

**AGRICULTURAL SCIENCES**

**ASD No. 1 PTERIDOPHYTES AS BIOINDICATORS OF  
FOREST CONDITIONS**

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The Pteridophyte composition of different forest types namely: deciduous dipterocarp-oak forest (DOF); deciduous degraded, hardwood (teak) with bamboo forest (BBDF); and primary, seasonal, evergreen, hardwood forest (EGF) areas at Mae ampong Village, Chiang Mai Province, Thailand, was studied from March 1996 to February 1997 to determine the potential of Pteridophytes as bioindicators. Three subsites, i.e. extremely disturbed, half-disturbed, and less disturbed were established in each forest type. Species richness in EGF (27 spp.) was significantly higher than in the DOF (12 spp.) and BBDF (9 spp.). The species composition in DOF and BBDF was similar with a Sorensen's index of similarity of 0.43. Between subsites, species richness and composition in less disturbed evergreen forested areas were significantly lower and very different from the more disturbed subsites, while that in the two deciduous forests were not.

*Selaginella repanda* (Desv.) Spring, *S. ostensfeldii* Hieron., and *Cheilanthes tenuifolia* (Burm. f.) Sw. were the most dominant Pteridophyte in DOF; *S. repanda*, *Dryopteris cochleata* (D. Don) C. Chr., and *Anisocampium cumingianum* Presl in BBDF; *Dicranopteris linearis* (Burm. f.) Underw. var. *linearis*, *Blechnum orientale* L., and *Pteridium aquilinum* (L.) Kuhn spp. *aquilinum* var. *wightianum* in the disturbed EGF; and *Brainea insignis* (Hk.) J. Sm., *Thelypteris hirtisora* (C. Chr.) K. Iwats., and *Bolbitis virens* (Wall. ex Hk. & Grev.) Schott var. *virens* in relatively undisturbed EGF. These species were used to characterize the conditions of the different forests that were studied.

Since certain species of Pteridophytes could be used, as indicators of forest conditions, detailed forest studies is not necessary if rapid assessment is required.

**Keywords:** pteridophytes, bioindicators, forests, DOF, BBDF, EGF, species richness, similarity index

## ASD No. 2 RESPONSE IN ROOTED STEM CUTTINGS OF PHILIPPINE TEAK (*Tectona philippinensis* Benth. & Hook.) TO BIOFERTILIZERS

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Propagation and proper fertilization treatment of seedlings in the nursery before outplanting need to be rigorously studied in the Philippine teak, *Tectona philippinensis*, primarily to save this endemic species. Its current global conservation status is classified as ENDEMIC by the 1997 International Union on Conservation of Nature (IUCN) Red List of Threatened Species and World List of Threatened Trees (Oldfield, et al., 1998; Walter and Gillet, 1998). Rooting of stem cuttings had been successfully achieved (Follosco-Edmiston, 2000), thus, the next step is to enhance the growth of seedlings using either bio- or inorganic fertilizers.

The study dealt with the use of commercially available biofertilizers. Treatments were carried out under nursery condition and the responses of seedlings were monitored using the parameters: height (cm), diameter at root collar (mm), root/shoot total dry weight (g), % dry matter, % inorganic matter, % organic matter, and % nitrogen. Among the parameters tested, significant differences were obtained on seedling height, diameter, % dry matter, % organic matter and % N. Height of rooted cuttings is found best with Biocore at 20 gram/seedling giving 36.06 cm over that of the control at 20.28 cm. Likewise, seedling height under a combination of Biocore + Mykovam was 25.30 cm. Seedling diameter at root collar was also affected by the application of biofertilizers. Biocore applied at 20 gram/seedling significantly yielded the biggest seedling diameter. Analysis of tissues also revealed significant differences in % dry matter, % organic and % nitrogen contents among different treatments. Mykovam-treated seedlings gave the highest (63%) dry matter content while Biocore-treated seedlings at 20 g, had the lowest (41%). Organic matter content was high (23.61%) under Biocore treatment at 20 g while Mykovam treatment yielded the lowest (19.83%) however, this is not significantly different with results obtained under Biocore at 10 g and the control treatment. Accumulation of % N had the same trend with those of the % organic matter found in the plant tissues.

Given the above responses of the rooted teak cuttings, it is therefore evident that the addition of biofertilizers, Mykovam and Biocore enhance the growth and survival of the Philippine teak in the nursery. Among all of the treatments, Biocore added at 20 g/seedling gave the best results.

**Keywords:** endemic, endangered, biofertilizers, cuttings, nursery

ASD No. 3      **ROOTING IN STEM CUTTINGS OF IPIL [*INTSIA BIJUGA*  
(*COLEBROOKE*) O. KUNTZE]**

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Asexual propagation via rooting of cuttings is a recognized method of mass propagating exact copies of desirable plants for clonal plantation, reforestation and for commercial purposes. Ipil (*I. bijuga*; *Caesapineaceae*) is native to Southeast Asia and the islands of southwestern Pacific. A large tree, it reaches a height of 20 to 25 m and a diameter of 250 cm. It is one of the trees recommended for reforestation not only for its high quality timber but also because of the fact that it has been classified as ENDANGERED by the Convention on International Trade on Endangered Species of Wild Flora and Fauna, CITES (ERDB-DENR, 1993).

Cuttings with node numbers 1-3 (young) and 4-5 (mature) from the tip were obtained from 6 to 8 mo-old seedlings, soaked in 5% Benlate solution for 1 h and then subjected for 30 min to various treatments: 0.1% Superthrive, a vitamin-hormone preparation, 3 levels of IBA and NAA alone (500, 1500, 2000 ppm), and equal amounts of combined IBA and NAA (250, 500, 750, 1000 ppm). Cuttings were immediately planted in trays containing equal amounts of sterile coconut coir dust and river sand. Both treated and untreated cuttings responded favorably under misted condition in polyethylene enclosures. Rooting response at 50 d was manifested by emerging roots and mostly by adventitious roots with or without laterals. Survival of young and mature cuttings was high at 70 to 100% and their difference was not significant in all treatments. Absence of rooting in some young cuttings was observed in treatments where NAA was added at 500, 1500 and 2000 ppm while in mature cuttings, it was in treatments supplemented with 0.5% Superthrive, 1500 ppm IBA and 500 ppm NAA. Also, the absence of rooting in mature cuttings was significantly higher than in young cuttings. Although absence of rooting was observed in some young and mature cuttings, this was definitely much lower as compared with any of the following: formation of 1-2 adventitious roots without laterals, formation of 1-3 adventitious roots with laterals and profuse rooting. Formation of 1-2 roots without laterals in young cuttings was from 0 to 37% and reached 71% in mature cuttings; these are not significantly different. The different types of treatments and types of cuttings have significant effect on profuse rooting. In young cuttings, the highest (71 to 83%) in profuse rooting was observed in treatments with 1500 ppm IBA and with 500 ppm IBA + 500 ppm NAA while in mature cuttings, this was recorded in three treatments: with 2000 ppm IBA, with 250 ppm IBA + 250 ppm NAA, and 500 ppm IBA + 500 ppm NAA. The study indicates that young cuttings are better adapted to rooting than mature cuttings under any type of treatment. The production of roots by untreated cuttings indicate the economic potential of producing clones at the farmer level.

**Keywords:** stem cuttings, rooting, Superthrive, native, *Intsia bijuga*, indolebutyric acid (IBA), alpha-naphthalene acetic acid (NAA)

ASD No. 4      **FACTORS CONTROLLING THE ALTITUDINAL  
VEGETATION AND LEAF SIZE ZONES ON MT. PULOG,  
CORDILLERA, NORTHERN LUZON**

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An anomalous altitudinal vegetation and leaf size zonation pattern has been observed on Mt. Pulog, the highest mountain peak on Luzon Island in the Cordillera mountain range, Northern Luzon. The four unique altitudinal tree vegetation and leaf size zones on Mt. Pulog, are: Zone I, needle-leaved *Pinus* forest zone at 2000-2300 m a.s.l.; II, mixed needle-leaved *Pinus* and microphyllous evergreen broadleaved forest zone at 2300-2400 m a.s.l.; III, Microphyllous *Lithocarpus-Dacrycarpus-Syzygium-Leptospermum* forest zone at 2400-2600 m a.s.l.; and IV, mixed microphyllous *Clethra* and nanophyllous *Rhododendron* forest zone at 2600-2700 m a.s.l. This pattern is contrary to what is usually observed in the tropical mountains where mesophyllous dipterocarps occupy the lower zones and then followed by notophyllous, microphyllous and nanophyllous trees respectively with increasing altitudes. This poses a problem in the study of vegetation science especially to beginners. Therefore, in order to explain this confusing pattern, a combined literature and field investigations were done to determine the factors controlling this unique zonation. Reviews on historical geography and geology were critically examined and field ecological conditions were analyzed. Results indicate three major factors controlling the characteristics zonation pattern. They are as follows: (1) complex geological history of the Philippine coupled with the phytogeographical position of Mt. Pulog as transition region between the tropics and subtropics; (2) temperature; and (3) topography. The findings eliminate the confusion on the anomalous distribution pattern of vegetation and leaf size along altitudinal gradients on Mt. Pulog and hopefully there will no longer be hindrances in interpreting results and drawing conclusions in related studies. Other factors such as cloud cover, soil humidity and wind pattern may have influenced the unique zonation pattern as well, but experimental studies on these aspects are yet to be conducted.

**Keywords:** Mt. Pulog, altitudinal vegetation and leaf size zones, Cordillera mountain range, controlling factors, geological history, phytogeographical position, temperature, topography, tropics, subtropics

**ASD No. 5 GENERAL AND SPECIFIC COMBINING ABILITIES  
FOR MATURE WEIGHT AND EXTERNAL BODY MEASUREMENTS  
OF REGISTERED GOATS IN THE PHILIPPINES**

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Data on mature weight (MWT) and external body measurements [i.e. body length (BL), heart girth (HG), midriff girth (MG), flank girth (FG), withers height (WH), head length (HL) and head width (HW)] of 1,315 goats listed in the Philippine Goat Breed Registry were analyzed using a linear mixed model that included the fixed effect of sex ( $X_i$ ) and random effects of the sire breed ( $S_j$ ), dam breed ( $D_k$ ), and sire breed x dam breed interactions ( $SD_{jk}$ ).

Estimates of general combining ability (GCA) were highest in the Boer (for MWT, HG, MG, FG, HL, and HW) and Saanen (for BL and WH). The lowest GCA estimates were found in the Native goats for all traits studied. Specific combining ability (SCA) was also computed based on the random interaction effects of the sire and dam breeds used in a specific cross.

The predicted mature weight in the Boer, Saanen, Nubian, and Native goats was 46.8 kg, 44.1 kg and 25.1 kg for bucks and 40.2 kg, 37.4 kg, 35.8 kg and 18.4 kg for does, respectively. External body measurements were greater in the Boer, Nubian, and Saanen cross NUXSA) was heaviest at 36.1 kg and 29.4 kg for bucks and does, respectively. Saanen x Native (SAXNA) goats had the lowest mature weight of 26.3 kg and 19.6 kg for bucks and does, respectively. The mature weights and body measurements in the high grade Nubian (HGNUB) or "87.5% Nubian-12.5% Native", Nubian x Native (NUXNA), and Boer x Nubian (BOXNU) were intermediate to the NUXSA and SAXNA crosses.

Average heterosis, defined as the relative superiority of a mating combination over the mid parent values was -4.91%, -1.64%, -2.06%, -1.76%, -1.54%, -1.44%, -2.14% and -1.26% for MWT, BL, HG, MG, FG, WH, HL and HW, respectively. The low and negative heterosis values may imply that mature weight and external body measurements are traits strongly influenced by additive gene effects and that genetic improvement through selection within the breed may be a better strategy under Philippine conditions. The advantage of crosses over the native stock in terms of mature weight was highest in the HGNUB (49.58%), intermediate in NUXNA (18.79%), and least in SAXNA (5.73%). The average advantage over Native goats for external body measurements ranged from 9.24 to 23.98%, 5.10 to 10.49% and -9.10 to 6.28% in the HGNUB, NUXNA and SAXNA crosses, respectively.

**Keywords:** general combining ability (GCA), specific combining ability (SCA), goat, heterosis

**ASD No. 6 FISH SILAGE AS A REPLACEMENT FOR FISH MEAL  
AND UREA WITH SORGHUM AND ITALIAN RYEGRASS  
SILAGES AS A BASAL RATION FOR GROWING LAMB**

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The uncontrolled rising price in imported fish meal and its subsequent shortage in the future necessitated the conduct of this investigation. Two studies were done to assess dietary manipulation of fish silage (FS) as a protein supplement and its comparison to fish meal (FM) and urea (UR) using sorghum silage (study 1) and Italian ryegrass silages (study 2) as a basal ration. In study 1, the molar propionate ratio, 4 hours after feeding, in lambs fed on the FS supplement was higher than the others ( $P < 0.05$ ), however, in study 2, it was largely reduced. The organic matter intake in the FS supplemented diet in study 2 remarkably improved while the digestibilities of crude protein and organic matter tended to be higher than the other protein supplements. An almost 100% increase in nitrogen balance was noted from lambs fed on the FS supplement in study 2 when compared to study 1. The energy balance of lambs fed on the FS supplement in study 2 was largely increased to  $116.6 \text{ kJ/kgW}^{0.75}/\text{d}$  against  $-213 \text{ kJ/kgW}^{0.75}/\text{d}$  in study 1. The urinary purine derivative excretions and microbial nitrogen production of lambs fed on the FS supplement in study 2 were increased by almost 2-fold compared to study 1.

The above results suggest that dietary manipulation enhanced the feeding value of fish silage and is a potential protein supplement in lamb.

**Keywords :** Fish silage, energy balance, volatile fatty acid, purine derivatives, protein supplement.

**ASD No. 7 ALINANG WEED (*Cyperus iria* Linn.): A NEW POTENTIAL  
FIBER RESOURCE FOR PULP AND PAPER**

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The potentials of Alinang (*Cyperus iria* Linn.), a naturally growing weed in the marsh areas, as raw material for the pulp and paper industry was evaluated using a modi-

fied pressure cooking method. The experiments were done in the laboratories of the Mariano Marcos State University, Batac, Ilocos Norte and The Forest Products Research and Development Institute, College, Laguna.

The usual pulping procedure was modified by cooking the samples for just two hours using an ordinary pressure cooker. The pulping treatments were: 16%  $\text{Na}_2\text{SO}_3$  + 10% NaOH; 16%  $\text{Na}_2\text{SO}_3$  + 10%  $\text{Na}_2\text{CO}_3$  and 8% HCl. The produced pulps were bleached with a non-chlorine bleaching agent by using the two stages – 3% hydrogen peroxide process.

Samples cooked with 8 % HCl consistently produced the highest biomass constituents (40% cellulose, 37.3% hemicellulose, 34.7% lignin, and 32.7% hot water extractives). It also gave the highest unbleached (87.1%) and bleached (23.19%) pulp yield. However, the pulps produced from 16%  $\text{Na}_2\text{SO}_3$  + 10 % NaOH and 16%  $\text{Na}_2\text{SO}_3$  + 10%  $\text{Na}_2\text{CO}_3$  treatments gave 10.30 - 10.56 mN.m<sup>2</sup>/g tear index, 51.16 – 65.10 N.m<sup>2</sup>/g tensile strength, 194.9 – 203.81 folding endurance and 5.56 – 6.55 Kpa.m<sup>2</sup>/g burst index. which were much stronger than the HCl-treated pulps.

Generally, the mechanical and physical properties of Alinang pulp faired well with the pulps produced from the traditional wood raw materials produced by conventional processes. Using the modified cooking method, Alinang gives a high strength pulp and can be produced at P 0.38/g pulp. It is much cheaper than the conventional soda cooking method using magabuyo, a hardwood species. giving a production cost of P 3.74/g pulp.

**Keywords:** Alinang, magabuyo, pulp, handmade paper, non wood fiber, conventional process

#### **ASD No. 8 DIVERSITY ANALYSIS OF CYTOPLASMIC MALE STERILE LINES OF RICE USING MICROSATELLITE MARKERS**

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Cytoplasmic-genetic male sterile (CMS) system is considered to be highly important in a hybrid rice breeding program. Various CMS sources have been used in developing CMS lines, therefore, genetic similarities are possible. In developing superior hybrid rices there should be genetic diversity in CMS germplasm to increase the likelihood of identifying heterotic combinations. Molecular technology plays an important role in characterizing and clustering of large array of CMS used in hybrid rice breeding, since this would avoid repetition in the use of the same germplasm. Fifty CMS lines were

studied: 32 came from IRRI, 8 from PhilRice, 4 from Yunnan Agricultural University (YAU) and 6 from backcross nursery (BC). IRRI CMS lines mostly belong to the CMS-WA types, while those from YAU are CMS-STB or CMS-ZTB types. Genetically pure seeds of each line were grown in seed box in the greenhouse. Leaf tissues from eight-week old plants were collected and extracted using the CTAB method. The CMS lines were assayed using microsatellite primers through polymerase chain reaction (PCR). Amplification products were separated using 5% denaturing polyacrylamide gel and polymorphism was detected using silver sequence DNA staining st. Initially, all of the 9 simple sequence repeats (SSRs) or microsatellite markers surveyed exhibited polymorphism. Use of SSR markers is efficient in characterizing and determining diversity in CMS lines. Further, markers unique to a specific CMS line may be used as diagnostic tool for identification.

**Keywords:** cytoplasmic male sterile lines (CMS), rice, PCR, SSR, diversity analysis

#### **ASD No. 9 GENETIC CHARACTERIZATION OF NEW TGMS RICE MATERIALS IN TERMS OF MOLECULAR DIVERSITY**

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Thermosensitive genetic male sterility (TGMS) genes regulate the pollen fertility of the male sterile rice when subjected to different temperature regimes. This system is considered to be a more efficient alternative than the cytoplasmic male sterile (CMS) system for hybrid rice. Genetic and molecular characterization of all TGMS lines aids in identifying their diversity as to explore the possibilities of utilizing the most promising lines. Diversity of TGMS materials were evaluated using TGMS 1 and TGMS 6 (from Vietnam), TGMS 4, TGMS 5 and TGMS 11 (from China) and TGMS 13 (from IRRI) established both in Maligaya and Capintalan, Nueva Ecija. DNAs from individual plants were subjected to PCR analysis using Simple Sequence Repeats (SSR) or Microsatellite primers. Six TGMS lines were characterized using a total of 67 SSR markers from which 58 showed polymorphism.

Two groups were resolved from the cluster analysis of TGMS lines based on the banding patterns of the 58 SSR markers used. The first main group comprises of TGMS 1, TGMS 6 (Vietnam), TGMS 5 and TGMS 13 (from China and IRRI, respectively) which were genetically distant based on low similarity coefficient computed. The second group comprises of TGMS 4 and TGMS 11, both originating from China. SSR analysis indicates that the TGMS lines characterized are genetically diverse.

**Keywords:** TGMS, Diversity, Simple Sequence Repeats (SSR), markers, rice



**ASD No. 10 GENETIC DIVERSITY IN THREE SPECIES OF CHILI  
PEPPER CAPSICUM (SOLANACEAE) FROM SOUTHEAST ASIA  
BASED ON SDS-PAGE OF SEED PROTEINS**

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Genetic diversity among three species of *Capsicum* collected from Southeast Asia, namely: *C. annuum* L., *C. chinense* Jacq., and *C. frutescens* L. was determined using SDS-PAGE of seed proteins. Twelve major protein bands were resolved, nine of which were monomorphic. Of the polymorphic bands, band 3 was the most common (18%), while band 7 was the least common (15%) of the accessions. Six banding patterns (BP) were exhibited by the three *Capsicum* species. BP 4 was the most common (63% of the total population). BP 1, found to be least common (1% of total population) was established to be specific to *C. chinense*, while BP 6, 7 and 13 were specific to *C. annuum*. No band pattern was specific to *C. frutescens*.

Frequency distribution yielded the geographic distribution of specific bands and band patterns. Specific protein bands and band patterns predominated in respective countries of origin. Band 1 predominated in Indonesia, Band 3 in the Philippines and Band 7 in Thailand. BP 1 and BP 7 predominated in the Philippines, BP 4 in Thailand and Indonesia, BP 5 and BP 13 in Thailand and BP 6 in Indonesia. Only BP 13 was not exhibited by the 17 accessions from the Philippines. Hence, the Philippines seem to have the highest diversity of banding patterns among the four Southeast Asian countries.

Similarity index (SI) values showed that interspecific variation is greater than intraspecific variation. Among the three species, *C. annuum* was observed to exhibit the highest intraspecific variation (93.2), with *C. frutescens* (96.7) next, while *C. chinense* has the lowest intraspecific variation (100.0). Based on the SI values and average linkage dendrogram, *C. annuum* was found to be most closely related to *C. frutescens*, while *C. chinense* is least closely related to *C. annuum* and *C. frutescens*. Thus, the SDS-PAGE protein profiles were able to determine the genetic diversity and divergence of the three *Capsicum* species.

**Keywords:** genetic diversity, *Capsicum* species, seed protein bands, SDS-PAGE, similarity index, inter-and intraspecific variation

**ASD No. 11 SELECTION, PROPAGATION, AND CULTIVATION  
OF *GRAMMATOPHYLLUM SCRIPTUM* (LINN.) BL.**

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*Grammatophyllum scriptum* (Linn.) Bl is a robust, epiphytic, and indigenous Philippine orchid that bears colorful and attractive flowers in inflorescence reaching up to 2 meters long. A wide variety of flower types are available, and it is therefore necessary to select those which are acceptable for landscaping or as a flowering potted plant.

About three hundred flowering plants were observed *in situ* and in cultivation from different areas of the country from 1999 to 2001. Preliminary selections were made from these populations and a germplasm collection was established at the Orchid Nursery of the University of the Philippines Los Baños (UPLB). At present, there are about 80 plants of 48 accessions in various stage of development from ten provinces, namely: Cavite, Laguna, Quezon, Oriental Mindoro, Romblon, Albay, Camarines Sur, Nueva Vizcaya, Ifugao, and Agusan del Sur. The observed flowering periods of these plants were from December to August,. Four selected forms are presented and described based on their flower size, form, color, marks, and fragrance.

*In vitro* propagation of these selections were made through the inoculation of embryos excised from freshly harvested or stored green capsules and seeds from mature dehisced capsules in UPLB Orchid Nursery Germination Medium and resealed in various types of differentiation media. Acclimatization of plantlets was performed in cooperation with growers in Cavite, Capiz Palawan and Negros Occidental. The required time for seedling production from inoculation is at least 14 months. Delayed resealed of germinated protocorms can be done to program the plant propagation schedule. Established seedlings or divisions are planted with limited substrate in rigid plastic pots with custom made holes to allow profuse root and shoot growth. They are hanged, watered and fertilized in a well aerated area with 25% to 50% shading.

Results indicate favorable prospects of commercially producing the selected *Grammatophyllum scriptum* for the Philippine ornamental industry.

**Keywords:** *Grammatophyllum scriptum*, orchids, *in vitro* propagation, orchid cultivation, embryo culture, germplasm

**ASD No. 12 PYRAMIDING OF BACTERIAL LEAF BLIGHT (BLB)  
RESISTANCE INTO THERMO-SENSITIVE GENIC MALE  
STERILE (TGMS) LINES**

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In addition to conventional breeding methods, molecular marker technology was utilized to improve efficiency and fast track the development of superior two-line rice hybrids. Since TGMS lines are susceptible to most Philippine races of BLB caused by *Xanthomonas oryzae* pv *oryzae* (*Xoo*), introgression of resistance genes was deemed important. A pyramid of multiple resistance genes into promising TGMS lines can lead to a higher level of resistance to *Xoo* than using only a single gene. Furthermore, breakdown of BLB resistance would be delayed. Hence, crosses of TGMS x IRBB21 x IRBB4/7 were designed to incorporate the resistance genes into the TGMS lines. DNA marker-aided selection through Sequence Tagged Sites (STS) analysis was conducted to pyramid and identify three BLB resistance genes, *Xa4*, *Xa7*, and *Xa21* using the primers PJ, MP1 and MP2, and *Xa21*, respectively on TGMS lines 1, 2, and 6. The potential BLB resistance donors used were IRBB21 AND IRBB4/7.  $F_1$ s of TGMS x IRBB 21 were crossed to IRBB4/7 and double cross progenies were tested for the presence of the genes. STS analysis on the progenies identified gene combinations of *Xa4/7* and *Xa4/21* on all three lines. However, only TGMS6 was identified to have *Xa4/7/21*, the gene combination of interest. Seeds of this cross were advanced to the next generation ( $F_2$ ). Resistance of pyramid lines to BLB pathogen will be confirmed in the succeeding generations via race inoculation.

**Keywords:** TGMS, BLB resistance, STS analysis, pyramiding, markers

**ASD No. 13 YIELD AND RESISTANCE OF EGGPLANT ACCESSIONS/  
VARIETIES AGAINST LEAFHOPPER, *AMRASCA BIGUTULLA* ISHIDA  
AND EGGPLANT BORER, *LEUCINODES ORBONALIS* GUENEE**

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The resistance and yield responses of 11 eggplant accessions, 2 open-pollinated, 3 farmers' and 5 hybrids varieties against the two major pests of eggplant, *Leucinodes orbonalis* Guenee and *Amrasca bigutulla* Ishida were studied at Block A, Lot 10, Central

Experimental Station, Pili Drive.

Results showed that resistance responses of the tested entries were almost indirectly proportional to yield for the 20 varieties. Accession 300 is an exception since it had shown a comparative resistance against the two pests and still the yield was somewhat proportional to the high yielding ones. Black Ninja had an intermediate resistance responses to both pests, but it yielded higher compared to the other resistant entries. The remaining 4 hybrids had almost the same production as that of Black Ninja and also with intermediate resistance. Tolerance is the mechanism of resistance exhibited by the above stated high yielding varieties. Abar, a native from Nueva Ecija was found to be the most resistant against leafhopper infestation but susceptible to fruit borer infestation.

**Keywords:** Eggplant, *Solanum melongena*, eggplant leafhopper, *Amrasca biguttula*, eggplant borer, *Leucinodes orbonalis*, yield, resistance

**ASD No. 14 RESISTANCE OF NATIVE VARIETIES AND WILD RELATIVES OF EGGPLANT (*SOLANUM MELONGENA* L.) AGAINST THE LEAFHOPPER, *AMRASCA BIGUTTULA* ISHIDA AND EGGPLANT FRUIT/SHOOT BORER, *LEUCINODES ORBONALIS* GUENEE**

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A total of ninety-nine eggplant genotypes were screened for field resistance to the leafhopper at vegetative and reproductive stages and resistance to the eggplant fruitborer at harvest time. The different eggplant accessions were planted at Block B Lot 12, IPB Demo Area, Central Experimental Station (CES), Pili Drive, UPLB.

Results shows that the native varieties Abar, SRO2 and Sinampedro were resistant to leafhopper but susceptible to fruit borer. Accession 544 white was most susceptible to leafhopper but resistant to fruit borer. Some wild relatives of eggplant that were resistant to both pests were Accessions 503, 566, 651, 671, 672 and 682.

Based on the results it was found out that the native and wild relatives of eggplant could be utilized as parent material for crop improvement or hybridization work.

**Keywords:** Eggplant, *Solanum melongena*, eggplant leafhopper, *Amrasca biguttula*, eggplant borer, *Leucinodes orbonalis*, resistance, native and wild relatives

**ASD No. 15 MOLECULAR TAGGING OF TGMS GENE USING  
NEW TGMS SOURCES OF RICE**

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The discovery and application of the Thermosensitive Genic male sterility (TGMS) system has a great potential for revolutionizing hybrid seed production technology. Mapping of TGMS genes and the subsequent development of useful DNA markers will provide an efficient alternative approach in breeding superior heterotic rice hybrids through marker-aided selection. Five  $F_1$  combinations were developed to map 3 unknown sources of TGMS genes, PRT 1 (Hanoi, Vietnam), PRT 2, (Hanoi, Vietnam) and PRT 4 (Guangxi, China). The  $F_2$  populations generated using IR64 and PSBRc 34 (Burdagol) as tester varieties were established both in BSU and Maligaya, Nueva Ecija and were evaluated for pollen fertility/sterility.

Of the 108 Simple Sequence Repeats (SSR) or microsatellite markers surveyed, 85 were polymorphic and 19 were monomorphic. Polymorphic SSR markers were detected on a denaturing 5% polyacrylamide gel and silver sequence staining procedure. Sterile plants that were identified in each mapping population were analyzed using SSRs in order to identify potential molecular markers linked to the TGMS gene. For each population, several SSR markers were identified that were potentially linked to the TGMS trait. For populations 1, 2, 4, 5 and 6, the respective number of markers identified were 9, 18, 13, 9 and 10. These markers showed monomorphic bands for all sterile TGMS lines. However, due to limited number of DNA samples, confirmation for the absence of such bands in fertile  $F_2$  samples was not conducted. The potential markers will then be used to map  $F_2$  population for gene identification and further identify chromosome location such that the transfer of the TGMS gene into genetic backgrounds of rice will be facilitated.

**Keywords:** TGMS, Tagging, Simple sequence Repeats (SSR), markers, rice

**ASD No. 16 INDUCTION OF MULTIPLE SHOOTS AND  
INFLORESCENCE FROM EXCISED SHOOT TIPS AND NODAL SEGMENTS  
OF IN VITRO GERMINATED SEEDLINGS OF MAIZE INBRED LINES**

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Plant regeneration from in vitro-cultured cells, tissues and organs is an important step towards genetic manipulation of plants. The plant materials to be used for tissue

culture should be morphogenetic and highly regenerable. The tissue culture requirements for plantlet regeneration via shoot organogenesis or somatic embryogenesis for different inbred lines of maize are being investigated. For multiple shoot induction, shoot tips and nodal segments excised from *in vitro* germinated seedlings of inbred lines Pi 23, Pi 17 and Pi 31 were cultured on MS medium supplemented with 30 g/L sucrose, 1mg/L NAA and 4 mg/L BAP. The incidence of multiple shoots obtained from shoot tips ranged from 54 to 100% and from nodal segments, 29 to 77%. Differentiation of inflorescence (ears) *in vitro* was observed on cultured shoot tips (21 to 57%) and nodal segments (100%) for inbred lines Pi 31 and Pi 23. The *in vitro* developed ears differentiated into shoots upon transfer to shoot regeneration medium. The multiple shoot and inflorescence differentiation can be an alternative plant regeneration system suitable for genetic manipulation of maize.

**Keywords:** Maize, multiple shoot induction, *in vitro* developed inflorescence

**ASD No. 17      A PROTOCOL FOR DOUBLED HAPLOID PLANT  
PRODUCTION FROM ANTHR CULTURE-DERIVED  
HAPLOID RICE PLANTS**

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Increasing the proportion of doubled haploid (DH) to haploid (H) regenerants is one parameter that measures the efficiency of anther culture (AC). In our AC work for indica rice, H plant regeneration, on the average, is 50 % or more, depending on the genotype. We initiated DH plant production from young inflorescence of the H plants regenerated from the anthers of  $F_1$  progenies of seven crosses for salt tolerance breeding. Young spikelets (<1 mm) were cultured in two callus induction media containing 10 mgL<sup>-1</sup> colchicine. One medium is supplemented with 2 mgL<sup>-1</sup> 2,4-Dichlorophenoxyacetic acid (2,4-D), while the other with 10 mgL<sup>-1</sup> phenylacetic acid (PAA). One batch of spikelets, plated in 2,4-D containing medium, was maintained in the dark for two weeks, sub-cultured in fresh induction medium without colchicine, and kept in the dark for another two weeks before transferring the calli formed in the regeneration medium. The other batch was maintained in the dark for four weeks. The third group of spikelets were cultured in PAA-enriched medium, maintained in the dark for two weeks, then transferred in the light, until plants regenerated without sub-culturing in the regeneration medium. The spikelets in 2,4-D medium and exposed to colchicine for two weeks formed calli in 22 to 26 days from plating. When transferred in the regeneration medium, the calli proliferated, but eventually turned necrotic and died. Those exposed to colchicine for four weeks in the dark turned brown. Plant regeneration was obtained from the spikelets of four of the seven genotypes

cultured in PAA and colchicine containing medium. Regeneration ranged from 0.6 to 8.1% with an average of  $4.1 \pm 3.2\%$ . We regenerated 52 plantlets from 36 spikelets, of which 34 (65%) were H and 18 (35%) were putatively DH. We obtained 112 DH lines from these regenerants. The ploidy level of these materials will be verified through cytological examination.

**Keywords:** colchicine, 2,4-D, PAA, inflorescence

**ASD No. 18      INDUCTION OF SOMATIC EMBRYOGENESIS IN  
PEANUT (*Arachis hypogea* L.) AND SHOOT ORGANOGENESIS IN  
POLE SITAO (*Vigna unguiculata* var. *sesquipedalis*)**

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Peanut (*Arachis hypogea* L.) and pole sitao (*Vigna unguiculata* var. *sesquipedalis*) are two of the priority leguminous crops in the Institute of Plant Breeding. In order to complement the conventional breeding for improved pest resistance and nutritional quality by plant biotechnology, tissue culture studies have been conducted to identify and develop suitable in vitro plant regeneration systems for the locally developed cultivars of peanut and pole sitao.

In peanut cultivars PSBPn 1 ('Biyaya 10') and PSBPn 2 ('Biyaya 12'), somatic embryos were induced directly from young leaf sections of in vitro-germinated seedlings cultured in agar-solidified MS-B5 basal medium with 50 g L<sup>-1</sup> sucrose and 40 to 80 mg L<sup>-1</sup> 2,4-dichlorophenoxyacetic acid (2,4-D). The transfer of the first two batches of somatic embryos in MS-B5 basal medium alone or with the addition of 1.0 mg L<sup>-1</sup> benzyladenine (BA) resulted in the maturation and germination of somatic embryos into green plantlets. Various stages of somatic embryo formation were identified and documented. Experiments on media requirements and culture conditions are currently being done to optimize the system for initiation, maturation and conversion of somatic embryos into complete plants. In pole sitao cv UPL PS 1 and UPL PS 2, cotyledon and cotyledonary node explants of in vitro-germinated seedlings were cultured in MS-B5 basal medium with 1.0 mg L<sup>-1</sup> BA based on the protocol developed for mungbean (Avenido and Hautea, 1990) and other Asiatic *Vigna* spp. (Avenido and Hattori, 1999). Preliminary observations revealed higher incidence of direct shoot organogenesis from the cultured cotyledon than in cotyledonary node explants, indicating a difference in the explants and/or tissue culture requirements of pole sitao to that of mungbean.

**Keywords:** cotyledon, cotyledonary node, grain legume, leaf explants, plant regeneration, peanut, pole sitao, shoot organogenesis, somatic embryogenesis, tissue culture

**ASD No. 19 DIRECT SHOOT ORGANO GENESIS FROM  
COTYLEDONARY NODE CULTURES OF MUNGBEAN AND  
OTHER ASIATIC *Vigna* spp.: NEW MARKER FOR SPECIES  
GROUPING WITHIN SUBGENUS *Ceratotropis* (Piper) Verdc.**

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The subgenus *Ceratotropis* (Piper) Verdcourt of the complex genus *Vigna* is comprised of yellow-flowered cultivated species and their wild relatives, which are all of Asiatic origin. This includes mungbean (*V. radiata* {L.} Wilczek), blackgram (*V. mungo* {L.} Hepper), mothbean (*V. aconitifolia* {Jacq.} Marechal), adzukibean (*V. angularis* {Willd.} Ohwi & Ohashi) and ricebean (*V. umbellata* {Thunb.} Ohwi & Ohashi). Application of plant biotechnology to crop improvement programs has been limited by the recalcitrance of many *Vigna* species to *in vitro* culture. As the best alternative, the cotyledonary node (CN)-culture system developed originally for mungbean was found suitable for other Asiatic *Vigna* species (Avenido and Hattori, 1999). This system involved the use of MS salts, B5 vitamins, 3.0% sucrose and 1.0 mg l<sup>-1</sup> benzyladenine (BA) medium during seed germination (ie., BA-preconditioning) and subsequent CN culture. High frequency induction of shoot organogenesis for all epigeal species namely *V. radiata*, *mungo*, *aconitifolia*, subspecies *radiata* var. *sublobata*, *mungo* var. *silvestris* and in the hypogeal but allotetraploid *glabrescens* was obtained. In contrast, two other hypogeal species *V. angularis* and *umbellata* failed to initiate shoots from the nodes.

Histological studies were done to establish a) the effects of BA-preconditioning on mungbean seedlings and b) the basis for the observed species-dependent shoot organogenesis from the CN explants. BA-preconditioning induced bigger axillary shoots on germinating seedlings over the control (basal medium only). Subsequent histological observations of the CN explants from 4-d-old seedlings at d0 (explantation day), d4 and d8 (after explantation) revealed the formation of primary axillary shoots (pas) in both *V. radiata* and *V. glabrescens* followed by secondary axillary branching at d8. Further examination by scanning electron microscope (SEM) confirmed the presence of shoot buds in the explants at d0 in all the epigeal species namely *V. radiata*, *V. mungo* and *V. aconitifolia* together with the hypogeal but allotetraploid *V. glabrescens*. Consistently, these structures were absent in *V. angularis* and *V. umbellata*. These results provide conclusive evidences in support of the existing genomic grouping within subgenus *Ceratotropis*, which designates AA, A<sub>1</sub>A<sub>1</sub> and A<sub>1</sub>A<sub>1</sub>/- to epigeal, hypogeal and the allotetraploid (digenomic) species, respectively. Therefore, the induction or non-induction of shoots directly from the nodes of cultured CN explants is a new and practical marker corresponding to the genomic grouping within the Asiatic *Vigna* species. For the first time, this differential *in vitro* regeneration response (i.e., response to BA) was attributed



to the inherent anatomical and developmental differences among the species, which would play a practical role in the effective choice of tissue culture protocol for biotechnology-assisted genetic improvement in different *Vigna* species.

**Keywords:** benzyladenine; cotyledonary node, histology, genus *Vigna*; plant regeneration, scanning electron microscopy, species relationships; subgenus *Ceratotropis*, taxonomy; tissue culture

**ASD No. 20 FREE-TRYPTOPHAN AND INDOLEACETIC ACID (IAA)  
IN RELATION TO ZINC NUTRITION IN HIGHER PLANTS**

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Zinc plays a fundamental role in a variety of metabolic processes in plants. Functional aspects of zinc nutrition and possible effects of its deficiency have long been studied. This study aimed to clarify the role of zinc in relation to free-tryptophan and IAA in higher plants.

Inducement of zinc deficiency in radish seedlings was done following the culture solution technique. Growth measurement at harvest and zinc determination using atomic absorption spectrophotometer were done for the control (50 ppb Zn) and zinc-deficient plants (0 ppb Zn). Free-tryptophan was measured using high performance liquid chromatography (HPLC). Identification and quantification of IAA were done using the two-dimensional thin layer chromatography (TLC), gas chromatography-mass spectrometry (GC-MS) and gas chromatography (GC) analyses, respectively.

Plants grown under zinc-deficient condition had stunted growth and exhibited symptoms characteristics of zinc deficiency. Free tryptophan was found to accumulate in zinc-deficient plants as compared with the control plants with values of 0.02 and 0.01 μmol/g f.w (fresh weight), respectively. TLC chromatogram showed that zinc-deficient plants gave the same *R<sub>f</sub>* value and color reaction with that of the authentic IAA. GC-MS revealed that peaks of IAA from the zinc-deficient and control radish shoots coincided with the peak of authentic IAA. Quantitative estimation of IAA using GC in the zinc-deficient and control plant obtained similar results with value of 0.36 and 0.32 μg/100g f.w., respectively.

Tryptophan being a precursor of IAA accumulated in zinc-deficient plants resulting to a normal level of IAA. Although IAA seemed to be normal in zinc-deficient plant, symptoms characteristics of zinc deficiency were observed. Results indicated that the growth of radish plants in relation to zinc nutrition is not solely controlled by the level of

IAA. It is also speculated that the IAA may not be biologically active or cannot promote growth in the absence of zinc.

**Keywords:** zinc nutrition, free-tryptophan, indoleacetic acid (IAA)

## ASD No. 21      **INCREASING THE YIELD OF GRAFTED TOMATOES THROUGH THE USE OF RAINSHELTER**

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Growing tomatoes during the hot, wet month is concentrated in very small hilly areas. However with the introduction of grafted tomatoes with rain shelter, tomatoes can now be grown in the lowlands during rainy season.

An experiment was conducted to determine the influence of rain shelter on the yield of grafted tomatoes during the hot, wet months. One-month seedling of EG-203 an eggplant variety and H 7996 a tomato variety were grafted with Apollo and CHT 501 tomato varieties. The grafted tomatoes were transplanted on a raised bed provided with rain shelter and under open field. The rain shelter was made of iron pipes made into an arc 2.5 m high covered with NO. 32 mesh plastic nets.

Rain shelter significantly increased the survival of grafted tomatoes with an average of 73.6 compared with that from the open field of 49.3 percent. Furthermore grafted Apollo to EG-203 and H7996 register highly significant plant survival (95.8 and 87.5) when provided with rain shelter than grafted tomatoes from the open field (62.5 and 45.8). The same result was also obtained from grafted CHT 510. The plant survival with rain shelter was 91.6 and 75.0 vs. 87.5 and 54.1 percent, from the open field.

The overall effect of rain shelter on yield was highly significant. The yield increment due to the provision of rain shelter was 257 percent or an increase 6,7 t/ha. The yield of grafted tomatoes with rain shelter was 9.1 while from the open field was only 2.4 t/ha.

Rain shelter through the used of No. 32 mesh plastic nets reduced the impact of heavy rain which causes the dropping off of flowers during the rainy season. The increased in yield was mainly due to higher plant survival and significantly more number of fruits brought about by higher percentage of fruit setting.

**Keywords:** graft, rootstock, scion, rain shelter

**ASD No. 22 NITROGEN FERTILIZER EFFICIENCY IN WET  
DIRECT-SEEDED RICE USING <sup>15</sup>N-LABELED UREA**

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The increasing cost of rice production makes it imperative to focus on nitrogen efficiency to maximize the benefits derived from the applied and native nitrogen in the soil. A sizable portion of the inorganic nitrogen applied in rice is lost, thus proper timing and placement are necessary to minimize losses. This study was conducted to determine the nitrogen fertilizer efficiency in wet direct-seeded rice at different growth stages using <sup>15</sup>N-labeled fertilizer.

PSB Rc28 was broadcast-seeded at 40 kg seeds/ha. <sup>15</sup>N-labeled urea was applied at 30 kg/ha basal, 40 kg/ha at 30 days after sowing (DAS), 60 kg/ha at panicle initiation (PI), and 20 kg/ha at flowering in microplots. Using the same rate, ordinary urea was applied in bigger plots for each application time.

There was low plant N uptake (8-10%) with basal N application. The fertilizer applied at 30 DAS was readily absorbed by the plant resulting in 38-38% recovery at 20 days after application. Twenty-eight percent of the basal and 26% of the fertilizer applied at 30 DAS remained in the soil. Most of the nitrogen taken up by the plant at the early stage of growth came from the native soil N. the lowest N recovery in the soil was noted at PI indicating high plant uptake.

The results imply that bulk of the rice nitrogen requirement should be applied at PI and flowering stage to attain higher nitrogen fertilizer efficiency. In wet direct-seeded rice, lower N must be applied at basal to 10 DAS to avoid high N losses.

**Keywords:** nitrogen fertilizer efficiency, <sup>15</sup>N-labeled urea, direct-seeded

**ASD No. 23 EFFECT OF RICE ROOT-KNOT NEMATODE ON  
GROWTH AND YIELD OF ONION**

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Root-knot disease of onion in the Philippines is caused by rice root-knot nematode, *Meloidogyne graminicola*. In rice, this pest causes yield reductions from 20-70%. Its effect on growth and yield of onion has not been established, hence this study. Seedlings

inoculated with different initial nematode densities ( $P_i$ ) and field onions with different gall index rating were assessed.  $P_i = 10,000$  J2 reduced seedling height, leaf weight, and depth of rooting of Yellow Granex. Onions transplanted at 55 days old had greater reduction in root weight and depth of rooting than those transplanted at 15 and 45 days old. Bulb diameter and weight of 55-day-old transplants were reduced by 17% and 41%, respectively, at  $P_i = 50$ . Onion yield of 45-day-old transplants was reduced by 20-28% at  $P_i = 100$  while 15-day-old transplants were reduced at  $P_i = 1,000$ . In the field, 50-100% root galling caused 20% reduction in the bulb diameter and 40% in bulb weight of Yellow Granex. Bulb weight of Red Creole was also reduced by 86%; Batanes, 59.5%; and Tanduyong, 31.4%. The number of aggregate bulbs of Tanduyong was also reduced by 48%.

**Keywords:** rice root-knot nematode, *Meloidogyne graminicola*, onion, yield loss

**ASD No. 24 NEMATOCIDAL ACTIVITY OF SOME PLANT SPECIES  
AGAINST THE ROOT-KNOT NEMATODE, *Meloidogyne graminicola*  
AFFECTING BULB ONION (YELLOW GRANEX)**

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Thirteen plant species showed high nematocidal activity against *Meloidogyne graminicola*. These were Mahogany (*Swetenia macrophylla*), Marikit (*Calotropis gigantea*), Marigold (*Tagetes erecta*), Papaya (*Carica papaya*), Kuyot (*Dioscorea hispida*), Euphorbia (*Euphorbia heterophylla*), Asunting (*Casia alata*), Centrosema (*Centrosema pubescens*), Crotalaria (*Crotalaria incana*), Bagalunga (*Melia dubia*), Neem tree (*Azadirachta indica*), Makabuhai (*Tinospora rumphi*) and Buyo (*Piper beetle*). No galls were formed in the roots of rice seedling 35 days after inoculating the second stage larvae previously dipped in these extracts for 24 hours. Neem, Papaya, Euphorbia, and Kuyot were more potent than the rest because their extracts still showed very high activity even at 25 percent concentration. These four plant species regardless of form applied (powder, fresh extract and chopped leaves/tuber) significantly reduced the number of root galls and nematode density in the soil compared with the untreated control. The powdered form of Neem tree and Papaya were comparable and or better than the nematicide Mocap.

**Keywords:** Galls, root-knot, *Meloidogyne graminicola*, *Azadirachta indica*, *Euphorbia heterophylla*, *Carica papaya*, *Dioscorea hispida*, bulb onion, yellow granex, Mocap

**ASD NO. 25      CONVERTING BIOMASS WASTES INTO ORGANIC  
FERTILIZER USING MICROBIAL INOCULANT**

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A sustainable recovery and recycling system for biomass wastes is a major concern of the country. The slow natural decomposition process and production of foul odor are among the problems in using biomass wastes as organic fertilizer. This study aimed to use microbial inoculant in enhancing the decomposition of biomass wastes and converting them into an organic fertilizer. A microbial inoculant (MI) was produced from carbonized rice hull, rice bran, and molasses inoculated with a mixture of effective and beneficial microorganisms (EMI). Biomass wastes recovered from kitchen garbage, grasses leaf droppings, crop residues, and tree trimmings were shredded and inoculated with MI. The results showed that MI decomposed the biomass wastes into organic fertilizer in 1-2 weeks and eliminated the foul odor emitted by the wastes in natural decomposition process. Moreover, the organic fertilizer produced from the decomposition of waste materials had higher nutrient content than chicken manure. Thus, the use of MI is better than the conventional composting process because the wastes undergo the fermentation-decomposition processes that reduce the processing time, with less foul odor, and minimal nutrient losses.

**Keywords:** biomass waste, crop residue, effective microorganisms, kitchen garbage, microbial inoculant, organic fertilizer, resource recycling system

**ASD NO. 26      BIO-ORGANIC FARMING FOR SUSTAINED  
CROP PRODUCTION IN THE ILOCOS**

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A rice-based bio-organic farm was established in MMSU to create awareness and serve as a show window for bio-organic farming technologies. Technologies such as use of organic fertilizer, green manuring, biological pest control and the use of biological fertilizers were combined. All farm wastes were composted using *Tricoderma harzianum* as activator. Compost was applied at the rate of 1 t ha<sup>-1</sup>. Chicken manure was also incorporated in the farm. Indigo was used as green manure. Indigo seeds were broadcasted

during the last irrigation of the dry season crop at the rate of 10 kg seeds ha<sup>-1</sup>. Bio-N, a microbial fertilizer, was mixed with rice seeds as inoculant at the rate of one pack per 20 kg seeds prior to seedbedding. There was no spraying of pesticides to enhance population of natural enemies.

After five years, yield of rice in the bio-organic farm was comparable with that of conventional farm due to the accumulation of organic matter in the soil which improved the texture, P and K content of the soil. Pest population was lower in the bio-organic farm because of a higher population of natural enemies.

Simultaneously, a survey was conducted to determine the problems and prospects of bio-organic farming in Ilocos. Results showed that utilization of the different bio-organic farming technologies was low due to the farmers' inadequate knowledge of the technologies and the inavailability of the inputs for the different technologies in the market. To address these problems, various trainings, technology demonstrations, field days, farmers' classes and radio interviews on the different bio-organic farming technology inputs available, a Memorandum of Agreement was forged between UPLB-BIOTECH and MMSU. MMSU markets and promotes various products of BIOTECH to the farmers which are primary inputs for the different bio-organic farming technologies.

**Keywords:** bio-organic farm, conventional farm, organic fertilizer, green manuring, biological pest control, biological fertilizer

**ASD No. 27 GENETIC DIVERSITY OF TWO NATURAL POPULATIONS OF *HISPODONTA* SP. (CHRYSOMELIDAE: COLEOPTERA), A NEW BANANA PEST RECORD IN THE PHILIPPINES**

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The genetic diversity of two populations of *Hispodonta* sp. a new banana pest record in the Philippines was determined through morphometric analysis and SDS-PAGE. Samples of adult *Hispodonta* sp. were collected from May-it, Lucban, Quezon and Buyagan, La Trinidad, Benguet. A total of seven protein bands of high molecular weight were observed to be present in the Buyagan population, which produced three protein band patterns. These were BP-A with bands 1,2,3,4,5,6, and 7; BP-B with bands 1,2,4,6,7; and BP-C with bands 1,2,5,6,7. The Buyagan population had a similarity index (SI) of 86-100%. SDS-PAGE of the May-it population will show whether there is similarity in morphological and biochemical compositions of the two populations given the geographical

distance and environmental differences of the sampling locations..

**Keywords:** *Hispodontu* sp., genetic diversity, SDS-PAGE, similarity index, morphometric analysis, Benguet, Quezon

**ASD No. 28 ANTHONOMUS SP., A NEW PEST OF DENDROBIUM ORCHIDS IN THE PHILIPPINES (COLEOPTERA: CURCULIONIDAE: ANTHONOMINAE)**

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The anthonomine group is known to be distributed world wide except for Australia. These are typically small, non-metallic snout beetles with long narrow snouts similar to Cylindidae. Moreover, they are considered pests of several crops from the Malvaceae including *Hibiscus* and *Abutilon*. This new pest of orchid from Davao del Sur and Davao City attacks both the local and imported Dendrobiums to the cotton boll weevil. It is similar *Anthonomus grandis* Boheman except for the semi-robust body, and the presence of 1 distinct spin on the profemora. It is small about 5.5 mm to 6.0 mm long abd has a reddish brown color. The adults feed on succulent leaves. Eggs are laid in feeding pits near the rook stock of orchids. The larvae, on the other hand, feeds inside the stem until it eventually dries up the whole orchid stalk. Pupation takes place inside the stalky stem.

The bio-ecology and life history of this pest are being studied further.

**Keywords:** *Anthonomus* sp., Dendrobium orchids, sweet beetles, profemora Cylindidae

**ASD No. 29 R&D ON COMMUNITY-BASED PRODUCTION AND UTILIZATION OF EGG PARASITIDS FOR THE CONTROL OF MAJOR LEPIDOPTEROUS PEST OF CORN (COMPUTEC-CONLEP)**

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Results of the on-farm research and outreach project implemented in Tarlac, Pangasinan, and Batangas showed significant reduction of corn pest when applied with

*Trichogramma evanescens* (Labios et al, 1966).

The egg parasitoids, *Trichogramma* spp. have been found to be effective against pest particularly corn borer and corn earworm and to lepidopterous pest of rice and vegetables. With the increase in production of major crops, pressure from lepidopterous pest also escalated. Coupled with the insufficient supply of egg parasitoids, the present needs of mass produced parasitoids by farmers for effective control of lepidopterous pest of corn is not satisfied.

The intended beneficiaries of this program are those who cannot avail of *Trichogramma* production from the government instrumentalities. Thus, this community-based production of *Trichogramma* will supplement the expected production shortfalls.

Two farmers multipurpose cooperative from Luzon namely: the Bacabac Primary Multipurpose Cooperative in Camiling, Tarlac and the Biba-Diwa Multipurpose Cooperative in Malasiqui, Pangasinan are the project partners. *Trichogramma* laboratory for each location were built and equipped. Key personnel from the cooperatives were trained on *Trichogramma* production. Project partners from state colleges and local governments units and the Department of Agriculture Regional Field Units 1 & 3 are also participating on project coordination and implementation.

Research managed trials in Camiling, Tarlac using calendar spraying of pest crops showed that the farmers practice plot gave a grain yield of 284 tons/hectare while the *Trichogramma* plots with three releases at a rate of 40,000 *Trichogramma* per hectare had a yield of 2.55 tons/hectare. The untreated plots have the yield of 1.33 ton/hectare. On the otherhand, the Malasiqui, Pangasinan showed 1.64, 1.23 and 1.18 for *Trichogramma*, farmers practice and untreated plots, respectively.

The program is on-going and more farmers expected to participate on the utilization of *Trichogramma* in their corn fields.

**Keywords:** *Trichogramma*, production, utilization, Camiling, Malasiqui, lepidopterous pest, corn borer, corn earworm, cooperative

**ASD No. 30 MUTABILITY OF ARTHROPOD PESTS  
OF AGRICULTURAL CROPS**

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Arthropod pests of agricultural crops such as mites and insects exhibit genetic



plasticity or mutability of genotypes. These genetic flexibilities which are worldwide problems in crop production are the pesticide resistance and development of biotypes in varietal resistance. Pesticide resistance was initially detected in 1908 and at present, resistance to at least one pesticide has been recorded for over 500 arthropods. Biotypes which are threat to the stability of resistant crop varieties have been recognized in six (6) orders, 16 families, and 35 species of arthropods. Genetic mechanisms of pesticide resistance and biotype development are discussed.

**Keywords:** mutability, arthropod pests, pesticide resistance, biotype, varietal resistance

**ASD No. 31 POTENTIAL OF EARWIG, *Euborellia annulata* FOR  
FLOWER WEEVIL, *Amorphaidea lata* (Motsch.) CONTROL**

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Flower weevil, *Amorphaidea lata* (Motsch.) is one of the destructive insect pests of cotton in the Philippines, causing yield reduction of 28-30% up to total crop failure when serious outbreak occurs especially in late planted cotton. Flower weevil has many naturally-occurring enemies or predators such as the earwigs *Euborellia annulata*. A field evaluation of *E. annulata* was conducted at the Cotton Research and Development Center, CODA, Batac, Ilocos Norte to determine the biology, predation efficiency and ability to suppress flower weevil in cotton areas using different densities of *E. annulata*.

Laboratory and field set-ups using plot barriers were done to determine the maximum predation efficiency of *E. annulata* and its ability in suppressing flower weevil population. There were three densities of *E. annulata* tested as follows: 9,000, 10,000, and 11,000 earwigs/ha.

Results in the laboratory showed that an adult *E. annulata* preyed a range of 16-35 flower weevil larvae per day. Female adult laid an average of  $46.18 \pm 9.49$  eggs with 85.98% hatchability. The total life span of adult was  $89.50 \pm 11.54$  while the total life span from egg to death of adult was  $121.50 \pm 11.86$  days.

The maximum predation capacity of *E. annulata* during a 24-hr test period was 35 flower weevil larvae. After reaching this point, their consumption decreased. In the field, the average number of flower weevil larvae consumed by *E. annulata* ranged from 8.1 to 10.2 larvae per day. Likewise, the predation efficiency ranged from 20.44 to 23.15%.

A significant reduction of flower weevil number was observed in plots released with either densities of *E. annulata* as compared with the unreleased plot. Moreover, seedcotton yield was significantly higher by the release of the earwigs.

**Keywords:** flower weevil, earwig, predation, seedcotton

**ASD No. 32 INFLUENCE OF SELECTED PLANT SPECIES ON THE  
POPULATION OF PARASITIC NEMATODES OF SUGARCANE**

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Selected plant species, marigold (*Tagetes erecta*), chichirica (*Cantharanthus roseus*), corn (*Zea mays*) and tomato (*Lycopersicon esculentum*) were intercropped with sugarcane in the greenhouse and in the field to determine their influence as non-host and host plants on the population dynamics of parasitic nematodes and growth and yield of sugarcane. Intercropping individually or a combination of non-host and host crops, with sugarcane, considerably decreased nematodes attacking sugarcane. *Pratylenchus* population in all the treatments were significantly lowered by the different selected plants. The beneficial effects of marigold as intercrop persisted until sugarcane maturity. Corn or tomato and in combination similarly provided control of the nematodes at the early growth of sugarcane but their efficacy declined as the sugarcane plants grew and developed roots and shoots and after their harvesting. The reduction in nematode population sustained by the intercrops at one-to four-month old sugarcane was reflected in the yield of cane and sugar. The dominant genera observed in both greenhouse and field experiments were *Pratylenchus*, *Tylenchorhynchus*, *Helicotylenchus* and *Rotylenchus*. Less observed were *Criconebella*, *Rotylenchus*, *Hemicyclophora*, *Hoplalaimus* and *Xiphinema*. Growing non-host and host plants with sugarcane can therefore be utilized as an alternative management practice to augment the reduction of nematodes pathogenic to sugarcane. The host plants however, must be susceptible and attractive to the dominant nematode genera and harvested with their roots as trap crops to prevent rapid population build-up in the sugarcane rhizosphere.

**Keywords:** sugarcane, intercrop, marigold, *Tagetes erecta*, non-host crops, parasitic nematodes

**ASD No. 33 THE RATE OF GROWTH OF *Oreochromis niloticus* REARED  
IN AQUARIA FED WITH COMPOUNDED FISH DIET OUT OF  
*Holothuria nigra* AND *Ipomea aquatica* Torks**

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*Holothuria nigra*, a black spotted spiny sea cucumber and discarded by most inhabitants of the Camotes Island because of its unfavorable taste was used as a feed component together with kangkong (*Ipomea aquatica* Torks) to tilapia. The compounded pelletized feed consists of three ratios of sea cucumber and kangkong given to tilapia to determine which of the three ratios will give a better growth of tilapia in terms of body