is apparent that the seedling rootstock imparts juvenility on the scion taken from a mature tree. R C Barba planted 10 seedlings of lanzones in 1984 and all fruited only in 2006, after 22 years. In comparison, 5 rooted cuttings from a mature tree were planted 10 years ago in the same location in which 2 died and the 3 remaining trees have fruited the last 2 years. With these observations, with the ease and convenience of propagation by cuttings, compared to marcotting, the long gestation period of seedlings and grafts and our knowledge and observations of the growth habit of lanzones, we will not hesitate to recommend, henceforth, the rooting of stem cuttings as the propagation method for lanzones.

Keywords: Lanzones, *Lansium domesticum*, rooting, cuttings, grafting

ASD-11

PATTERNS OF VARIATION OF THE LEAF OUTLINES OF TEN CLOSELY RELATED *Aglaonema* species

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Patterns of variation of the leaf outlines of ten closely related *Aglaonema* species was investigated using Elliptic Fourier Analyses (EFA), eight of which are hybrids. A total of sixty-six (66) outline points were collected from around the leaf outlines. EFA of these outline coordinates returned a total of forty coefficients that were used as morphometric variables in several multivariate methods of statistical analyses. Results of the analyses showed no clear-cut distinction among the different species included in this study as revealed be the scatter plot and dendogram produced using two ordination methods—suggesting a high degree of similarity among the species. PCA of the outline coordinates confirmed the existence of directional asymmetry with regards to the direction of the leaf apex among all ten species. This result suggests a common genetic architecture that confers directional asymmetry among the ten closely related *Aglaonema* species.

Keywords: PCA, outline coordinates, dendrogram

ASD-12

INTRA- AND INTERSPECIFIC VARIATIONS IN THE SHAPES OF THE CORONA OF SELECTED PHILIPPINE HOYAS (Asteridae, Asclepiadaceae)

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Quantitative evaluation of the shapes of the corona of the flowers of selected Philippine Hoyas was done using image analysis and Elliptic Fourier analysis (EFA) to give light into the nature of these plants and their systematic relationships. To do this, the shapes of both structures were summarized using chain-coding techniques. This procedure eliminated the size component of the two biological forms. Then, the chain codes were converted into Elliptic Fourier (EFA) descriptors using a mathematical algorithm. The information contained in the EFA descriptors were summarized through principal component analysis based on a variance-covariance matrix of the coefficients. The scores of the components were then used in subsequent statistical analyses. Results showed wide variations in the shapes of the corona among the species especially in the shape and relative sizes of the corona hood and the amount of asymmetry corona traits. Hierarchical cluster analysis of the mean coefficients of the EFA descriptors were also used to determine the systematic relationships of the different species and the results are discussed in the light of morphological integration and evolution. Results also showed that Elliptic Fourier analysis is very effective in illustrating graphically and statistically variations in the shapes of biological structures.

Keywords: corona, hood, EFA, chain-coding

ASD-13

SEED DEVELOPMENT AND DESICCATION SENSITIVITY IN LETTUCE (*Lactuca sativa* L. cv. 'Tango')

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Seed development of orthodox species undergoes maturation drying which is the terminal event of seed development. Because of this character, it has been suggested by several researchers that desiccation of orthodox seeds plays an important role in the transition from developmental program to a germinative mode. To test this hypothesis, seeds of lettuce cv. 'Tango' at different stages of development were dried and germinated. The onsets of germination and desiccation tolerance in developing seeds were determined in the greenhouse-grown lettuce plants. Tagged flower heads were sampled every day starting at 4 days after flowering (DAF). Freshly extracted seeds were immediately tested for germination and other seed samples were subjected to slow (equilibrium over salt solution with 54% relative humidity) and fast-drying (drying over activated desiccant) for 2 days before seeds were sown. Most of moisture loss (91-100% of final seed moisture) occurred during the first day of drying for both drying methods. The seeds achieved equilibrium in the second day of slow drying. The moisture content (MC) of seeds at different stages of development when fresh ranged between 15-78% and when dried for 2 days ranged between 2.2–6.9% and 5.7-13.9% for fast and slow-drying, respectively. Seed maturity in lettuce was achieved 14 DAF but germination of freshly harvested was observed as early as 4 DAF (45%). Maturation drying was observed at 9 DAF as indicated by the onset of loss of moisture content in the seeds. The physiological maturity was achieved at 10DAF. Germination of dried seeds was only observed starting at 6 DAF (3% germination) and 7DAF (13% germination) for slow and fast-dried seeds, respectively. Slow drying of seeds improved the vigor of seeds however; fast drying resulted in a decrease in vigor. This study showed that premature drying did not influence germinability of developing lettuce seeds and is not a requirement in the transition of lettuce seeds from developmental to germinative mode.

Keywords: lettuce, seed development, desiccation, maturation drying, physiological maturity

ASD-14

EFFECT OF MICROBIAL INOCULANT TO PIG LIQUID FERTILIZER ON GERMINATION INDEX OF CHINESE CABBAGE

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This study was conducted to investigate the effect of Synechocystis sp KACC 91007 when added to a pig slurry or pig liquid fertilizer (PLF) on the germination index (GI) of Chinese cabbage. The preliminary experiment involved the screening of inoculant levels which were: 0.05, 0.1, 0.2, and 0.3%, respectively. The 0.05% level of inoculant was selected based on low phytotoxicity and high GI. The PLF underwent a 107- day aerobic and anoxic processing conditions. The T-N, T-P, NH4, and NO3-N concentrations of the untreated pig slurry were: 2,873, 753, 1,441.6 and 16.48 ppm, respectively. Using aerobic processing treatment, the fertilizer value of the PLF were: 3,672, 164, 183.87 and 21.97 ppm, respectively. In contrast, the fertilizer value of the PLF processed under anoxic condition was reduced to: 1,261, 68, 161, and 16.87 ppm. The GI value of the untreated PLF under aerobic and anoxic processing condition was 83 and 40.4 %, respectively. With the addition of the 0.05% microbial inoculant, the GI improved by more than 40 and 50 % , respectively, when the PLF was processed under both anoxic and aerobic conditions. The above findings proved that the aerobic processing of PLF for 107 days was better than anoxic and yielded higher T-N, which is macro-nutrient fertilizer material. Consequently, the addition of 0.05% microbial inoculant resulted to a higher GI of the Chinese cabbage specifically under aerobic processing condition.

Keywords: Synechocystis sp, Chinese cabbage, microbial inoculation, pig liquid fertilizer

ASD-15

IN VITRO SHOOT PROLIFERATION RESPONSE OF *Musa* cv. 'Lakatan' TO 6-BENZYLAMINOPURINE (BAP) AND THIDIAZURON (TDZ)

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'Lakatan', a triploid banana is the most highly priced and popular cultivar grown in the Philippines. Tissue culture provides disease-free and true-to-type planting materials where the important requirements are the culture medium and plant growth regulator (cytokinin). 6-benzylaminopurine (BAP) induces more shoot formation than other types of adenine-based cytokinin. Thidiazuron (TDZ) is one of the most active phenylurea with cytokinin-like activities and more active at low concentration than adenine-type cytokinin for woody and herbaceous plants. Hence, effects of Murashige and Skoog's with BAP and TDZ on banana explants are compared. TDZ (1 and 2 ppm) provided 80% positive response compared to 50% in BAP (10 and 20 ppm). Explants in the first (4 weeks) and second (8 weeks) subcultures on BAP produced more phenolic compound. Its presence is crucial because it hinders the continuous proliferation and growth of the explant. Calli were formed after 2-3 days in TDZ after four days of inoculation while it took 4 days in cultures with BAP. Explants in TDZ generally exhibited higher multiplication rate than in BAP after the second subculture. The average number and length of shoots of plantlets in TDZ cultures were significantly different from those grown in BAP. TDZ (1 ppm) induced the highest average number of shoots at 6 cm, followed by TDZ (2 ppm) at 5 cm while those on BAP 10 and 20 ppm had only at 3 and 4 cm, respectively. The average length of shoots obtained at TDZ was highest at 1 ppm at an average of 7.5 cm, then 6 cm at 2 ppm. Microplants in 10 and 20 ppm BAP, however, developed to 2 and 3 cm, respectively. Therefore, TDZ provided better results than BAP. It will be essential for a faster and more productive banana micropropagation.

Keywords: banana, Musa cv '*Lakatan*', *in vitro*, tissue culture, shoot proliferation, callus, cytokinin, 6-benzylaminopurine, BAP, Thidiazuron, TDZ

ASD-16

GROWTH RESPONSE OF *Dendrobium crumenatum* (Orchidaceae) TO KNUDSON C MEDIA WITH SUPPLEMENTS

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Growth response of *Dendrobium crumenatum* on Knudson C media with upplements: Hormex ™, a rooting hormone (1ml/L media); HB101™, an organic ooting hormone (1ml/L media) and Gaviota 30-10-10™, a fertilizer (1/4 tsp./L media) vas determined. Protocorms were grown on each medium and plantlets, which vere randomly selected, were measured after seven months. Parameters measured vere plant height (roots excluded), number and length of shoots and roots, presence of callus and color of plantlets. The difference between treatments were not tatistically significant except for Gaviota™ which compared to a standard culture nedium provided an amount greater than the required nutritional requirement of he plant thereby causing phytotoxicity. Thus, micropropagation of *D. crumenatum* ould make do without the above-mentioned supplements.

Keywords: *Dendrobium crumenatum*; supplements; phytoxicity ;growth response; Knudson C

ASD-17

RESPONSE OF YAM (*Dioscorea alata* L.) TO VARIOUS GROWTH REGULATOR

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Dioscorea alata L. (Kinampay) is known for its sweet aroma and good taste nd is dubbed as the "Queen of Philippine Yams". Tissue culture can yield more lants, hence determining which plant hormone could provide more callus, shoot nd leaf formation was studied. One cm long node explant was inoculated into

solid MS media (T1-control) and into MS with different concentrations of Naphthaleneacetic acid (NAA) [T2 (2.5 ppm), T3 (5.0 ppm), T4 (7.5 ppm)]; 6-benzylaminopurine (BAP) [T5 (2.5 ppm), T6 (5.0 ppm), T7 (7.5 ppm); and kinetin (KN) [T8 (2.5 ppm), T9 (5.0 ppm), T10 (7.5ppm)]. The following parameters were obtained with four trials: (1) number of days prior to callus induction; (2) length and number of shoots; and (3) number of leaves. Callus formation was observed after five to 15 days after inoculation. Explants in T6 and T10 responded within 8 days while it took 12-14 days in all NAA treatments. All cultures showed positive response in all treatments but it was in T5 and T6 where callus were predominantly formed thus the most effective media with respect to callus induction. T6 generated an optimum response in shoot length of 0.8 mm while T10 had only 0.27 mm. Shoot formation was observed in T5-T10 but the most number of shoots were formed in T9 at 1.95 whereas T7 had only 1. All explants on kinetin media underwent direct organogenesis where T9 displayed the most number of leaves at 4.0. However calli continuously developed on NAA and BAP. Generally, T1 showed minimal reaction since it did not undergo direct organogenesis as well as embryogenesis. Therefore, BAP (T5 and T6) is highly active for callus induction and Kinetin (T9 and T10) is the most effective in shoot and leaf formation.

Keywords: Yam, *Dioscorea alata* L., plant growth regulators, tissue culture, naphthaleacetic acid (NAA), 6-benylaminopurine (BAP), kinetin (KN),

ASD-18

EFFECT OF SILVICULTURAL MANAGEMENT ON THE BASIC PROPERTIES OF BAMBOO

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Kauayan tinik (*Bambusa blumeana*) and giant bamboo (*Dendrocalamus asper*) culms from old plantations established 15 and 9 years, respectivel, prior to silvicultural treatments, were harvested and assessed over a period of 5 years. The kauayan tinik poles underwent 13 combinations of silvicultural treatments i.e., irrigation, fertilizer, mulch, organic matter and number of culms maintained. All practices except irrigation were also applied to giant bamboo in 10 combinations.

The basic properties: anatomical, chemical, physical and mechanical including culm wall thickness and diameter of the above species were tested and evaluated. The data were statistically analyzed.

The culm wall thickness and diameter were improved, although not generally significant. On the other hand, basic properties of culms with and without treatments were generally comparable. The best treatments to adopt by farmers in regenerating bamboo stands for poles were discussed. Likewise, the end-uses of bamboo culms that underwent various treatments were also included.

Keywords: bamboo, *Bambusa blumeana, Dendrocalamus asper*

ASD-19

ASSESSMENT OF VERMICOMPOSTING AS A WASTE MANAGEMENT TECHNOLOGY AND A LIVELIHOOD TECHNOLOGY

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A survey was conducted on twenty-four (24) vermicomposting facilities all over the country. The survey included an intensive evaluation of the different vermi systems in terms of technical management, economic viability, social and environmental impacts.

The vermicomposting adoptors consisted mostly of middle to upper class farmer entrepreneurs. Several innovations were introduced in their farms in order to optimize the performance of their systems and make use of their available resources, thus making each system unique in form and quantity. In terms of economic viability, the technology was proven to be a good source of income. The return on investment ranged from Php 142.04 to 540.65 which varied according to size/scale. The social impact for most of the adoptors was not yet realized since their labor requirement was minimal. On the other hand, large scale vermi facilities have already demonstrated the positive social influences of the technology adoption and implementation such as job creation and good community relations. For the environmental impacts, the technology has the potential to affect water, air and land resources positively. Some possible impacts include organic waste management, air pollution reduction, and reduction in the application of chemical fertilizers and pesticides to some extent.

Keywords: vermiculture, vermicomposting, vermicompost, African night crawler, technical management, environmental impact, social impact, economic impact

ASD-20

CONSERVATION AND MORPHOLOGICAL DIVERSITY OF INDIGENOUS LEGUMES IN THE PHILIPPINE HIGHLANDS

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This study was conducted with the aim of collecting, characterizing, evaluating, conserving and determining the diversity and relationships of indigenous grain legumes: rice beans and lima beans in Benguet, Philippines.

All collection trips were conducted in the 13 municipalities of Benguet province with elevations ranging from 200 to 2,929 meters above sea level. Rice bean and lima bean collections were characterized using the descriptor's list by International Plant Genetic Resources Institute. The collections were further evaluated at the Benguet State University experimental farm from 2005 to 2006. Clustering of the collections was done using the Ward's method.

In the rice bean (*Vigna umbellata* L.) germplasm, diversity analysis revealed low variation within the collection and the accessions were clustered into four. Cluster 1 collections were late maturing; cluster 2 was vigorous; cluster 3 had high flower bud production and cluster 4 was the highest seed yielder.

Grouping the lima beans (*Phaseolus lunatus* L.) revealed three clusters. Cluster 1 is associated to flowering, seed setting and filling characteristics. Collections under cluster 1 were the latest to set pods and seed fill. Cluster 2 is associated to pod length and number. Cluster 3 is related to seed width, length and weight. The lima bean germplasm showed medium variation.

Keywords: *Vigna umbellata* L., *Phaseolus lunatus* L., germplasm, diversity and cluster analysis, Philippine highlands

ASD-21

DEVELOPMENT OF IMPROVED VARIETIES OF FIELD LEGUMES: MUNGBEAN (NSIC Mg11 AND NSIC Mg14), SOYBEAN (NSIC Sy8), AND PEANUT (NSIC Pn9 AND NSIC Pn10)

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Field legumes (mungbean, soybean and peanut) are some of the popular and important crops grown in the Philippines. BPI-LBNCRDC continuously conducts research on developing superior lines/varieties of these crops through varietal improvement.

Promising lines of mungbean and soybean were field tested and evaluated under the Preliminary Yield Trial (PYT) in 1992 to 1998 and General Yield Trial (GYT) in 1994 to 2000. Potential varieties from the GYT were screened further in different regions of the country under the National Cooperative Trial (NCT) in 1999 to 2003. Likewise, peanut entries were tested and evaluated under the PYT in 1996 to 1998 and under the NCT in 1998 to 2000. Evaluation was conducted to screen and develop varieties with high bean yield, early and uniform maturity, and resistant to natural occurrence of diseases.

Based on the on-station and across location performances, five varieties were approved and released by the National Seed Industry Council (NSIC) in 2001 and 2004 for commercial production. Approved in 2001 were: EGM 4310 as NSIC Mg11 locally named "Kintab", EGSy 96-6-1 as NSIC Sy 8 with "Mapusyaw" as local name, and EG Pn57 as NSIC Pn9 and EGPn62 as NSIC Pn10 locally named as "Likas" and "Yaman", respectively. In 2004, EGM 93-266 was approved as NSIC Mg14 with local name "Kulabo".

Keywords: preliminary yield trial, general yield trial, national cooperative trial, national seed industry council, varietal improvement

ASD-22

OPEN FIELD PRODUCTION OF HIGH VALUE COMMERCIAL CROPS USING PRESSURIZED IRRIGATION (HVCC TECHNO DEMO FARM)

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The High Value Commercial Crop Development Program techno-demo farm project at the BPI-LBNCRDC was perceived to showcase the new technology on Pressurized Irrigation (drip irrigation and fertigation system) in the production of high value commercial crops in the open field and also to determine the economic viability of using the technology.

The production of high value commercial crops (HVCC) such as super sweet corn, eggplant, daikonfoliage, lettuce and cucumber in the open field promises to be profitable venture. The use of drip lines and pressurized irrigation makes water and fertilizer use more efficient. Manual labor in terms of watering and fertilizer application is reduced by 60%. Therefore minimizing the most laborious and time consumable watering of the crops .

Private entrepreneurs were the most interested in the technologies being showcased. These clienteles represented different provinces nationwide who regularly consulted the staff through telephone, e-mail and farm visits .

Keywords : pressurized irrigaion,drip irrigation, fertigation ,F1 hybrids and high value commercial crops

ASD-23

IMPROVING THE YIELD OF GREENHOUSE GROWN-LETTUCE THROUGH UTILIZATION OF ORGANIC SUBSTRATES

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Cultivation of crops inside the greenhouse involves the modification of some growth factors such as humidity, light and temperature. Greenhouse provides the much needed protection against heavy rainfall and insect pests resulting in better crop quality. Lettuce is a high value vegetable crop and one of its requirements for a successful production is appropriate nutrient management. Inorganic fertilizers, while they contain high levels of nutrients, are limited only to 2-3 major elements, unlike organic fertilizers which can supply almost all the essential elements for proper plant nutrition. The protection provided through greenhouse cultivation and appropriate management of nutrients together will lead to successful lettuce production.

We studied the use of organic substrates either mixed with the soil or as a soilless media for lettuce production. Ground culture (soil culture) was used as a control treatment. Each of coco coir dust, CC (8 t ha^{-1}), household waste compost, HWC (16 t ha^{-1}), and CC + HW (4 + 8 t ha^{-1}) were mixed with the upper 10 cm soil in the plots. In soilless treatments, the amounts of organic materials were: CC (37 t ha^{-1}), HWC (75 t ha^{-1}) and CC+HWC (18 + 38 t ha^{-1}). All treatment plots received blanket application of 90-30-30 kg N, P_2O_5, K_2O ha^{-1}. The experiment was laid out in Randomized Complete Block Design with three replications and treatment plot size of 1 x 3 m. Yields were taken from one sq m.

Best yields were from plots treated with HWC and CC + HWC with a yield advantage over the ground-cultured lettuce of 24 and 22 percent, respectively. HWC as soilless substrate compared with the soil-mixed organic materials with a yield advantage over the ground-cultured lettuce of 26 percent.

Mixing either CC+HWC or HWC with the soil improved the physical and chemical soil fertility resulting in higher yield of lettuce. On the other hand a soilless substrate of HWC had the same effect as mixed organic substrates.

Keywords: coconut coir dust, household waste compost, organic substrates, soilless, greenhouse, ground culture

ASD-24

EFFICIENCY OF MARKER ASSISTED SELECTION (MAS) FOR FERTILITY RESTORER (*Rf*) GENES OF WILD ABORTIVE (WA) TYPE OF RICE CYTOPLASM

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Molecular markers have been proven useful in the transfer of gene(s) from donor parents to elite rice cultivars and in tracking down the presence of these genes in the progenies. In hybrid rice, DNA markers tightly linked to the fertility restorer loci in the wild abortive (WA) cytoplasmic male sterility system of rice have been reported. This study highlights the application of RG140 and S10019 DNA markers in selecting plants carrying the restorer gene(s) *Rf3* and *Rf4*, respectively. In the set of 143 male parent entries evaluated in 2005 WS and 2006 DS, efficiency of MAS for *Rf* gene was 64% and 83%, respectively. An estimated 50% potential reduction of SN materials to be used in hybridization is possible when any or both marker alleles of *Rf3* and *Rf4* were present in the male parents. In the initial evaluation (2006 WS) of the 146 male parent entries used in 2006 DS crosses, MAS was 87% efficient to identify possible restorer lines and is estimated to reduce approximately 68% of the SN materials that are normally being handled during hybridization to produce Philippine 3-line hybrid cultivars.

Keywords: molecular markers, fertility restorer (Rf) genes, hybrid rice, wild abortive, cytoplasmic male sterility system

ASD-25

FUNCTIONAL ANALYSIS OF CANDIDATE *RESTORER OF FERTILITY* GENES AND DEVELOPMENT OF DNA MARKERS FOR WILD-ABORTIVE CYTOPLASMIC MALE STERILITY IN RICE

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Hybrid vigor can increase crop yield by as much as 20-30%. In rice, massive adoption of superior hybrids is considered a major strategy to attain rice self-sufficiency. However, the lengthy and tedious process of developing parental lines and producing F_1 hybrid seeds are the main constraints. This study aims to fast-track hybrid rice breeding by developing DNA markers that can classify potential parental lines based on their ability to restore fertility in CMS plants. This will limit testcrosses only to potentially useful combinations, thus, saving resources and increasing efficiency. Another objective is to clone the rice *Restorer of fertility* (*Rf*) gene for the wild-abortive (WA) cytoplasm. This will be useful both in marker-assisted breeding and in designing strategies to simplify F1 hybrid seed production. Based on reports that duplicate genes (*Rf3* on chromosome 1 and *Rf1B* on chromosome 10) control fertility restoration in WA-CMS rice, two candidate *Rf* genes were isolated from IR64. To test the function of these genes, transgenic complementation assay was carried out by introducing two plasmid constructs containing these genes into the CMS lines of Mestizo2 and 3 through biolistic and *Agrobacterium*-mediated transformation. Pollen fertility in more than 100 regenerants ranged from completely sterile to highly fertile. Correlation of transgene presence as determined through PCR and restoration of pollen fertility is being performed using T1 populations derived from highly fertile T0 regenerants. In another activity, potential *Rf*-linked markers were produced by testing primers designed using public genomic sequences. For *Rf3*, six polymorphic bands were identified when 18 primer combinations were evaluated. For *Rf1B*, evaluation of 14 primer combinations revealed three polymorphic bands. These are being tested for their cosegregation with fertility restoration. Large amplicons from B and R lines are being sequenced to develop markers and understand the comparative structure of the *Rf* loci in these lines.

Keywords: hybrid rice, cytoplasmic male sterility, restorer gene, molecular marker, candidate gene approach

ASD-26

QUANTITATIVE TRAIT LOCI (QTL) ANALYSIS AND MAPPING OF FEMALE AND MALE FERTILITY GENES IN AN INTERSPECIFIC CROSS OF TOMATO (*Lycopersicon esculentum* Mill. X *Lycopersicon pimpinellifolium* [Jusl.] Mill.)

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Quantitative traits related to female fertility were mapped on the chromosomes of the recombinant inbred lines of a cross between cultivated tomato (*Lycopersicon esculentum* Mill.) and currant tomato (*Lycopersicon pimpinellifolium* [Jusl.] Mill.). Morphological characteristics related to fertility were observed. Most of the fertility traits observed has values near that of *L. pimpinellifolium* parent. At á<0.05, a significant weak association was observed for pollen number and number of seeds per fruit. On the other hand, at á<0.01, very weak associations were detected for fruit weight and stigma exertion; and fruit weight and pollen number. Forty-one Simple Sequence Repeats (SSR) markers and two Single Nucleotide Polymorphism (SNP) markers were used to saturate the previous genetic map for the LA1269 RILs. A total of sixteen markers (14 SSR and 2 SNP) were incorporated into the genetic map of the same population. The phenotypic and genotypic data gathered were used in the QTL analysis. A total of 11 QTLs related with fertility with LOD scores greater than 2.0 was detected. These include the following: one fruit weight QTL which is located at chromosome 7; one for pollen number at chromosome 11; four for pollen viability at chromosomes 4, 5, 6, and 9; two for number of seeds per fruit both at chromosome 3; one for number of flowers per inflorescence at chromosome 8; and two for stigma exertion at chromosomes 6 and 8.

Keywords: QTL, fertility genes, SSR, *Lycopersicon esculentum*, *Lycopersicon pimpinellifolium*

ASD-27

QTL MAPPING OF FLOWER MORPHOLOGY, FRUIT-RELATED TRAITS, BACTERIAL SPOT RESISTANCE, AND LEAF FLECKING IN AN INTRASPECIFIC CROSS OF PEPPER (*Capsicum annuum* L.)

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To map QTL markers linked to flower morphology, fruit-related traits, bacterial spot resistance and leaf flecking, recombinant inbred lines were developed from an intra-specific cross of pepper, *Capsicum annuum* Linn (bacterial spot susceptible sweet pepper (Nacional AG-506) x resistant male hot pepper (CNPH703). A total of 20 tomato SSR primers amplified genes in the parentals. Thirty-six QTLs were found, 15 for flower morphology, 9 for bacterial spot resistance, 2 for foliar flecking and 10 for fruit-related traits. Majority of the QTL were found in Linkage Groups (LG) 10A, 03B, and 10C with 8,7, and 9 QTL, respectively. For LG10A, majority of the QTL were associated with flower morphology (style exertion, pistil color, and pistil length). QTL associated with resistance to *Xcv* race 1 were found in LG03B. For LG10C, QTL for the four morphological characters were found, these include Xcv race 8 resistance, style exertion, pistil color, pistil length, number of petals, anther color and fruit length to width ratio. QTL for flower morphology were found on chromosomes 8 and 1 while QTL for fruit-related traits were found on chromosomes 1, 2 and 3. A QTL for resistance to Xcv race 8 was also found on chromosome 3 while leaf flecking was found on chromosome 1,(LG10C). Genes coding for bacterial spot resistance for both race 1 and race 8 seem to be introgressed from the parentals towards the 121 F7 RIL offsprings. The same may be said for genes coding for capsaicin, among other fruit-related traits and floral morphology traits. The QTL markers found on the same chromosome or linkage group were also strongly correlated according to the Pearson table of correlations at both a= 0.05 and a=0.01.

Keywords: intraspecific cross, pepper, QTL, *Capsicum annuum*, bacterial spot resistance, flower morphology, leaf flecking

ASD-28

PERFORMANCE OF THE SECOND BACKCROSS (BC_2) GENERATION OF PAPAYA AGAINST PAPAYA RINGSPOT VIRUS (PRSV-P) AND EVALUATION OF AGRONOMIC TRAITS

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Performance against papaya ringspot virus (PRSV-P) of the second backcross (BC_2) generation of papaya from backcrossing the resistant BC_1 plants to its recurrent parent, 5648, was studied. BC_1 is the product of hybridization between papaya inbred line, 5648 and F1 intergeneric hybrid, 410. Intergeneric hybrid 410 is a cross between *Carica papaya* x *Vasconcellea quercifolia* where *V. quercifolia* is the source of resistance to PRSV-P.

A total of 137 BC_2 plants were manually inoculated three times at two-week intervals in the screenhouse. Fifty-two plants or 38 % showed typical symptoms (ranging from chlorosis to shoe-stringed leaves) of papaya ringspot virus after inoculations. Surviving healthy plants (27 plants) were transplanted in the field and were exposed to aphid vectors from susceptible papaya (inbred 4172, and Davao Solo) plants that had a high inoculum level of PRSV-P. Leaves were collected from all the twenty-seven plants and were assayed for virus concentration. ELISA test result showed that only four out of twenty-seven plants tested were positive to the virus. It was also observed that another four BC_2 plants already showed mild infection of the virus based on visual inspection but were negative after performing the ELISA test. The mild symptom during the first few months after field transplanting did not progress in those four plants, which explained the result of the serological test.

Evaluation of some agronomic characters was also done. The BC_2 plants were routinely checked to know how the backcross plants perform compared with the susceptible lines 4172 and Davao Solo. Differences between BC_2 plants and the susceptible check were highly evident in terms of severity of symptom on the leaves and on the number of observed spots in the fruit. The promising results could provide the basis for restoration of the papaya industry in those regions that have been devastated by disease in the Philippines.

Keywords: Papaya ringspot virus (PRSV-P), backcrossing, intergeneric hybrid, inbred lines, ELISA, *Carica papaya* x *Vasconcellea quercifolia*

ASD-29

SSR PRIMER PAIR "MANAM 1 AND 2" CONFIRMED THE INTROGRESSION OF PAPAYA RINGSPOT VIRUS RESISTANCE (PRSV-P) FROM *Vasconcella spp.* TO *CARICA PAPAYA*

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Resistance to papaya ringspot virus (PRSV-P) from *Vasconcella quercifolia*, a wild relative of papaya was introgressed into IPB-developed inbred lines. A resistant back cross $(BC)_1$ plant was obtained from the hybridization between papaya inbred line, 5648 and F1 intergeneric hybrid 410. Intergeneric hybrid 410 is a cross between *Carica papaya* x *Vasconcella quercifolia*. Simple sequence repeats (SSRs) were used as molecular markers to fingerprint and confirm the introgression of the resistant trait from *V. quercifolia* to the BC_1, IPB inbred lines, and F1 intergeneric hybrid lines. SSRs or simple sequence repeats are composed of a few base pairs (1-6 bp in length) and the repeat units are generally found in the non-coding regions of the DNA called introns.

C. papaya nucleotide sequences were downloaded from the GenBank database and analyzed for the presence of SSRs using several programs such as the WebTROLL. Nine repeat motifs were identified and several primer pairs were designed based on conserved sequences flanking the SSRs. All the polymorphic bands generated by *V. quercifolia* were characterized by the separation of PCR fingerprints/amplicons and nucleotide sequencing. Sequences were aligned and compared to the *C. papaya* sequences. A primer pair (MANAM 1and 2) was identified as markers that can be used in screening resistant progenies of the succeeding backcross generations.

Results indicated the introgression of the PRSV resistance trait from *V. quercifolia* to *C. papaya* (BC1 5648 x 410). The generated polymorphic bands differentiated the *C. papaya* genotypes from its wild relative, *V. quercifolia*. This technique represents a practical approach of designing SSR primers based on exons rather than intronic-based sequences.

Keywords: Papaya ringspot virus (PRSV-P), molecular markers, introgression, SSRs, primers

ASD-30

INHERITANCE AND TRAIT EXPRESSION OF PRSV COAT PROTEIN GENE IN TRANSGENIC PRSV-RESISTANT 'DAVAO SOLO' PAPAYA (*Carica papaya* L.)

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The Philippine papaya industry has continuously suffered production losses since the outbreak of Papaya Ringspot Virus (PRSV) disease in 1982. Efforts are underway to develop papayas that are resistant to the PRSV disease through bioengineering. The coat protein (CP) gene of Philippine PRSV (Bulacan isolate) was introduced into the genome of Davao 'Solo' papaya variety through *Agrobacterium*-mediated transformation. Inheritance of the CP transgene and expression of resistance to the virus conferred by the transgene were established in two successive generations through polymerase chain reaction (PCR) analysis, PRSV challenge, and kanamycin leaf bleach assay. Chi-square analyses were done to determine the inheritance and type of gene action of the CP gene and resistance expression. Results of segregation analyses of the PCR product of CP transgene showed that the CP gene was inherited in a 3:1 Mendelian ratio. Similar segregation ratios and inheritance patterns were also obtained for the CP-mediated resistance to the virus and expression of *nptII* marker gene by leaf bleach assay. The results indicate that the CP transgene has been stably integrated into the papaya genome.

Keywords: *Carica papaya*, transgenic papaya, PRSV coat protein, *nptII* marker gene, *Agrobacterium*--mediated transformation

ASD-31

WHITE RUST: A NEMESIS OF CHRYSANTHEMUMS IN THE HIGHLANDS OF NORTHERN PHILIPPINES

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Chrysanthemum (*Dendranthema* grandiflora T. Zveler) is one of the leading cutflowers and potted plants in the local and international markets. In the Philippines, the major production areas are Baguio City, Benguet, Laguna and

Cavite in Luzon, Cebu and Bacolod in the Visayas and Davao in Mindanao. However, production and quality of chrysanthemums are being threatened by the occurrence of several diseases, one of which is white rust. White rust is considered to be the most important disease of chrysanthemums worldwide. It is caused by the fungus, *Puccinia horiana* Henn. White rust infections appear initially as small light green to yellow spots on the upper leaf surfaces and beige to pink rust pustules are present on the underside of the leaf. The pustules become white over time followed by necrosis and abscission of diseased tissue. The pathogen has no alternate host and does not infect the common weeds found in the area. It can survive in the soil 2-3 weeks after inoculation. Chrysanthemums are most susceptible during the first 7 weeks after transplanting and gradually become less susceptible as they mature. Inoculation of 10,000 spores/ml at transplanting and 15 days after transplanting (DAT) significantly enhanced an early occurrence of rust symptoms on susceptible plants, high infection rate and a concomitant 80% reduction of marketable yield. On the other hand, inoculation of 10 spores/ml at 60 days after transplanting (DAT) significantly affected delayed symptom development, lowest infection rate and more marketable cutflower without reduction in yield. The disease is favored by very densed planting density and high nitrogen fertilization. Development of a sustainable management strategy for the disease is therefore needed.

Keywords: white rust, pustules, *Puccinia horiana*, chrysanthemum, nemesis, alternate host, susceptible

ASD-32

BIOCHEMICAL, PATHOGENIC AND AFLP ANALYSIS OF *Ralstonia solanacearum* FROM THE PHILIPPINES

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In the Philippines, bacterial wilt caused by *Ralstonia solanacearum* is one of the most important diseases affecting vegetables and banana plants. Knowledge of their biological and genetic characteristics is very important in order to make a sound control measure. In this study, we screened 89 strains of *R. solanacearum* isolated from various hosts for their biovar classification, pathogenicity and genetic diversity. The results of the biochemical test on the utilization of trehalose and D-ribose showed that the strains isolated from vegetables were either classified as biovars 2, 3, 4 or N2. This is the first report of biovar N2 in the Philippines. All strains isolated from banana were classified to biovar 1. The results of the pathogenicity tests divided the strains to 9 pathogenicity groups based on their virulence in tomato, potato, eggplant, sweet pepper and tobacco. One strain isolated in tomato was pathogenic to tobacco and all strains isolated from banana were non-pathogenic to all the tested crops. To have a good comparison of the local strains' genome, foreign strains were included in the AFLP-DNA analysis which divided the strains into 4 clusters. Cluster 1 was composed of strains isolated from solanaceous crops, ginger and *Morus* sp. from China. Cluster 2 grouped the potato strains (biovar N2) from Philippines and BDB strains from Indonesia. Cluster 3 has the local and foreign strains isolated from potato (biovar 2) and banana (biovar 1). Cluster 4 has solely the tomato strain from USA. The results revealed the very diverse characteristic of *R. solanacearum* strains in the Philippines. This is one of the reasons that make this pathogen difficult to control.

Keywords: Amplified Fragment Length Polymorphism, hypersensitivity reaction, biovar classification, *R. solanacearum*

ASD-33

Plasmodiophora brassicae Wor. PATHOTYPES IDENTIFIED IN BENGUET

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The research aimed at determining pathotypes and virulence of the collections and single spore-derived culture (SSDC) of *Plasmodiophora brassicae* Wor. in Benguet. The virulent pathotype identified is used as inoculum source for selection or breeding for resistance for certain crucifer crops as component of disease management.

The collections from La Trinidad and Buguias, Benguet as well as single spore-derived culture from the La Trinidad collection were subjected to the European clubroot differential (ECD) host lines and assessed for pathotype make-up based on clubbing and consequent assigned denary values for each host line.

Two pathotypes designated as pathotypes 31/31/31 and 19/31/31 were identified from the *Plasmodiophora brassicae* populations from La Trinidad, Benguet. Another, pathotype 21/23/31, was identified from the Buguias population.

From the pathotype (31/31/31), 14 SSDCs of 220 inoculated seedlings or 6.36% success rate were produced through the technique of Jones and Ingram (1982) versus the unsuccessful result from using that of Some *et al.* (1996).

One of the SSDC was subjected to ECD host test and was identified as pathotype 16/16/19.

In order of virulence based on the 25% cut-off disease index, the pathotype 31/31/31 was the most virulent, infecting seven ECD host lines with the highest (100%) on the universally susceptible cultivar, ECD 05 (Chinese cabbage Graanat). Likewise, pathotype 19/31/31 is virulent on seven ECD lines with the highest (79.17%) on ECD #7 (Giant Rape Commercial).

The SSDC pathotype 16/16/19 was virulent only on ECD 05 and 10, with 75.83% and 71.66% indices, respectively. This pathotype with virulence differing from its collection source may indicate composite make-up of a collection.

The use of the identified virulent pathotype (31/31/31) is recommended as inoculum source when screening for clubroot resistance.

Key words: pathotype, collection, single spore-derived culture, European clubroot differential host

ASD-34

MAPPING OF QTL FOR BACTERIAL STALK ROT RESISTANCE IN CORN

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Bacterial stalk rot (BSR) caused by *Pectobacterium chrysanthemi pv. zeae* is one of the most important diseases in maize (*Zea mays* L.). Improved host resistance provides an efficient method of increasing corn production especially in infested areas. The advent of DNA marker technologies has paved the way to map qualitative and quantitative traits in maize.

This study is the first report on molecular mapping of BSR resistance in maize. A set of 120 F_3 progenies derived from the cross, P8 (BSR-susceptible) x YIF62 (BSR-resistant) parental inbred lines, was used in the molecular analysis. A linkage map consisting of 35 simple sequence repeats (SSR), 34 amplified fragment length polymorphism (AFLP) and eight resistance gene analog (RGA) markers, was constructed covering a distance of 932.8 cM with approximately 12.1 cM marker density. The integrated linkage map is about 54% of the total map length of the maize map standard. Quantitative trait loci (QTL) analysis based on composite interval mapping (CIM) and multiple interval mapping (MIM) revealed three putative QTLs associated with resistance to BSR. The QTL with the largest effect (40.41%) was mapped in chromosome 8 and exhibited over-dominance gene action. The other two QTLs both located in the same region of chromosome 2 showed additive gene effects, and accounted for more than 40% of the total phenotypic variation observed. Results from this study have contributed to the understanding of the genetics of BSR resistance in maize, the resistance genes involved and their most likely gene actions and in designing efficient and effective strategies to breed for BSR resistance in maize.

Keywords: bacterial stalk rot, linkage map, maize, SSR, AFLP, RGA, QTL

ASD-35

BUILDING NATIONAL PEST LISTS TO UNDERPIN AGRICULTURAL EXPORTS IN THE PHILIPPINES

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The development challenge for the Philippines, as the country seeks to increase competitiveness and expand trade in agricultural commodities, is to manage plant health to maximize productivity, to address food security concerns and to generate rural income. A key element is to generate list of arthropod pests and plant diseases of crops. Such data are required by potential trading partners to assess the quarantine risks associated with importing agricultural commodities. Thus it is a must to produce a credible pest list now.

The Bureau of Plant Industry the National Crop Protection Center and the National Museum conducted a workshop to plan for the rehabilitation of the arthropod pests collections and plant disease herbaria. This activity was funded by the Australian government. A follow-up undertaking was done on SPS awareness of the importance of pest lists. stock stake of biological collections and entomological/pathological collections and preservations techniques funded by AUSAid. Trainees from BIOTECH, CPC-UPLB, MNH and DA RCPC IV participated on biological collections study tour and specialized short courses on pathogens and arthropods collections. curation and data management in Australia from October 2006 - December 2006

Keywords: pest list, arthropods pest. plant disease herbaria, specimen

ASD-36

COST-EFFECTIVENESS OF THE ENHANCED LIGHT TRAP FOR INSECT PEST CONTROL OF LOWLAND HYBRID RICE AND COTTON+CORN CROPPING SYSTEM

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The effectiveness of the enhanced light trap in controlling insect pests of rainfed lowland hybrid rice and cotton-corn intercropping system was assessed during the dry season, October 2005- May 2006 at the Central Experiment Station.

The enhanced light trap effectively controlled the major pests infesting rice specifically *Nephotettix virescens*, *Recilia dorsalis*, *Sogatella furcifera*, *Nilaparvata lugens*, *Hydrellia philippina*, *Sesamia inferens*, and several unidentified species of leaffolders and stemborers.

Cotton with the light trap produced a greater number of bolls and subsequently higher seedcotton yield than the comparative farm. Further, the number of chemical spraying for bollworm, *Helicoverpa armigera*, control was only 2x in contrast to the 5x of the comparative farm which also was exposed to 950 strips of the egg parasitoid, *Trichogramma chilonis*.

Paddy rice, corn kernel and seedcotton yields were higher on the area with the light trap than that without light trap. Partial budget analysis showed a high index of profitability using the enhanced light trap attributable to the increase in yield and excellence in pest control.

The trap is highly recommended to farmers and distribution to be done through government intervention.

Keywords: enhanced light trap, insect pests of cotton, rice, corn, seedcotton, grain yields, partial budget analysis

ASD-37

CORN BLOTCH LEAFMINER: AN OBSCURE PEST OF CORN THAT IS BECOMING PREVALENT?

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An uncommon Agromyzid fly was serendipitously observed in corn areas of Mexico and Lubao, Pampanga in April– July 2006. It was also noted in Camiling, Tarlac, Los Baños Laguna and at Xavier University, Cagayan de Oro City. Gabriel (2001) cited an Agromyzid leafminer that attacks corn based on Capco's (1957) list of corn pest.

The adult is a tiny fly. It laid eggs on leaf surfaces. The larvae tunnel into the leaves leaving behind transparent tunnels or mines. As the maggots grow, the mines increase in width. When larvae are mature they drop off the plant and pupate in the soil. The mean counts of mines per 100 plants replicated 3 times in sweet corn and Bt corn in Anao, Mexico and Santiago, Lubao Pampanga were; .30, .31, and .32, .33 respectively. The mean counts on hybrid corn in Sawat Camiling Tarlac and MANRESA, Xavier University Cagayan De Oro City were .27, and .30 respectively. The mean count on lagkitam in Los Baños was .28. This pest is becoming prevalent in the country. We identified this pest as *Agromyza parvicornis* (Agromyzidae: Diptera) corn blotch leafminer.
e country.

Keyword: corn blotch leaf miner, *Agromyza parvicornis*, pest survey, corn

ASD-38

POST-COMMERCIALIZATION MONITORING OF ASIAN CORN BORER *Ostrinia furnacalis* (Guenee) RESISTANCE TO Bt CORN IN THE PHILIPPINES AND THE IMPACT OF POLLEN DISPERSAL ON NON-TARGET LEPIDOPTERA

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Corn is the number two crop in the Philippines next to rice. Since its approval for commercial use in the Philippines in 2002, farmer adoption of Bt corn (Mon 810) has increased. More than 162,050 hectares of Bt corn have been planted since its commercialization. Post-commercialization monitoring of the performance of Bt corn is required to detect the development of Asian Corn Borer (ACB) resistance at the earliest possible time and the possible effect of Bt corn on native biodiversity. This study attempted to estimate the frequency of Cry1Ab resistance alleles in ACB that will serve as quantitative baseline data for monitoring resistance.Also, the effects of Bt corn on non-target Lepidoptera, *Hypolimnas bolina* was evaluated. It was conducted from March 2006 to December 2006 at the National Crop Protection Center – Crop Protection Cluster, CA, UP Los Baños, Laguna.

The hypothesis that the frequency of Cry1 Ab resistance in ACB is low ($<10^{-3}>$) was tested using Andow et al. (1998) protocol. Neonate larvae (F_2) were assayed in artificial corn borer diet containing a discriminating dose (LC_{99} = 120 ng/cm2) (Alcantara et al., unpubl.) of Cry 1 Ab protein. Four hundred one (401) females of the ACB from farms at Lubao, Pampanga were used to establish isofemale lines. The larvae from the F_2 screen were susceptible to Cry 1Ab protein. The mortality rate for all of the isofemale lines was at its peak during the first seven days of exposure to the toxin.

The effect of Cry1Ab protein on nontarget Lepidoptera, *Hypolimnas bolina,* was determined. Bioassays using 10x the maximum hazard dose of Cry1Ab protein was utilized. Individual larvae were exposed to 1 cm diameter leaf disc of *Ipomoea triloba* Linnaeus soaked in solution of Cry1Ab protein. Controls were exposed to

I. triloba leaf discs soaked in 0.1 M carbonate buffer. Fifty larvae were used in treated and control experiments, respectively. Two trials were done. Mortality was scored after seven days. On the average, six out of 100 first instar (three-day old) larvae exposed to Cry I Ab protein for several days died. Mortality at seven percent was also observed in the control set-up. These initial results showed that Cry1 Ab protein is not hazardous to the butterfly, *H. bolina.*

Keywords: post commercialization monitoring, Asian corn borer, Bt corn, non-target, Lepidoptera, *Hypolimnas* bonina

ASD-39

IDENTIFICATION OF RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD) MARKERS FOR BRUCHID RESISTANCE GENE IN MUNGBEAN (*Vigna radiata* (L.) Wilczek)

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To develop bruchid resistant mungbean varieties, introgression of bruchid resistance genes from the wild strain *Vigna radiata* var. *sublobata* to domesticated *Vigna radiata* was done. Marker assisted selection (MAS) was employed to hasten the screening of resistant and susceptible samples. To identify random amplified polymorphic DNA (RAPD) markers for bruchid resistance (*Br*) gene, ten UBC (University of British Columbia) primers were tested on 208 mungbean DNA samples. These samples were all previously identified as either resistant or susceptible via direct exposure to bruchid infestation. A total of 61 polymorphic bands for all ten primers were scored and analyzed. Two polymorphic bands were found to be present in high frequency in resistant samples: a 1400 bp DNA fragment produced by primer UBC 168 (present in 73% of highly resistant samples) and a 750 bp DNA fragment produced by primer UBC 313 (present in 80% of highly resistant samples). These two markers were also shown to be absent in susceptible samples. These data suggest that these two markers are possibly linked to the *Br* gene.

Keywords: mungbean, bruchid resistance, introgression, MAS, RAPD

ASD-40

INDIGENOUS BIOLOGICAL CONTROL AGENTS OF *Brontispa longissima* (Gestro) IN THE PHILIPPINES

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Brontispa longissima (Gestro), commonly known as coconut leaf beetle (CLB) is an invasive pest from Indonesia which is one of the potentially most serious pests of coconut and other Palmae species. This was suspected to have entered the Philippines in 2004 via ornamental palm importation from other Southeast Asian countries. Due to the rapid spread of the pest, the coconut leaf beetle (CLB) is currently invading Visayas and Mindanao since its possible entry from Luzon in 2004. The absence of its natural enemies from its country of origin like *Ascecodes hispinarum* Boucek, has hampered the control of this pest. However, based on CLB collections, five indigenous biological control agents have been retrieved, namely, *Hispidophila (Haeckeliana) brontispa* Ferrierre (egg parasitoid), *Tetrastichus* sp.(pupal parasitoid), *Chelisoches morio* (Fabricius) (earwig), *Metarrhizium anisopliae* (green muscardine fungus) and *Beauveria bassiana* (Balsamo) Vuillemin (white muscardine fungus) which has the high potential to reduce CLB populations.

Keywords: *Brontispa longissima* (Gestro), coconut leaf beetle, *Hispidophila (Haeckeliana) brontispa* Ferrierre, *Tetrastichus* sp., *Chelisoches morio* (Fabricius), *Metarrhizium anisopliae, Beauveria bassiana* (Balsamo) Vuillemin

ASD-41

BIOEFFICACY OF TOBACCO (*Nicotiana tabacum* L.) SEED POWDER AGAINST CORN WEEVIL (*Sitophilus zeamays*)

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The use of botanical pesticides for agricultural stored food stuffs is the most environment-friendly way to safeguard the consuming public from the risk of possible pesticidal residue poisoning.

The laboratory and *in situ* bioefficacy tests of Tobacco Seed Powder (TSP) against corn weevil were evaluated. Dry tobacco seeds were powderized and different TSP quantities at 1, 3, 5, 7, 9, 11, and 15 g were prepared and mixed separately into a 7 g uninfected corn kernels previously placed in a petri dish. Percent (%) mortality of the test insects was evaluated 6 h after application and every 6 h thereafter for 72 h.

The 15 g TSP outperformed the other treatments including the positive control. The commercial insecticide and the 15 g TSP showed 100% mortality of the test insects after 66 and 72 h, respectively.

The *in situ* test used the best treatment from the laboratory experiment. The 15 g TSP was then tested and was evaluated in two preparations; the TSP in powder form and TSP in tea bag. Each of the TSP preparation was used to treat the 100 g corn kernels which were previously infested with 30 healthy corn weevils placed in a rectangular box of 6.5 x 4.5 inches dimension. After one month observation period, the TSP in powder form showed the highest and fastest insecticidal action at par with the TSP in tea bag including the commercial pesticide.

Furthermore, percent (%) damage of the corn kernels was least pronounced in TSP powder form. Percent germination of the corn kernels treated with TSP in powder form gave 100% germination while those seeds treated with the commercial insecticide, negative control, and TSP in tea bag gave 98%, 45% and 82%, respectively.

Keywords: Tobacco seed powder (TSP), pesticidal, mortality, bioefficacy

ASD-42

UTILIZATION OF *Eocanthecona furcellata* (Wolff) AGAINST TOMATO FRUITWORM *Helicoverpa armigera* (Hubner) AND EGGPLANT FRUIT AND SHOOTBORER *Leucinodes orbonalis* Guenee

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A study on *Eocanthecona furcellata* against tomato fruitworm *Helicoverpa armigera* Hubner and eggplant fruit and shootborer *Leucinodes orbonalis* Guenee was undertaken. Different densities of *Eocanthecona furcellata* Wolff were evaluated against tomato fruitworm and eggplant fruit and shoot borer. The feeding capacity of *E. furcellata* against third instar larvae of *H. armigera* and *L. orbonalis* were evaluated under laboratory condition.

First nymphal instar of *Eocanthecona furcellata* fed 1.22± 0.33 larvae while the adult fed 10.24±0.64 larvae of *L. orbonalis* in one day. The feeding capacity

increased as the predator grew from first instar to adult stage. A similar trend was observed on the feeding capacity of *Eocanthecona furcellata* against larvae of *H. armigera*. It showed that the attack rate of adults was higher than the nymphs. The first instar nymph preyed 1.68±0.42 larvae while the adult preyed 11.96±0.71 larvae of *H. armigera*.

Results on field release of *E. furcellata* showed that higher rates significantly increased the yield of both tomato and eggplant. Field release of 5 adult *E. furcellata* per tomato plant produced an average yield of 2.03 kg per plant as against field release of 3 and 1 adult *E. furcellata* per plant with an average yield of 1.75 and 0.98 kg per plant, respectively. In eggplant, field release of 5 adult *E. furcellata* per plant of eggplant produced an average yield of 1.37 kg per plant.

Feeding capacity of *E. furcellata* against tomato fruitworm and eggplant fruit and shootborer increased from young to older instar. The adult had higher feeding capacity than the nymph.

Keywords: *Eocanthecona furcellata*, *Helicoverpa armigera*, *Leucinodes orbonalis*, field release, feeding capacity

ASD-43

YEAST SUPPLEMENTED BROTH FOR THE PRODUCTION OF *Pasteurella* VACCINES FOR CATTLE, CARABAOS AND POULTRY

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Hemorrhagic septicemia and fowl cholera, caused by *Pasteurella multocida*, are economically important diseases because of the great morbidities and mortalities they cause. In the Philippines, these highly fatal diseases has been classified as one of the top priority diseases. Vaccines are of great help in preventing these diseases together with good sanitation procedures. The production of vaccines from locally isolated strains of *Pasteurella* will have a great impact on both the economy and livestock production. This study presents the potential of using yeast supplemented broth for the production of *Pasteurella* vaccines for cattle, carabaos and poultry.

Tryptic soy broth (TSB) supplemented with 0, 0.1 and 0.5% (w/v) of either yeast extract (YE)(BBL) or baker's yeast (BY) were evaluated as media for the growth of *P. multocida* in shake flask experiments. TSB with 0.5% BY after 8 hours of incubation at 37ÚC showed the best growth of *Pasteurella* at 1.5×10^{10} cells/ml compared with only 4.5×10^{9} and 1.08×10^{10} cells/ml in TSB alone and TSB with 0.5% YE, respectively. On the other hand, TSB supplemented with 0.1% of either BY and YE showed a population of 6.75×10^{9} and 3.75×10^{9} cells/ml, respectively. Vaccines formulated from TSB supplemented with 0.5% baker's yeast passed the safety and potency tests conducted using Swiss white mice and thus, can be a good and cheaper alternative medium for the growth of *P. multocida* for local vaccine production.

Keywords: *Pasteurella multocida*, vaccine production, baker's yeast, hemorrhagic septicemia, fowl cholera.

ASD-44

PHYSICOCHEMICAL CHARACTERIZATION OF POSTHARVEST QUALITY OF EXCELSA AND LIBERICA COFFEE PRODUCTS

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Specific agronomic, harvest and postharvest practices for Excelsa and Liberica coffee were surveyed, described and assessed. Postharvest qualities of Excelsa and Liberica coffee from major producers in Bataan, Batangas and Bulacan were characterized in terms of moisture content, bulk density, bean color and defects.

Results indicate that although there is a declining interest in coffee farming, majority of the old commercial coffee farmers are still maintaining their Excelsa and Liberica coffee, together with other crops.

All the coffee farmer respondents used color of berries as maturity index, and harvested coffee by stripping. Only 81 % of the farmers practiced trimming, and cleaning. Majority of the farmers practiced sorting before and after drying of berries. A wide range of bulk density values for Excelsa and Liberica was observed which indicates irregularities in terms of size. Moisture content of coffee samples was in conformity with the standard, 13%. Black beans, brown beans, and silver skin residues were found present in all samples evaluated. Foreign materials like stones and sticks were found to be minimal

Keywords: postharvest, coffee products, Excelsa , Liberica

ASD-45

IMPORTANT ALGAL POLYSACCHARIDES EXTRACTED FROM *Undaria undarioides* (Yendo) OKAMURA

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Two important polysaccharides; fucoidan and alginate, were successfully extracted from brown algae, *Undaria undarioides*. This kelp, locally known as *Hirome* in Japan, productively thrives in the warm waters of Japan sea specially in Wakayama and Okinawa Prefecture. Polysaccharides were extracted and characterized according to published procedures in Kyoto University, Forest Biochemistry Laboratory (Recycling System Biomass), Japan.

Fucoidan and alginate are complex polysaccharides found in the cell wall matrix of brown algae and has recently gained prominence because of their wide range of industrial and biomedical applications. Fucoidan has a number of advancements in cancer treatment and other biomedical uses while alginate is widely used as gelling agent and stabilizers for foods and recently been explored for biological and biotechnological applications.

Sugar content of fucoidan analyzed by HPAEC with sulfuric acid hydrolysis showed galactose (47.29%) and fucose (37.68 %) as its primary component sugars. Mannose, xylose, and glucose contributed 9.07, 4.75, and 1.29 %, respectively, to its total carbohydrate component. The polysaccharide of alginate had fucose (37.01 %) as the most dominant sugar. Xylose, glucose, and mannose were present in decreasing order at 17.72, 12.84, and 8.52%, respectively.

The infrared absorption properties of the isolated fucoidan and alginate were consistent with the previous studies from other brown algae sources. The spectrum of fucoidan indicated a hydroxyl group (H-O stretching) at 3422 cm^{-1}. The prominent band at 1254 cm^{-1} was caused by the S=O stretching vibrations. The band at 820-850 (C-O-S) cm^{-1} is common to all sulfated polysaccharide due to sulfate absorption.

The desired signals of the two polysacharrides were not detected in the prepared samples for the ^{13}C-NMR analysis due to their high viscosity that hampered good peak resolution. For fucoidan, which gave better resolution than alginate, the weak signals at 5.34 ppm and 1.27 ppm indicated the presence of L-fucopyranosyl units and methyl protons of the L-fucosyl residues. Also, the prominent signal at 2.17 ppm indicated the methyl signal of the acetyl group of the fucoidan structure. All the above results confirmed the true nature of fucoidan and alginate isolad from *Undaria undarioides*.

Dry weight yield of fucoidan and alginate based on oven dry sample of the kelp were considerable at 2.03% and 28.91%, respectively. The above results and the temperate growth requirements of this species indicates its great promise for farming under the Philippine sea conditions for further exploration to varied -applications.

Keywords: Fucoidan, *Undaria*, Brown algae

ASD-46

STOCK ASSESSMENT OF MUDCRAB *Scylla* spp.) IN THE MARINE WATERS OF CAMOTES ISLANDS CENTRAL HILIPPINES: BASIS FOR MUDCRAB CULTURE AND PRODUCTION PROPOSAL

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Mud crab is a highly priced marine commodity mostly found in mangrove areas. Mangroves have been exploited for the past years including Camotes Islands having a mangrove area of 717 hectares. That is why stock assessment of mudcrab *(Scylla spp.)* found in Camotes Islands was studied in two lunar cycles including the socio-economic profile of collectors, rate of extraction and catch per unit effort (CPUE). Physicochemical parameters in all the sites were also taken. Mud crabs including associated species were collected using crab lift nets "bintol" through systematic sampling at the eight sampling sites with a distance of 50 meters from each other taking into account the carapace length, width and weight up to species level.

Results show that there were only two species of mudcrab caught, the *Scylla olivacea* and *paramamosain* with *S. olivacea* as the dominant one. In Unidos, San Francisco, Cebu mudcrab caught weighed 1,400 grams, in Calmante, Tudela, 250 grams and in San Juan, Pilar, 320 grams during the first operation (last quarter and new moon). During the second operation (first quarter and full moon) Unidos got 180 grams, Teguis, Poro weighed 53 grams and San Juan, Pilar, 150 grams. Their carapace length varied from 8- 11 cm and carapace width from 12- 15 cm in first phase period. For the second phase, carapace length varied from 7- 10 cm and the width was from 10-14 cm. There were only 7 species of mudcrab caught during the two operations.

Results further showed that the respondents (mudcrab collectors) were more or less evenly distributed with a total of 15 collectors. The age of respondents slightly varied and more than seventy percent of the total respondents were married compared to single ones. One hundred percent were males. Majority of them lived in the area for more than 30 years.

The physicochemical parameters of the research area slightly differed during the first phase and second phase periods (phases of the moon). There were 3 species of crabs caught —the *Charybdis hawainensis, Portunus pelagicus* and the red spotted crab in association to mudcrab species during the operation. The carapace length, width and weight of the associated species slightly differed depending on the species.

The catch per unit effort (CPUE) ranged from 37.3- 277.1 grams per hour during the first phase period and 52.8 – 180.1 grams per hour during the second operation.

Keywords: *Scylla spp.*, Comotes Islands, Crab Lift Nets, Assessment

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DEVELOPMENT OF CONCH SHELLS (*Strombus* sp.) MEAT AND SHRIMP *(Metapenaues* sp.) AS FOOD SEASONING

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The development of conch shells meat and shrimps into food seasoning was tried to determine its effectivity in terms of palatability, odor, flavor and general acceptability.

The conch meat and head and skin of shrimps were collected after boiling. A 1:1 proportion of ground conch meat and shrimps was mixed with ground pepper, onion, garlic, salt with gelatin as binder. It was packed at 11 grams. There were four treatments in the study. Treatment 0 uses Knorr shrimps; Treatment 1, mixture of conch-shrimp, Treatment 2, conch and Treatment 3 shrimp. All the treatments were used as seasoning to pancit canton, vegetable soup and porridge preparations. They were subjected to organolyptic evaluation by 50 tasting panel members who were teachers and students of CSCST-FIC, San Francisco, Cebu using the 9 point Hedonic scale.

Results revealed that for palatability, Treatment 3 got 6.89 (liked moderately); Treatment 0, 1, and 2 rated 6.10, 6.24 and 6.04, respectively (liked slightly). For the attribute on odor, Treatment 3 obtained 7.15 (liked moderately), followed by Treatment 1, 6.68 (liked moderately), and Treatment 0 and Treatment 2, 6.24 (liked slightly). For flavor, Treatment 3 rated 6.91 (liked moderately) and the rest, Treatment 0, 1 and 2 rated 6.16, 6.32 and 6.39 (liked slightly). For general acceptability, Treatment 3 was 6.94 (liked moderately) and Treatment 0, 1 and 2 rated 6.20, 6.39 and 6.08, respectively (liked slightly). Analysis of variance (ANOVA) showed that there is no significant difference on the effects of the shrimps and conch shells as food seasoning in terms of flavor, palatability, odor, and general acceptability.

Keywords: *Strombus mutabilis, Metapenaeus ensis,* shrimp, conch shells, food seasoning