

ABSTRACTS OF PAPERS

Presented at the Annual Scientific Conference of the Philippine Association of Entomologists, Inc. held during the 49th Annual Convention of the Pest Management Council of the Philippines, Inc., May 10-12, 2017, Crown Regency Resort and Convention Center, Boracay Island, Malay, Aklan.

Acronyms in authors addresses: ARMM – Autonomous Region of Muslim Mindanao; CAFS – College of Agriculture and Food Science; CANS – College of Agriculture and Natural Sciences; CAS – College of Arts and Sciences; CBSUA – Central Bicol State University of Agriculture; CLSU – Central Luzon State University; CS – College of Science; DA-BPI – Department of Agriculture-Bureau of Plant Industry; DLSU – De La Salle University; IBS – Institute of Biological Sciences; IPB – Institute of Plant Breeding; IWEP – Institute of Weed Science, Entomology and Plant Pathology; MNH – Museum of Natural History; MMSU – Mariano Marcos State University; MSU – Mindanao State University; NCPC – National Crop Protection Center; NIMBB – National Institute of Molecular Biology and Biotechnology; NSC – National Science Complex; PGC – Philippine Genome Center; PhilRice – Philippine Rice Research Institute; RCPC – Regional Crop Protection Center; UPD – University of the Philippines Diliman; UPLB – University of the Philippines Los Baños

ORAL PAPERS

1. RAPID MULTIPLEX PCR-BASED PROTOCOL FOR *Aspidiotus rigidus* Reyne DETECTION

Romnick A. Latina¹, Darlon V. Lantican², Michelle S. Guerrero³ & Barbara L. Caoli,¹ ¹Insect Pathology Laboratory, IWEP, ²Genetics Laboratory, IPB, ³Molecular Biology Laboratory, NCPC, all under CAFS, UPLB; romnicklatina@gmail.com

Different studies focusing on *Aspidiotus* species infesting coconuts have been rapidly increasing in the country as a result of the threatening outbreak of these armored scale insects just a few years back. Intensive morpho-taxonomic study coupled with molecular analyses revealed the identity of the causal diaspidid pest as *A. rigidus* and not the initially identified *A. destructor*. The earlier non-recognition of *A. rigidus* as distinct from *A. destructor* calls for a more accurate and rapid diagnostic protocol especially for non-diaspidid experts. Using the aligned partial nucleotide sequences coding for the 28S ribosomal DNA of *Aspidiotus* spp., an *A. rigidus*-specific oligonucleotide marker based on the deletion site common to all *A. rigidus* samples was developed and optimized. The multiplex-based PCR protocol which was evaluated using laboratory-reared and field-collected samples provides a fast and economical detection of *A. rigidus*.

Key words: 28S, *Aspidiotus rigidus*, multiplex-PCR

2. HAPLOTYPE DIVERSITY OF *Aspidiotus* SPECIES IN THE PHILIPPINES USING THE 28S rRNA GENE REGION

Janice F. Laquinta, Edsel C. Rubico, Michelle S. Guerrero¹, Gelyn D. Sapin & Barbara L. Caoili, IWEP, & ¹NCPC, CAFS, UPLB, College, Laguna; blcaoili@up.edu.ph

The haplotype diversity of coconut scale insect (CSI) populations collected from 10 provinces in the Philippines was investigated using the 28S region of the large subunit ribosomal RNA gene. Three *Aspidiotus* species, namely *A. destructor* Signoret, *A. rigidus* Reyne and *A. excisus* Green were identified. Molecular analyses using BioEdit and DNAsp revealed the presence of at least seven haplotypes of *A. destructor* with the dominant haplotype (HF=0.575) found in six provinces in the country including Bataan, Batangas, Laguna, Quezon, Camarines Norte, and Zamboanga City. Three haplotypes were observed for *A. rigidus* with the most dominant (HF=0.800) covering Bataan, Laguna, Quezon, and Basilan. On the other hand, two haplotypes were revealed for *A. excisus* with the dominant (HF=0.857) found in Laguna and Basilan. Haplotype diversity (Hd) index of the *Aspidiotus* species was 0.633, 0.346, and 0.286 for *A. destructor*, *A. rigidus*, and *A. excisus*, respectively. High haplotype diversity of *A. destructor* suggests high species survival through adaptation to varied local environments as depicted by its wide distribution, and host range. The phylogenetic analysis suggested close association of the species within the genus *Aspidiotus* but distinct groupings were formed when compared to the other genera within the tribe Aspidiotini.

Key words: 28S rRNA, Aspidiotini, *Aspidiotus*, coconut scale insect, haplotype

3. CHARACTERIZATIONS OF 28S RIBOSOMAL RNA REGION OF INSECT PARASITIDS AND PREDATORS ASSOCIATED WITH ARMORED SCALE INSECTS

Edsel C. Rubico, Janice F. Laquinta, Michelle S. Guerrero¹, Gelyn D. Sapin & Barbara L. Caoili¹, IWEP, & ¹NCPC, CAFS, UPLB, College, Laguna 4031; blcaoili@up.edu.ph

The parasitoids and predators associated with armored scale insects on coconut were identified using 28S nucleotide regions. Based on BLAST hits, the parasitoids identified were *Comperiella bifasciata*, *Pteroptrix* sp., *Coccophaginae* sp., *Encarsia heratyi*, and *Marietta* sp., while the predators were *Telsimia* sp., *Pseudoscymnus* sp., *Nothocolus* sp., and *Chilocorus cacti*. However, low percent homologies were observed, ranging from 83-92%. All of the sequences of parasitoids and predators showed cytosine (C) and guanine (G) biases. Sequences of *Co. bifasciata*, *Coccophaginae* sp., *E. heratyi*, and *Telsimia* sp. were aligned among their samples, these shown with gaps, singleton variable sites, and parsimony informative sites. In terms of nucleotide and haplotype diversities among the parasitoids, highest was obtained from *Coccophaginae* sp. and *Pteroptrix* sp., respectively. In the case of predators, only *Telsimia* sp. showed polymorphic sequence. Phylogenetic trees for parasitoids and predators were constructed.

Key words: 28S ribosomal RNA, *Chilocorus cacti*, Coccophaginae sp., *Comperiella bifasciata*, *Encarsia heratyi*, *Marietta* sp., *Nothocolus* sp., parasitoids, predators, *Pseudoscymnus* sp., *Pteroptrix* sp., *Telsimia* sp.

4. MOLECULAR MARKER-BASED IDENTIFICATION OF STINGLESS BEES (*Tetragonula* sp.) IN THE PHILIPPINES

Alfredo Jose C. Ballesteros¹, Maria Dulce J. Mostoles², Ma. Carmina C. Manuel³ & Ma. Anita Mascareñas-Bautista^{1,2*} ¹Functional Genomics Laboratory, NIMBB, CS, NSC, UPD, Diliman, Quezon City 1101; ²CANS, CBSUA, Pili, Camarines Sur; ³Genetics and Molecular Biology Division, IBS, CAS, UPLB, College, Laguna 4031; ⁴PGC, NSC, UPD, Diliman, Quezon City 1101; mambautista@mbb.upd.edu.ph

Stingless bees, *Tetragonula* sp., are known to be key pollinators in agriculture; contribute to farmlands by pollinating various cultivated crops, maintain plant biodiversity, and promote ecological conservation in various ecosystems. It is, therefore, crucial to be able to identify taxonomic diversities for these insects. Species identification using highly conserved regions found in mitochondrial 12S and 16S ribosomal RNA (rRNA) genes has been widely used in molecular taxonomic studies. This study thus aims to determine efficiency of species identification using these molecular markers on stingless bees found in the Philippines. Samples morphologically characterized to be *Tetragonula* sp. were collected from colonies of representative sampling locations in Southern Luzon, mainly Bicol and CALABARZON regions, and were stored in 95% ethanol. Genomic DNA extraction of samples was performed and optimized. Regions of 12S and 16S were then PCR-amplified and subjected to agarose gel electrophoresis to check for target amplicons. The amplicons were then sent for capillary sequencing at the Philippine Genome Center, and nucleotide sequences were analyzed using NCBI BLAST. The BLAST results showed extensive number of hits for the 16S amplicons which mainly consisted of *Tetragonula* species with $\geq 90\%$ and above identity. On the other hand, results for the 12S show limited BLAST hits consisting of *Melipona* and *Bombus* species with percent identities $< 90\%$. This study revealed that 16S rRNA-based identification proved more effective in identifying stingless bees up to the species level for more efficient taxonomic diversity studies.

Key words: 12S, 16S, *Bombus*, *Melipona*, Philippine Genome Center, stingless bees, *Tetragonula* sp.

5. PRELIMINARY DIVERSITY STUDY OF *Bemisia tabaci* (Gennadius) BIOTYPES IN LUZON, PHILIPPINES

Aaron V. Ogot, Regina Faye C. Sandoval, Gelyn D. Sapin, Romnick A. Latina & Barbara L. Caouli, Insect Pathology Laboratory, IWEP, CAFS, UPLB

Bemisia tabaci (Gennadius), commonly known as silverleaf whitefly, is among the most notorious insect pests worldwide because of its wide host range (e.g. banana, cotton, solanaceous vegetables, cucurbits, root crops, legumes, onions,

and tobacco) and its ability to transmit numerous types of plant pathogenic viruses. *B. tabaci* exhibits high genetic variability among populations but without obvious distinct phenotypic differences. Several studies suggested the presence of 11-44 biotypes of this species. In this study, a cladogram based on cytochrome oxidase I (COI) fragment of Philippine *B. tabaci* samples was constructed. Out of the 24 low-level groups reported by de Barro et al. in 2011, four (4) biotypes were detected in Luzon (Laguna, Bicol, Cavite, and Baguio). These biotypes were MEAM 1, ASIA 1, AUS (Australian) and ASIA II 6. Another biotype referred to as ASIA II 10, is an addition to the local biotype list. This study provides preliminary baseline information on *B. tabaci* biotypes occurring in the Philippines which is vital for the development of an efficient pest management strategy. Continuous sampling and processing are done to cover more areas around the country.

Key words: ASIA 1, ASIA II 6, *Bemisia tabaci*, biotype, cytochrome oxidase I, MEAM 1

6. TRANSCRIPTOME SEQUENCING OF PHILIPPINE BENEFICIAL INSECTS

Jessa Mae T. Camposano¹, Alfredo Jose C. Ballesteros¹, Mario V. Navasero², Marcela M. Navasero², Maria Dulce J. Mostoles³ & Ma. Anita Mascareñas-Bautista^{1,3*} ¹Functional Genomics Laboratory, NIMBB, CS, NSC, UPD, Diliman, Quezon City 1101; ²NCPC, CAFS, UPLB, College, Laguna 4031; ³CANS, CBSUA, Pili, Camarines Sur; ⁴PGC, NSC, UPD, Diliman, Quezon City 1101; mambautista@mbb.upd.edu.ph

The parasitoid *Comperiella* and the stingless bee, *Tetragonula sp.* are known beneficial insects in the Philippines. *Comperiella* is able to parasitize coccolisap, a pest of coconut, and feeds on the internal structures, leading to eventual death of the pests. On the other hand, stingless bees are key pollinators in Philippine agriculture. This study aims to optimize a full-length protocol for the transcriptome sequencing of these beneficial insects using next generation sequencing (NGS) platforms, from RNA extraction to preparation of libraries and templates for NGS. *Comperiella* samples were obtained from San Roque, Sampaloc, Quezon, while stingless bee samples were collected from different provinces and cities in the Bicol Region. Total RNA was extracted from pupae and adult of *Comperiella*, and adult for stingless bees. Extracted RNAs were then used for library preparation. Sequencing templates were then multiplexed, and paired-end sequencing was performed in a MiSeq sequencing platform. Sequencing results for *Comperiella* show a 6.36Gb read length, 20.84 M paired-end reads and 89.12% Q30 score, while for the stingless bee, a read length of 7.28Gb was generated, with 28.59 M paired-end reads, and a Q30 score of 89.64%. The transcriptome datasets obtained from these beneficial insects are currently undergoing bioinformatics analysis to completely provide the molecular toolboxes from which many genes of biological importance can be mined.

Key words: *Comperiella*, next generation sequencing, *Tetragonula*, transcriptome

7. DEVELOPMENT OF SINGLE NUCLEOTIDE POLYMORPHISM (SNP) MARKERS FROM THE ASIAN CORN BORER, *Ostrinia furnacalis* (Guenee)

Adria Gabrielle D. Lao¹, John Carlo M. Marasigan², Desiree M. Hautea², Polychase Magaoay¹ & Ma. Anita Mascareñas-Bautista^{1,3*} ¹Functional Genomics Laboratory, NIMBB, CS, NSC, UPD, Diliman, Quezon City 1101; ²IPB, CAFS, UPLB, College, Laguna 4031; ³PGC, NSC, UPD, Diliman, Quezon City 1101; mambautista@mhb.upd.edu.ph

Ostrinia furnacalis (Guenee), commonly known as the Asian Corn Borer (ACB), is an insect that inhabits and feeds within the stems of corn plants. Their feeding habits are destructive to these host plants, preventing the plants from producing their grains and thus devastating corn crop yields. Infestations of ACB have been observed throughout the country. Here we discuss the collection of ACB samples from different locations in the Philippines, the subsequent extraction of RNA from these samples, and the construction of the insect's transcriptome with the end goal of identifying single nucleotide polymorphism (SNP) markers which will allow detailed study of the population structures of ACB in different locations. RNA was extracted and processed from these insects, and the purified RNA was sequenced using Illumina technology. The sequences were assembled and annotated to a variety of databases including InterPro, Kyoto Encyclopedia of Genes and Genomes, and Cluster of Orthologous Groups. This assembled and annotated ACB transcriptome was successfully validated by gene mining and endpoint PCR. Further bioinformatics analysis of the sequences yielded the identification of 2,177,173 potential SNP markers in the ACB transcriptome. A selection of these potential SNP markers will be targeted for validation with endpoint PCR and TaqMan quantitative PCR. The transcripts and SNP data will be used in downstream assays to allow further deconstruction of the ACB's genetic make-up and expression patterns, and from there to a better understanding of ACB.

Key words: *Ostrinia furnacalis*, SNP markers, transcriptome

8. SURVEY OF SECONDARY ENDOSYMBIONTS OF *Bemisia tabaci* BIOTYPES PRESENT IN THE PHILIPPINES

Regina Faye C. Sandoval, Aaron V. Ogot, Gelyn D. Sapin, Romnick A. Latina & Barbara L. Caoili, Insect Pathology Laboratory, IWEP, CAFS, UPLB

Bemisia tabaci (Gennadius), just like many arthropods, harbors bacterial endosymbionts. These symbionts, particularly the secondary endosymbionts (S-endosymbionts) have been widely investigated because of their significant role in parasitoid resistance, virus transmission, insecticide susceptibility, and insect ecology and fitness of their whitefly hosts. Here, we did preliminary survey of the S-endosymbionts present in the different *B. tabaci* biotypes in the Philippines previously identified (MEAM 1, ASIA 1, AUS (Australian), ASIA II 6 and ASIA II 10). Amplification of the 16s and 23s ribosomal DNA using genus-specific primers revealed the presence of four S-endosymbionts, namely: *Hamiltonella*, *Wolbachia*, *Rickettsia*, and *Arsenophonus*. *Wolbachia* was abundant in all of the samples, regardless of biotype. Out of the 186 *B. tabaci* samples, 46.77% had

single detection, 32.26% two, 8.6% three, and 12.37% had no detection of any of the four endosymbionts. *Hamiltonella* was restricted to the destructive MEAM 1 biotype, where it was present in 85% of the samples. Meanwhile, *Arsenophonus* appears to be present solely in Asia 1 biotype. While amplicons were generated from some samples using the genus-specific primers for *Cardinium*, Ch-f and Ch-r, nucleotide sequences surprisingly revealed the presence of a primary endosymbiont, *Ca. Portiera aleyrodidarum*, instead.

Key words: 16S, 23S, *Bemisia tabaci*, secondary endosymbionts

9. MOLECULAR IDENTIFICATION AND PRELIMINARY GENETIC DIVERSITY ANALYSIS OF TOBACCO STEM BORER, *Scrobipalpa aptatella* (Walker) (LEPIDOPTERA: GELECHIIDAE) FROM MISAMIS ORIENTAL AND BUKIDNON USING CYTOCHROME OXIDASE SUBUNIT I (COI) GENE

Aaron V. Ogot, Romnick A. Latina & Barbara L. Caoili, IWEP, and NCPC, CAFS, UPLB, College, Laguna; avogot@up.edu.ph

Scrobipalpa aptatella (Walker) (Lepidoptera: Gelechiidae), also known as tobacco stem borer (TSB), is a reported pest of tobacco. The damage it inflicts are mainly tunnels created by larval feeding on the stem. As the infestation progresses, other symptoms appear like stem galling and wilting. With serious infestation, a plantation can lose 30-70% of field output. Proper identification of the pest is crucial in establishing effective control measures to prevent serious infestation of the TSB. DNA barcoding is an efficient way to establish the identity of a specific organism. However, there are no studies in the Philippines using this technique to identify TSB. Cytochrome c oxidase I (COI) was used as the molecular marker to identify the collected TSB from Claveria, Misamis Oriental and Bukidnon. COI gene sequences from individuals were obtained and compared with those in GenBank which revealed a 99% BLAST hit. All TSB samples point to *S. aptatella* (GenBank Acc. No. KF388766.1). Multiple sequences alignment of the COI gene revealed single nucleotide polymorphisms within and between the collected populations. Haplotype and nucleotide diversity of the populations had values of 0.2584 and 0.00074, respectively. Five haplotypes were identified. A cladogram showed the haplotypes through the groupings. The Mindanao population, in general, is slowly expanding, based on the negative results of Tajima's *D* test of neutrality. Fu's *F_s* test of neutrality showed an excess of rare haplotypes in the population. The recent population expansion suggests that there is already a need for control measures to prevent further expansion.

Key words: Fu's *F_s* test, *Scrobipalpa aptatella*, Tajima's *D* test

10. PRELIMINARY PATHOGENICITY TESTS OF POTENTIAL ENTOMOPATHOGENIC FUNGI ISOLATED FROM COCONUT SCALE INSECTS (*Aspidiotus* spp.)

Constance Aurelle M. Macalinao, Ester A. Magsino, Fe D. Alzona, Regina Faye C. Sandoval & Barbara L. Caoili, IWEP, CAFS, UPLB, College, Laguna 4031 Philippines; blcaoili@up.edu.ph

The coconut scale insects, *Aspidiotus* spp. (CSI) recently became one of the most important pests of coconut in the Philippines. Sustainable control measures and efficient management strategies are urgently needed. Entomopathogenic fungi (EPF), an environmentally-benign group of biocontrol agents, is a promising option for the regulation of CSI populations. In this study, the mycoflora associated with CSI collected in 26 localities of 12 provinces (Aurora, Basilan, Bataan, Batangas, Cagayan, Cavite, Isabela, Laguna, Quezon, Zamboanga, Zamboanga del Norte, and Zamboanga Sibugay) were identified. Five fungal species from this collection, namely: *Aschersonia* sp., *Cladosporium oxysporum* Berk. & M.A. Curtis, *Fusarium incarnatum* (Desm.) Sacc., *Lecanicillium psalliotae* (Treschew) Zare & W. Gams, and *Purpureocillium lilacinum* (Thom) Luangsa-ard et al. were molecularly identified and classified EPFs based on published journal articles. Pathogenicity tests of these fungal isolates were done using depression slide assay with the presence of the mycelial growth through the scales of the CSI as the indicator of fungal infection. Bioassays using different CSI populations on the coconut seedlings are underway.

Key words: coconut scale insect, entomopathogenic fungi, *Aschersonia*, *Aspidiotus*, *Cladosporium oxysporum*, *Fusarium incarnatum*, *Lecanicillium psalliotae*, *Purpureocillium lilacinum*

11. PREDATORY BEHAVIOR OF THE LYNX SPIDER *Oxyopes javanus* Thorell (ARANEAE: OXYOPIDAE) ON THE CACAO MIRID BUG, *Helopeltis bakeri* Poppius (HEMIPTERA: MIRIDAE) IN LUZON ISLAND, PHILIPPINES

Dagame O. Bohol^{1,2} & Alberto T. Barrion¹, ¹Biology Department, DLSU, 2401 Taft Avenue, Manila; ²Senior High School Department, Colegio San Agustin, Makati, Philippines; dagame_bohol@dlsu.edu.ph

The lynx spider, *Oxyopes javanus* Thorell, occurs abundantly in rice and cacao agroecosystems of Luzon Island, Philippines and was found to be associated as a predator of the cacao mirid bug, *Helopeltis bakeri* Poppius. *H. bakeri* is an important pest of fruit trees with a wide host range and can cause damage to young and mature pods of cacao. This study investigated the predatory behavior of *O. javanus* on *H. bakeri* and the life history of *O. javanus* under laboratory conditions. The study showed that the adult spider (male or female) prefers adult mirid bug as food. A single adult spider consumed 2-4 adult mirid bugs per day. Of the total *O. javanus* individuals, 80% captured their prey upon release inside the cage within 7.25 ± 2.5 minutes. The longest time recorded before a spider would catch a prey averaged 20.45 ± 6.11 minutes. Eggs of *O. javanus* were collected and observed. The incubation period ranged from 21-28 days. Nymphs had 8-11 molts before adult spiders emerged. Females needed 2-3 extra molts before reaching sexual maturity. Adult males of *O. javanus* are 8.11 ± 1.25 mm long and, thus, smaller than females, which are usually 12.39 ± 1.25 mm long.

Key words: Araneae, cacao, *Helopeltis bakeri*, *Oxyopes javanus*, Oxyopidae

12. LARVAL CONSUMPTION AND PREY PREDILECTION OF *Toxorhynchites splendens* (DIPTERA: CULICIDAE) ON DIFFERENT IMMATURE STAGES OF *Aedes* spp. AND *Culex quinquefasciatus* (DIPTERA: CULICIDAE)

Justine Bennette H. Millado & Augusto C. Sumalde, Department of Pest Management, College of Agriculture, Visayas State University, Baybay City, Leyte; IWEP, CAFS, UPLB, College, Laguna; justinebennette@gmail.com

Aimed at providing a novel and sustainable local control measure for Dengue mosquitoes, *Aedes aegypti* (Linnaeus) and *A. albopictus* (Skuse), the predatory performance of larval *Toxorhynchites splendens* (Wiedemann) was evaluated under laboratory conditions. Overall, more *A. aegypti* wrigglers and pupae were eaten than *A. albopictus* by all larval instars of *T. splendens*. Predation also increased as more preys were introduced. However, the proportion in relation to the total number of preys declined as the larva reached satiation. The fourth and last instar was the most voracious contributing to 70% of the total consumption during the entire larval period. On the other hand, consumption rates of males and females did not vary significantly. First and second instar *T. splendens* preferred younger larval instars of *A. aegypti* while the fourth instar was inclined to feed on older larvae and pupae. Moreover, most larval instars of *T. splendens* consumed more *A. aegypti* when offered mixed preys over *A. albopictus* and *C. quinquefasciatus*.

Key words: *Aedes*, *Culex*, mosquito control, Predation, *Toxorhynchites splendens*

13. FIELD PARASITISM OF *Comperiella calauanica* Barrion et al. (HYMENOPTERA: ENCYRTIDAE) ON *Aspidiotus rigidus* Reyne (HEMIPTERA: DIASPIDIDAE) IN SOUTHERN TAGALOG REGION, PHILIPPINES

Billy Joel M. Almarinez* & Divina M. Amalin, Biology Department, College of Science, & Biological Control Research Unit, Center for Natural Sciences and Environmental Research, DLSU, Manila; *billy.almarinez@dlsu.edu.ph

Comperiella calauanica Barrion et al. was discovered in 2014 as a native endoparasitoid of the coconut scale insect (CSI), *Aspidiotus rigidus* Reyne. An outbreak of CSI devastated coconut plantations and stands in the southern part of Luzon, Philippines from 2010 to 2015. So far, *C. calauanica* is the only associate of *A. rigidus* that has been very highly efficient as a natural enemy and great potential for biological control. To evaluate such potential, the degree of parasitism of *C. calauanica* in the field was assessed across three periods from August 2014 to June 2015 in selected areas of Southern Tagalog. Average percent parasitization of *A. rigidus* by *C. calauanica* was found to be notably high, ranging from 44.9-92.4% in August 2014, 57-92.6% in December 2014-January 2015, and 89-96.5% in June 2015. Consistent findings of significant, very high positive correlation between the total number of scales and the number of parasitized scales suggest host density-dependent parasitism by *C. calauanica*. Furthermore, a significant decrease in the abundance of *A. rigidus* in the monitored points in Southern Tagalog was found to be remarkably parallel with the complete recovery of the sampled coconut palms that did not receive chemical treatment. Collectively, these findings not only point to the very high

potential of *C. calauanica* as a biological control agent against *A. rigidus*, but also suggest the putative role of natural biological control in the management of the CSI outbreak in the region.

Key words: *Aspidiotus rigidus*, biological control, *Comperiella calauanica*, field parasitism, integrated pest management

14. FIRST REPORT OF *Comperiella calauanica* Barrion et al. (HYMENOPTERA: ENCYRTIDAE) AND PROMOTING ITS VILLAGE-LEVEL PRODUCTION FOR THE CONTROL OF *Aspidiotus rigidus* Reyne (HEMIPTERA: DIASPIDIDAE) IN ZAMBOANGA CITY

Randolph N. Candano¹, Mario V. Navasero¹, Bonifacio F. Cayabyab¹, Priscilla C. Jover², Anacleto P. Quilantang², Anita U. Gallebo² & Isidro A. Quijano Jr.³, ¹NCPC, CAFS, UPLB, College, Laguna; ²RCPC IX, Molave, Zamboanga del Sur; ³City Agriculturist Office, Zamboanga City

This paper presents the first report of *Comperiella calauanica* Barrion et al. in Zamboanga City and outlines the output of the collaboration generated through the Quick Response Team formed by the Office of the Chancellor of UPLB. The collaboration was formed among the following sectors: NCPC of UPLB, Department of Agriculture Region IX and its attached agency, the RCPC IX, Philippine Coconut Authority, and the City Government through the City Agriculture Office of Zamboanga. Initial releases of pupae of *Comperiella* collected in CALABARZON had been made in two barangays. One of the releases was inoculative in one barangay where no previous occurrence of *Comperiella* was detected. In the other barangay, the release was augmentative because adults and pupae were collected from samples of infested leaves of coconut and banana. However, the level of parasitization was still negligible, although 40% parasitization was recorded on infested leaves of palmera (*Dypsis lutescens* (H.Wendl.) Beentje & J.Dransf.). Second generation from the inoculative release had been detected. Plant rearing in a net cage using mangosteen for *Aspidiotus rigidus* Reyne and *Comperiella* had been set up in the first barangay. Based on field and laboratory observations, the parasitoid survives well in outdoor or field rearing using several of the scale insect's host plants. Initial results from field rearing set up in Zamboanga City showed the potential of this method and its upscaling into a community-based mass production for *Comperiella* toward a more sustainable approach in addressing the CSI problem in Mindanao.

Key words: *Aspidiotus rigidus*, *Comperiella calauanica*, Zamboanga City

15. FIRST REPORT OF A HETERORHABDITID NEMATODE IN SURIGAO DEL SUR, PHILIPPINES

Romnick A. Latina & Barbara L. Caoili, Insect Pathology Laboratory, IWEP, CAFS, UPLB

Surigao del Sur is one of the top tourist spots in the Philippines because of its breath-taking scenery and diverse flora and fauna. Recent soil sampling along the shore of Bretania, Municipality of San Agustin followed by soil baiting for an

interesting group of microfaunal species revealed the presence of a population of entomopathogenic nematodes (EPNs) in this province. This group of nematodes has been holding a worldwide reputation as effective biological control agents against agriculturally important insect pests belonging to an array of insect orders. Characterization of this local population identified the isolate as *Heterorhabditis indica* Poinar et al. This was based on characteristics of infected *Ostrinia furnacalis* (Guenee) cadavers, general morphology of infective juveniles, females, and males, and molecular analyses of the ITS region of the nematode's 28S rDNA gene. Their bacterial symbionts were also isolated, characterized, and identified as *Photorhabdus luminescens* (Thomas & Poinar) Boenare et al., based on the 16S rRNA. Bioefficacy assays are underway to determine their biological control potential.

Key words: 16S, 28S, *Heterorhabditis indica*, ITS, *Photorhabdus luminescens*

16. TECHNOLOGY TRANSFER OF *Chelisoches morio* (Fabricius) AS BIOLOGICAL CONTROL AGENT AGAINST *Brontispa longissima* (Gestro) ON COCONUT THROUGH S&T COMMUNITY BASED-FARM IN NAGCARLAN, LAGUNA

Marcela M. Navasero, Randolph N. Candano & Maricon dP. Javier, NCPC, CAFS, UPLB

The technology of using *Chelisoches morio* (Fabricius) for the biological control of *Brontispa longissima* (Gestro) was transferred to farmers through Science and Technology (S&T) Community-Based Farm in Nagcarlan, Laguna. This involved training of farmers followed by farmer-participated setting-up of community-based mass rearing of the predator, familiarization of damage assessment of *B. longissima*, and field releases of the predators. The training was conducted in cooperation with local government unit of Nagcarlan and the Lawaguin Multipurpose Cooperative, Inc. (LMCI), a farmers' cooperative based in Nagcarlan, Laguna. A total of 54 farmers of LMCI participated in the project and more than 3000 coconut palms aged 2-5 years were released with 5-10 fourth instar individuals of *C. morio*. The impacts of the technology are as follows: 1) The farmer-participated field releases of the technology convinced the farmer cooperators, LGU personnel, other barangay leaders, and farmers of the effectiveness of the predator; 2) Farmers learned to assess the damage caused by *B. longissima*; 3) The releases influenced LCMI members and other farmers to adopt the technology; 4) Farmers' awareness on the role of biological control agents in managing *B. longissima* increased; and, 5) Farmers involved in rearing the predator found the technique simple, easy, and doable.

Key words: biological control, *Brontispa longissima*, *Chelisoches morio*, community-based technology adoption

17. WASP-ASSOCIATED FACTORS CAN INDUCE PHYSIOLOGICAL SUPPRESSION AND PROMOTE COEXISTENCE DURING MULTIPLE PARASITISM

Peter Magdaraog & Toshiharu Tanaka, Laboratory of Applied Entomology, Graduate School of Bio-Agricultural Sciences, Nagoya University; petermagdaraog@yahoo.com

Resource sharing or exclusion of parasitoids within a host during multiparasitism may depend on their similar life-history traits and strategies. Conflict in the possession of a host may lead to displacement of inferior species through physical attack and/or physiological suppression. However, mechanisms of physiological suppression during multiparasitism remain equivocal. In the present study, we investigated the influence of wasp regulatory factors (virus-like particles, polydnaviruses, and venoms) on the development of competing endoparasitoids *Meteorus pulchricornis* (Wesmael), *Cotesia kariyai* (Watanabe) and *Cotesia ruficrus* (Haliday) in their common host *Mythimna separata* (Walker). We found that the virus-like particles alone (or with venom) of *M. pulchricornis* were deleterious to the development of the two gregarious parasitoids. Similarly, polydnaviruses plus venom of *C. kariyai* had toxic effects on solitary *M. pulchricornis* eggs and immature larvae, although they were not harmful to *C. ruficrus*. The two gregarious species were able to coexist mainly through the expression of regulatory factors and both could successfully survive from a multiparasitized host. The presence of *C. kariyai* polydnaviruses and venom facilitated *C. ruficrus* after oviposition in L5 host increasing the rate of successful parasitism from 9-62%. This suggests that the two gregarious parasitoids exhibit strong phylogenetic affinity, favoring their coexistence and success in multiparasitized host. Different protein bands from hemolymph of parasitized host larvae were also observed, suggesting dissimilarity in nutritional requirements of each parasitoid species.

Key words: endoparasitoids, multiparasitism, polydnaviruses, venoms, virus-like particles

18. HOST RESISTANCE SCREENING IN COCONUT AGAINST THE INVASIVE COCONUT SCALE INSECT, *Aspidiotus rigidus* Reyno (HEMIPTERA: DIASPIDIDAE)

Ma. Luz J. Sison¹, Don Serville R. Reynoso¹, Cris Q. Cortaga¹, Joseph P. Lagman¹, Darlon V. Lantican¹, Melvin P. Dancel¹, Ernesto E. Emmanuel², Susan Rivero² & Hayde F. Galvez¹, ¹IPB, CAFS, UPLB, College, Laguna; ²Philippine Coconut Authority-Zamboanga Research Center, San Ramon, Zamboanga City

The devastation of millions of coconut palms caused by invasive Coconut Scale Insect (CSI), *Aspidiotus rigidus*, has posed a serious threat to the coconut industry in the Philippines. To help address this problem, host plant resistance (HPR) studies were conducted to provide a very economical and effective approach to mitigate the infestation through utilization of the innate resistance of coconut. This study aimed at identifying potential resistant variety/ies and

mine putative resistance genes for coconut breeding. Host resistance screenings (natural infestation) were separately done at UPLB and two (2) sites in Basilan. Varieties used were 23 Tall, 25 Dwarf, 16 Synthetic, eight Orgullo for a total of 72, and a susceptible Laguna Tall (LAGT) as the control. Results showed that Dwarf, Synthetic, and Orgullo varieties were preferred by *A. rigidus*, but some Tall varieties during this duration were not infested or less preferred. These include Vanuatu (VTT), West African Tall (WAT), and Salambuyan (SALT). In Basilan, higher rate of progression of CSI infestation was observed at Lanote compared to East Side. Under no-choice test (controlled infestation), the least preferred variety was Tupi dwarf. Additional coconut varieties from Albay Research Center were also studied using no-choice test, namely: Coconiño, Tambulilid, and LAGT, and CALABARZON collection which were the putative progenies of the selected coconut trees resistant to CSI during the outbreak. Initially, LAGT was the least preferred variety based on the number of newly settled and developed CSI, while among CALABARZON selection, the least preferred was M11 having the fewest CSI.

Key words: *Aspidiotus rigidus*, coconut, coconut scale insect, host plant resistance

19. COPULATION AND OVIPOSITION BEHAVIOR OF *Helopeltis bakeri* UNDER LABORATORY CONDITIONS

Leslie Ann Ormenita & Divina M. Amalin, Biological Control Research Unit-CENSER, DLSU, 2401 Taft Avenue, Manila; leslie_ormenita@dlsu.edu.ph

Theobroma cacao L. is susceptible to a number of insect pests and pathogens which could hinder the country's campaign for production boost. One of the major insect pests of cacao in the Philippines is the cacao mirid bug (CMB), *Helopeltis bakeri* Poppius. The CMB feeds on the cacao pods as well on young shoots manifested by black lesions, which progress into a dieback symptom. One of the control measures being investigated is the use of its sex pheromone. In identifying the sex pheromone of CMB, it is very important to understand its reproductive behavior. This paper presents observations on sexual maturation and courtship behavior, which will help in the extraction and identification of sex pheromone to be used in developing the sex pheromone trap for the monitoring and management of cacao mirid bug.

Key words: *Helopeltis bakeri*, reproductive behavior, sexual maturation, sex pheromone, *Theobroma cacao*

20. ADULT EMERGENCE PATTERN IN *Ostrinia furnacalis* (Guenee) (LEPIDOPTERA: CRAMBIDAE)

Marcela M. Navasero¹, Randolph N. Candano¹, Gelyn D. Sapin², Maricon dP. Javier¹, Wilson N. de Panis¹, Mario V. Navasero¹, Merdelyn T. Caasi-Lit³ & Meiji T. Bagangao³, ¹NCPC, ²IWEP, and ³IPB, CAFS, UPLB, College, Laguna

Basic data on adult Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee), emergence pattern and mating in support to IRM plan for Bt corn in the

Philippines were generated under laboratory conditions and using small cage technique in the field. The emergence pattern of laboratory-reared adult ACB shows that the moths emerge in the early evening and peaked between 8:00 to 10:00 p.m. In cage experiments in the field, the emergence pattern of adult ACB started in late afternoon, increasing at dusk, and peaked at about 8:00 p.m. for the female and between 8:00 and 9:00 p.m. for the male, and declined as it approached midnight. More males than females emerged from corn plants infested at 30 days after planting (DAP) and 40 DAP, although more individuals emerged from 40 DAP plants. The results did not show significantly different emergence patterns between male and female moths in both laboratory and field cage experiments. There is strong support or basis for random mating of ACB in the field, which reduces the risk of asynchronous emergence of ACB, if it ever happens, in Bt corn and refuge fields, within an Insect Resistance Management (IRM) program.

Key words: Asian corn borer, emergence pattern, Insect Resistance Management, *Ostrinia furnacalis*

21. MATING FREQUENCY IN ASIAN CORN BORER, *Ostrinia furnacalis* (Guenee) (LEPIDOPTERA: CRAMBIDAE)

Gelyn D. Sapin¹, Marcela M. Navasero², Randolph N. Candano², Maricon dP. Javier², Wilson N. de Panis², Mario V. Navasero², Merdelyn T. Caasi-Lit³, & Meiji T. Bacangao³, ¹ IWEF, ²NCPC, and ³IPB, CAFS, UPLB, College, Laguna

Experiments on mating frequency experiments in the Asian Corn Borer (ACB), *Ostrinia furnacalis* (Guenee), showed that male ACB successfully mated more than one female up to seven days after emergence. Frequency of mating decreased from Day 7 onward due to death and old age of males. Females, on the other hand, exhibited multiple mating as indicated by spermatophores deposited both in the bursa copulatrix and spermatheca. These results provide new evidences to show that adult male and female *O. furnacalis* are capable of random mating, which is important in insect resistance management in Bt corn.

Key words: Asian corn borer, *Ostrinia furnacalis*, spermatheca, spermatophores

22. INVESTIGATION ON THE 2016 OUTBREAK OF THE ONION ARMYWORM, *Spodoptera exigua* (Hübner) (LEPIDOPTERA: NOCTUIDAE), IN ONION GROWING AREAS IN NUEVA ECIIJA

Mario V. Navasero¹, Marcela M. Navasero¹, Bonifacio F. Cayabyab¹, Melvin D. Ebuenga¹, Randolph N. Candano¹, Gideon Aries S. Burgonio¹, Nelson M. Bautista², Evergilio M. Aquino Jr.² & Grandeur G. Gaspar², ¹NCPC, CAFS, UPLB, College, Laguna 4031; ²RCPC III, Maligaya, Muñoz, Nueva Ecija

The extent of infestation of armyworm on onion and possible cause of its outbreak in 2016 in Nueva Ecija were determined through site visits, interviews and dialogue with farmers, and review of pertinent literature. Notes on its biology are also provided. The species involved in the outbreak was identified as *Spodoptera exigua* (Hübner). Fourteen municipalities covering 5,330 hectares

and involving 4,089 farmers were affected. An estimated total loss of PHP 1,609,997,316.00 was incurred from February to April 2016. *S. exigua*, a polyphagous species, was documented on the following alternate crop and weed hosts: *Capsicum annum* L., *Cucurbita maxima* Duchesne, *Momordica charantia* L., *Vigna unguiculata* (L.) Walp., *Zea mays* L., *Achyranthes aspera* L., *Amaranthus viridis* L., *Centrocema pubescens* Benth., *Commelina benghalensis* L., *Eleusine indica* (L.) Gaertn., *Synedrella nodiflora* (L.) Gaertn., *Rottboellia conchinchinensis* (Lour.) Clayton, and *Tagetes* sp. Developmental period of onion armyworm reared on fruits of stringbeans ranged from 16-25 days. Outbreak is suspected to have resulted from mass long distance migration from countries northeast of the Philippines, which could have been triggered by El Niño.

Key words: Nueva Ecija, onion armyworm, outbreak, *Spodoptera exigua*

23. SURVEY OF INSECTS ASSOCIATED WITH TOMATO (*Solanum lycopersicum* L.) IN LANA DEL SUR, ARMM

Nelson M. Balabag¹ & Emma M. Sabado², ¹Sto. Rosario, Magallanes, Agusan del Norte; ²Department of Plant Science, College of Agriculture, MSU, Marawi City, Lanao del Sur, ARMM

A study was conducted in the Mindanao State University Campus in Marawi City, Lanao del Sur, ARMM, from December 14, 2011 to February 16, 2012 to identify the insects and other arthropods associated with tomato. Collected insects belong 18 families under six orders, namely: Coleoptera, Diptera, Hemiptera, Lepidoptera, and Hymenoptera. The insect pests included the cotton aphid (*Aphis gossypii* Glover), leafminer (*Liriomyza* sp.), common cutworm [*Spodoptera litura* (Fabricius)], tomato fruitworm [*Helicoverpa armigera* (Hübner)], cabbage looper [*Trichoplusia ni* (Hübner)], flea beetle (*Psylliodes* sp.), ladybird beetles (*Henosepilachna* sp.), and melon fly [*Bactrocera cucurbitae* (Coquillett)]. Beneficial species were honey bees (*Apis* sp.), braconid wasp (*Cotesia* sp.) and spiders.

Key words: *Bactrocera cucurbitae*, *Helicoverpa armigera*, Lanao del Sur, *Spodoptera litura*, tomato

24. HISTOLOGICAL INVESTIGATION OF INSECT-INDUCED GALLS ON LEAVES OF *Ficus ulmifolia* Lam.

Jeremy Carlo B. Naredo¹ & Ivy Amor F. Lambio², ¹Entomology and ²Botanical Herbarium Sections, respectively, MNH, and ²IBS, CAS, UPLB, College, Laguna; jbnaredo@up.edu.ph

Leaf galls on *Ficus ulmifolia* Lam. caused by *Pauropsylla deflexa* Uichanco are commonly observed in various locations in Mt. Makiling. Samples of normal and galled leaves were collected for anatomical studies. Samples were fixed, embedded in paraffin, sectioned, and stained with safranin and fast green. Measurements were done on the different tissues of the galls for comparison with those of healthy or normal leaves. Leaf galls arise from modifications of the morphogenesis of the cells and tissues of plant organs. Thick layers of

parenchyma were observed on cross sections of leaf galls which are modified palisade mesophylls of normal leaves. Other modifications observed on the leaf gall are apparent adaptations to protect the insect contained inside its chamber.

Key words: *Ficus ulmifolia*, histology, leaf galls, *Pauropsylla deflexa*

25. NOTES ON TWO EREBID HERBIVORES (LEPIDOPTERA: EREBIDAE) IN LOS BAÑOS, LAGUNA

Aimee Lynn B. Dupo, IBS, CAS, UPLB, College, Laguna; abdupo@up.edu.ph

This paper presents distributional and biological notes on two erebid moths from the genera *Lemyra* and *Xanthetis* collected from the UP Los Banos Campus. *Lemyra* contains many species from East and South Asia, Sundaland, and Australia. On the other hand, *Xanthetis* is so far monotypic and a Philippine endemic with the type species *X. luzonica* (Felder). Host plant records (e.g. *Cananga odorata*) are reported in addition to published data. In addition, documented aspects of their immature stages are shown.

Key words: *Cananga odorata*, Erebidae, larvae, *Lemyra*, Lepidoptera, moth, *Xanthetis*

26. SCALE INSECTS (HEMIPTERA: COCCOIDEA) ON THE COCONUT INFRACTESCENCE

Ireneo L. Lit, Jr.^{1,3}, Merdelyn T. Caasi-Lit², Cristian Lucañas³, & Kristine O. Abenis³ ¹IBS, ²IPB and ³Entomology Section, MNH, UPLB, College, Laguna; illit@up.edu.ph

Reports of scale insects on coconuts are mostly on species that infest leaflets. During surveys on several coconut-planting provinces in the Philippines, scale insects and mealybugs were observed to attack also the fruit and infructescence – the ensemble of fruits derived from the ovaries of an inflorescence (cluster of flowers). Three families of Coccoomorpha (or Coccoidea): five species of Diaspididae, one Pseudococcidae, and one Monophlebidae, were observed and recorded. Three species, *Aspidiotus destructor* Signoret, *A. nerii* Bouche and *Lepidosaphes* sp. were observed to attack the fruit directly. *Nipaecoccus nipae* (Maskell) and *Lepidosaphes* sp. shared the calyx whereas *A. destructor*, *Pseudaulacaspis pentagona* (Targioni), and *Pseudaulacaspis* sp. were observed to attack the peduncle. *Hemiberlesia lataniae* (Signoret), *Lepidosaphes* sp., *N. nipae*, and *Icerya* sp. also shared the pedicel. Simultaneous attack by several species on the same plant, in the same place, and at the same time, confounded the damage on coconuts, and implies that extra caution should be taken in relying mainly on unverified, and unmounted specimens for field identification.

Key words: Coccoidea, coconut infructescence, coconut scale insects, confounded damage, mixed colonies

27. CONSERVATION OF TERRESTRIAL ARTHROPODS IN THE PHILIPPINES: TOWARD AN INITIAL LIST OF THREATENED PHILIPPINE INSECTS AND OTHER ARTHROPODS

Ireneo L. Lit, Jr.^{1,2}, Aimee Lynn A. Barrion-Dupo^{1,2}, Sheryl A. Yap^{2,3}, Cristian C. Lucañas², Orlando L. Eusebio², Jeremy C.B. Naredo², Joseph B. Rasalan², Ace Kevin S. Amarga³, Kristine O. Abenis² & Hendrik Freitag², ¹IBS, CAS, UPLB, College, Laguna; ²Chair & Members, respectively, Technical Working Group Subcommittee for Invertebrates, DENR Philippine Red List Committee (PRLC) c/o Entomology Section, MNH, UPLB, College, Laguna; ³IWEP, CAFS, UPLB, College, Laguna; correspondence: illit@up.edu.ph

The more familiar side of entomology is pest management but the larger, although less popular side is insect or terrestrial arthropod biodiversity and its conservation. On the other hand, the more familiar side of biodiversity conservation are the plants and vertebrates. However, the threats to the existence of vertebrates also threaten arthropods and people. Realizing this, the Department of Environment and Natural Resources would be issuing a National Threatened Species List of Wildlife Fauna. The creation of the list, which would now include insect and other invertebrates, is in accordance with Rule 22.2, Section 22, Article 2 of the Joint DENR-DA-PCSD AO no. 01 series of 2004, which is also the joint IRR of RA 9147. Using a defined set of criteria, nominated species were evaluated and scored with the following results: 779 species qualifying for the Philippine Red List classified as: 11 critically endangered, 6 endangered, 319 vulnerable, 440 other threatened species, and 3 other wildlife species. Of those initially listed, 412 belong to Coleoptera (beetles), 165 Phasmatodea (stick and leaf insects), 55 Blattodea (non-termite cockroaches), 53 Hemiptera (true bugs and allies), 33 Lepidoptera (butterflies and moths), 28 Odonata (dragonflies and damselflies), 25 Araneae (spiders), and 8 Hymenoptera (mainly thread-waisted wasps). The list will be expanded in the future to include other groups that have not yet been evaluated within the prescribed deadline.

Key words: biodiversity conservation, endangered species, insect conservation, Philippine Red List

28. RODENT DAMAGE IN THE PHILIPPINES: PRiSM2016 NATIONAL SURVEY RESULTS

Leonardo Marquez, Ulysses G. Duque & Edwin C. Martin, Philippine Rice Research Institute, Muñoz, Nueva Ecija; lv.marquez@philrice.gov.ph

Rodents are a chronic pest of rice inflicting an average of 5-60% crop damage. To help address rodent problems in rice in the Philippines, the Department of Agriculture, PhilRice, IRRI, and Sarmap (Switzerland) through the 4-year collaborative project, Philippine Rice Information System (PRiSM), conducted a nationwide rodent damage survey. Organized information on rice area, yield, and yield gaps, and corresponding causes including rodent damage were gathered following a standard monitoring procedure for rodent damage sampling. We monitored 548 and 658 fields during the first and second semester of 2016 to assess the percent rodent damage in the Philippines. Rodent damage

nationwide averaged 1.96% during first semester and 1.72% during second semester of 2016. This information revealed the economic importance of rodents to policy makers and pinpointed the location and extent of rodent damage for field technicians.

Key words: PRiSM, rice, rodent damage

29. MOSQUITO LARVICIDAL TRAP (MLT): AN EFFECTIVE SURVEILLANCE AND CONTROL TOOL FOR *Aedes* MOSQUITOES

Lilian A. De Las Llagas¹, Lisa Grace S. Bersales², Arlene G. Bertuso¹, Myra S. Mistica¹, Virginia R. Ocampo³, Jocelyn B. Samaniego³, Ester A. Magsino³ & Fe D. Alzona³, ¹Department of Parasitology, College of Public Health, University of the Philippines Manila, Ermita 1000, Manila City; ²School of Statistics, UPD, Diliman, Quezon City; ³IWEP, CAFS, UPLB, College 4031, Laguna; agbertuso@up.edu.ph

Larvicidal potential and ovipositional effect of Mosquito Larvicidal Trap (MLT) on *Aedes* mosquitoes were determined under field conditions. The MLT is modified from an ovitrap utilized by De Las Llagas et al. in all dengue mosquito surveillance and control studies in the Philippines. It is the classical ovitrap with 2% Novaluron, an insect growth regulator and proven attractant in an ovitrap clean water. MLT was installed and serviced every three weeks (July 2012 to June 2013) in each of 220 households in Batong Malake and San Antonio, Los Baños, Laguna, both known endemic sites for dengue transmission. Efficacy of MLT as a surveillance tool was compared in terms of relative attractiveness to ovipositing mosquitoes, to the conventional inspection of containers with water and the classical ovitrap. The Breteau Index, ovitrap index (OI), and MLT positive for wigglers were determined. The mean MLT positive with mosquito was 70.5% in Batong Malake (OI = 53.5%) and 56.6% (OI = 50.4%) in San Antonio. Novaluron increased attractiveness to females to lay eggs, and killed larvae. MLT was more attractive than containers or classical ovitraps for oviposition, lethal to deposited eggs, and prevented pupal development, indicating autocidal activity to larvae. Thus, MLT prevents adult emergence by preventing pupal development. MLT as an integral component of dengue vector control program will help reduce mosquito density at immature stages and lessen dependence on adulticides. With threats of vertical and transstadial transmission, managing vectors at early developmental stages must be implemented.

Key words: *Aedes* spp., dengue vectors, mosquito larvicidal trap, surveillance and attractant tool

30. EVALUATION OF LOCAL CLAY PARTICLES AS COATING AGENTS AGAINST CACAO MIRID BUG

Sharin C. Albacete, Divina M. Amalin & Ma. Ellenita G. De Castro, Biological Control Research Unit-CENSER, DLSU, Taft Avenue, Manila; sharin_albacete@dlsu.edu.ph

Efficacy of clay particles as a coating agent for the control of cacao mirid bug

was evaluated. Preliminary experiment compared local clay particles as a coating agent of pods to repel *Helopeltis bakeri* Poppius, with the commercially available particle film. Cacao pods were coated separately with the different local clay particles such as local kaolin, zeolite, bentonite, and the US kaolin (commercially available particle film). Coating with plain water, and commercial synthetic insecticide were included as negative control and positive control, respectively, in order to determine the most efficient among the local clay particles in protecting the pods from *H. bakeri* feeding. US kaolin-coated pods had the fewest feeding punctures followed by the local zeolite. Pods sprayed with water had the highest number of feeding punctures. All insects in cacao sprayed with insecticides died. Cacao mirid bugs in all clay particle coated pods were alive. The commercial particle film, US kaolin has a particle size of 0.4 microns which is very fine as compared to the local clay particles, which ranged from 25-32 microns. Thus, complete coating coverage of the pods was attained using US kaolin and therefore exhibited more repellent action against mirid bugs. Refining the particle size of the local clay particles will be done to further evaluate their efficacy as coating agents of the cacao pods to manage pests.

Key words: cacao, coating agent, mirid bug, particle film, pest

31. PUBLIC-PRIVATE PARTNERSHIP IN MANAGING ONION ARMYWORM OUTBREAK IN NUEVA ECIJA

Jedeliza B. Ferrater¹, Jun M. Ramos¹, Evergilio M. Aquino Jr.², Marietta DI. Agregado², Gideon Aries Burgonio³, Randolph N. Candano³, Grandeur G. Gaspar¹, Nelson M. Bautista², Marcela M. Navasero³, Mario V. Navasero³ & Bonifacio F. Cayabyab³, ¹East-West Seed Company, Inc., San Rafael, 3008 Bulacan, Philippines; ²RCPC RFO, Department of Agriculture Region III; ³NCPC, CAFS, UPLB; jun.ramos@eastwestseed.com

Approximately 5,000 out of about 8000 hectares planted to onion in Nueva Ecija were heavily infested with armyworms during the first quarter of 2016, an unprecedented outbreak. Bongabon, considered the onion capital of the Philippines incurred the most damage at 2,938 hectares. The larvae skeletonized the leaves and the feeding reached down to the bulbs thereby reducing yield significantly. In April, 2016, the Department of Agriculture through RCPC III organized a forum in Nueva Ecija on armyworm management with entomologists from the NCPC - UPLB as lead lecturers. This forum was well-attended by local government units, agriculture officers/technicians, farmers and private companies involved in the onion industry. The highlight of the forum was a consensus from various stakeholders of the need to have an updated reference material to be used in region-wide farmer education campaign on armyworm integrated pest management (IPM). This paper discussed the different IPM strategies and struggles to manage armyworms during the past year up to the present planting season, highlighting the joint efforts by both the government and private agencies in helping our farmers manage armyworms in an integrated approach rather than complete dependence on agrochemicals.

Key words: armyworm, integrated pest management, public-private partnership

32. CONSUMER AWARENESS AND ACCEPTANCE OF EDIBLE INSECTS IN LANA DEL SUR, ARMM: POTENTIALS FOR FOOD SECURITY

Leo M. Aguanta¹ & Emma M. Sabado², ¹Department of Agribusiness and Extension, and ²Department of Plant Science, respectively, College of Agriculture, MSU, Marawi City, Lanao del Sur, ARMM

Entomophagy or the practice of eating insects is not well accepted in the Philippines, compared to other parts of the world, where they are routinely eaten, as a great protein source. In fact, experts are exploring ways to incorporate entomophagy in the global food system to replace common animal protein sources. In line with this global trend, entomophagy was promoted in Mindanao State University, Marawi City, Lanao del Sur, through Insect Eating Festivals (IEF) to educate students on utilizing insects as food. This study assessed entomophagy in terms of participants' perceptions, consumption of insect-based food, and change in awareness before and after IEF. Data from 90 participants gathered using structured questionnaire were analyzed with SPSS. IEF participants consumed predominantly cassava cake with Chinese grasshopper toppings (37%), followed by horseradish polvoron with rice and corn weevils (22%), and horseradish turon with earwigs and ants (21%), spaghetti with superworms (17%), and sandwich with honeybees as fillers (17%). The least consumed was glutinous rice with cabbage worms (10%). Increase in participants' awareness level after IEF on insect edibility and as key food for nutrition suggests that IEF is effective for educating people about the potentials of entomophagy. These initial findings point toward the possibility of using entomophagy to manage pest populations during outbreaks, provide alternative source for animal and fish feeds, and address problems in malnutrition due to low protein intake. However, further multidisciplinary studies need to address food safety issues and explore openness of potential consumers.

Key words: awareness, entomophagy, insect-based foods, perceptions, Philippines, potentials

33. PHILIPPINE RECORDS OF *Aspidiotus destructor*, *A. rigidus* AND RELATED SPECIES (HEMIPTERA: DIASPIDIDAE): HISTORICAL, BIOGEOGRAPHICAL, QUARANTINE, AND OTHER ISSUES

Ireneo L. Lit, Jr.^{1,3*}, Merdelyn T. Caasi-Lit², Cristian Lucañas³ & Kristine O. Abenis³, ¹IBS, ²IPB and ³Entomology Section, Museum of Natural History, UPLB, College, Laguna; illit@up.edu.ph

Effective pest management strategies in coconut plantations require accurate identification of insect pests on coconuts and associated crops. *Aspidiotus rigidus* Reyne is the species involved in the most recent pest outbreaks and it is morphologically quite close to *A. destructor* Signoret. *A. rigidus* was originally described as a subspecies of *A. destructor* and for a long time, it has also been treated as a synonym of *A. destructor* despite its recognition as a species by Borchsenius in 1966. Such synonymy and other lumping of species under the *A. destructor* complex led to delays in effective pest management. This study reviews historical, biogeographical, quarantine and other issues pertaining to the

records of occurrence of *Aspidiotus* species in the Philippines. There is a great possibility that *A. rigidus* is not a recent introduction as widely claimed. Likewise, its occurrence in Basilan, the Bicol Region and a few other places are confirmed. Other important data on host associations and distribution of *A. destructor* and other *Aspidiotus* species are discussed.

Key words: *Aspidiotus*, *Aspidiotus destructor*, *Aspidiotus rigidus*, biogeography, history of species introduction, invasive species

34. ADVANCED LINES OF TRADITIONAL CORN TOWARD BREEDING FOR RESISTANCE TO THE ASIAN CORN BORER, *Ostrinia furnacalis* (Guenee) (LEPIDOPTERA: CRAMBIDAE)

Merdelyn T. Caasi-Lit, Bryan V. Novio, Marieta T. Arapan, Artemio A. Salazar, Jefferson F. Paril, Ayn Kristina M. Beltran, Alma B. Sanchez & Raphael Cuizon, IPB, CAFS, UPLB, College, Laguna; mclit@up.edu.ph

The Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee), is still the most destructive insect pest of open-pollinated varieties (OPV's) of maize in the Philippines. This paper reports the results of initial renewed efforts to search for native corn germplasm with inherent resistance to ACB. Two hundred eighty-seven S1 advanced traditional maize lines were generated in 2016. These were evaluated through no-choice leaf disc and stalk-feeding bioefficacy tests, using 2nd instar laboratory-reared ACB larvae. Test materials were taken from corn plants at vegetative (30-35 days after planting, DAP) and reproductive (40-60 DAP) stages, respectively. The S1 families, CGUARDCnN32_C0-14, CGUARDN32_C0-04 and CGUARDCnN40_C0-02 exhibited significant levels of leaf feeding and stalk feeding resistance in both assays as revealed in mean percent survival (35.33-49.33%) and the mean tunnel length (4.33-8.33 mm). Strip test for Bt Cry1Ab/Ac protein of these lines using leaf collected randomly from the field at 30-35 DAP had negative results implying inherent ACB resistance. Feeding behavior of ACB larvae when grown on promising S1 lines were also noted. DIMBOA (2,4-dihydroxy-7-methoxy-(2H)-1,4-benzoxazin-3(4H)-one) levels were compared *in vitro* for the promising lines to elucidate the mechanism of resistance of these varieties. These promising advanced lines of native corn can be utilized for maize population improvement and eventually for breeding for resistance to the ACB, especially in the tropics.

Key words: Asian corn borer, bioefficacy, leaf and stalk feeding damage, native corn, S1 lines

35. LEAF DISC AND WHOLE PLANT ASSAYS OF BT CORN AGAINST *Ostrinia furnacalis* (Guenee) FOR REGULATORY REQUIREMENTS AND RESISTANCE MONITORING

Merdelyn T. Caasi-Lit, Abigail P. De Leon, Mark Bryan T. Lontoc Bryan V. Novio & Rachel H. Dacuba, Entomology Laboratory, IPB, CAFS, UPLB, College, Laguna; mclit@up.edu.ph

As part of the responsive regulatory system for all Bt corn applications prior to commercialization, formulation or modification of science-based risk assessment protocols to comply strictly with biosafety guidelines is needed. Bioefficacy testing is one way to determine whether Bt transgenic products will be approved for release and use. Direct, simple, cost-effective, and environment-friendly methods would be recommended as standard protocols for Asian corn borer (ACB) resistance management strategies and regulation of Bt-protected maize lines. Leaf disc and whole plant assays have been used for efficacy testing of Bt transgenics. Successive trials were done both in the laboratory and field in 2015-2017 which demonstrated their effective use in determining effects of Bt corn on either neonates or early instars of ACB. For each leaf disc trial, optimum laboratory conditions were maintained and acceptable threshold larval mortality strictly monitored. Petri dish, plastic cup, and assay wells were compared as containment of leaf discs. The effects of test leaf discs (Bt against non-Bt) can be discriminated at different periods from 1-5 days. Whole plant assays using developed artificial infestation technique have been employed both for caged and uncaged (field) conditions. Under favorable conditions, at different corn stages and multiple sites, bioefficacy of Bt corn can be easily evaluated on the basis of larvae and pupae recovered from Bt and non-Bt plants. The 100-whole plant assay was the most effective. These tests can be further improved and recommended for efficacy testing especially for Bt corn family lines.

Key words: 100-whole plant assay, Asian corn borer, biosafety, Bt corn, leaf disc method

36. FIELD BIOEFFICACY OF MAIZE BT11 AGAINST *Ostrinia furnacalis* (Guenee) USING ISABELA AND SOUTH COTABATO POPULATIONS

Merdelyn T. Caasi-Lit, Gian R. Pescadero, Mark Bryan T. Lontoc, Jenifer P. Bigcas, Emmanuel V. Elladora, Rachel H. Dacuba & Victor V. Alpuerto, Entomology Laboratory, IPB, CAFS, UPLB, College, Laguna; mclit@up.edu.ph

The Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee), has always been the major pest of corn before Bt corn was introduced almost 15 years ago in the Philippines. High levels of field infestation could reduce yield up to 100%. The insect-resistant and herbicide tolerant Bt11 became the second Bt corn hybrid in the country and has been available commercially for 12 years. The Department of Agriculture-Bureau of Plant Industry included it in its Lists of Approval Registry. Efficacy and other studies are required for biosafety permits for direct use of Bt11 as food, feed, or for processing and propagation. Field efficacy of the specific single trait Bt11, was studied, including its isolate as susceptible control, against the ACB. Experiments were conducted in Carabatan Punta, Cauayan, Isabela, and San Isidro, General Santos City, South Cotabato, at the vegetative and reproductive stages of corn under artificial infestation. The 100-whole plant field assay was employed where all the 168 plants in a plot were infested with 50 second instar larvae using the barbecue infestation technique. The 100 middle test plants were rated for leaf and stalk feeding at 5 and 10 days after infestation (DAI) and dissected at 15 DAI for larval recovery. All trial sites and stages showed that larvae and pupae were recovered from infested non-Bt

plants but none from Bt plants. This demonstrates that the single trait Bt11, remains effective against the ACB. The 100-whole plant field assay can be recommended as a standard protocol for resistance monitoring.

Key words: Asian corn borer, bioefficacy, Bt corn, Bt11 isoline, maize Bt11

37. COMPARISON OF SURVIVAL RATES OF NEONATES AND SECOND INSTAR LARVAE OF *Ostrinia furnacalis* (Guenee) FOR LARVAL MOVEMENT STUDIES

Merdelyn T. Caasi-Lit, Jenifer Bigcas, Gian R. Pescadero & Emmanuel D. Elladora, Entomology Laboratory, IPB, CAFS, UPLB, College, Laguna; mclit@up.edu.ph

The behavior of neonates and early instar larvae of the Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee), in the field is little understood. Studies along this line are needed to understand the refuge recommendation of introduced Bt corn products for insect resistance management, and in designing an appropriate refuge system that will delay the development of resistance to ACB. This study aims to generate basic information on the larval survival of ACB by introducing neonates and second instar larvae on 40-day old corn plants. This will be useful in studying larval movement of ACB in the field. ACB were collected from four locations (Katangawan, Arenas, Revas, and Conel Road) in General Santos City, Philippines and infested on the test plants, caged to prevent natural infestation of feral or wild ACB and natural enemies. Test plants from different treatments with three replications were dissected at 4, 8, 12, and 16 days after infestation (DAI). The experiment was conducted under normal field conditions. Second instar larvae at 4, 8, and 16 DAI had the highest mean larval survival compared to neonates. However, more neonates survived at 12 DAI and then both had almost the same number of larvae at 16 DAI. Although 2nd instar larvae had the highest larval survival from the start, surviving larvae were the same during the last sampling period. Hence, both neonate and second instar larva can be used for larval movement studies. The use of blackhead-stage egg masses is also being tested.

Key words: Asian corn borer, Bt corn, larval survival, neonates, second instar larvae

38. VIDEO-DOCUMENTATION OF THE EFFECTS OF BT CORN AND THE PROGRESSION OF SIGNS AND SYMPTOMS OF SEPTICEMIA ON NEONATE *Ostrinia furnacalis* (Guenee)

Merdelyn T. Caasi-Lit & Rachel H. Dacuba, Entomology Laboratory, IPB, CAFS, UPLB, College, Laguna; mclit@up.edu.ph

Bt corn is effective against the Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee), providing excellent protection against newly hatched (neonate) and second instar larvae. The initial feeding pattern of neonates was recorded on video, as well as the corresponding progression of signs and symptoms of septicemia, and the time spent before death. A neonate larva was carefully

placed on the adaxial side of the expanded leaf of corn next to the whorl. A 30-day old Bt corn plant was used in the observation. Larval movement, infestation, crawling, ballooning, transferring from one part of the leaf to another, scraping and feeding, feeding time, and part of leaf fed upon, and the time until complete manifestation of septicemia on the larva were recorded. Clearly, signs and symptoms of septicemia gradually developed hours after feeding on the leaf. The symptoms include “vomiting-like” reaction and the slow darkening on the anal area. Also, the larval thoracic area that probably corresponds to the internal midgut portion – became narrow during “vomiting.” The abdomen then appeared to be bloated after the narrowing of the thorax. After this, the larva moved slowly until it was stationary, the whole body slowly turning black and eventually completely motionless, and died. The video-documentation will help explain the initial injury on Bt corn plants, but which do not progress further, and elucidate to farmers what is often seen as lack of knockdown effect among Bt transgenic plants.

Key words: Asian corn borer, Bt corn, cry protein, neonates, septicemia

39. RAPID BIOASSAY FOR PESTICIDE RESIDUES (RBPR) AND THE RAPID TEST KIT (RTK) FOR DETECTION OF RESIDUES ON VEGETABLES

Cristina M. Bajet, John Julius Manuben, Eric Jhon Cruz & Jasper Sarmiento, NCPC, CAFS, UPLB, College, Laguna; cmbajet@up.edu.ph

Pesticide residues in raw agricultural commodities pose major concerns in food safety. Rapid detection of pesticide residues can assist in consumer awareness and protection. Rapid bioassay for pesticide residues (RBPR) and rapid test kit (RTK) are rapid detection tools for the detection of organophosphate (OP) and carbamate (CM) pesticide residues based on enzyme inhibition and colorimetric reactions, respectively. Vegetables from different markets in Laguna, Quezon, Metro Manila, and Benguet were sampled and analyzed for the presence of OP and CM residues. Out of 112 samples of organic-labelled vegetables, 17 (15.18%) were positive to RBPR, compared to 7 (5.38%) out of 130 conventionally produced vegetables. RTK results were 27.8% and 37.5% positive for organic labelled and conventional vegetables, respectively. Bittergourd, eggplant, and tomato were frequently positive using RBPR and/or RTK tests. RBPR and RTK are complimentary rapid detection tools useful in monitoring compliance to principles of organic farming and market collected samples for immediate action. RBPR and RTK are limited to the detection of OPs and CMs, the group of pesticides which are toxic, cheap and commonly used by vegetable farmers.

Key words: carbamate, organic labelled vegetables, organophosphate, pesticide residues, rapid bioassay for pesticide residues (RBPR), rapid test kit (RTK)

POSTER PAPERS**1. THE QUEST FOR BLEMISH-FREE ‘CAVENDISH’ BANANA USING MATRINE, A NATURAL DERIVATIVE OF SHRUBBY SOPHORA (*Sophora flavescens* Aiton)**

Leslie T. Ubaub¹ & Rex John R. Celiz², ¹University of Southeastern Philippines, Apokon, Tagum City, Davao del Norte; ²Aktiv Multi Trading Corporation Philippines Inc., Agdao, Davao City; leslie.ubaub@usep.edu.ph

Matrine is a new broad spectrum biological insecticide. It is a natural derivative extracted from the leaves and roots of shrubby sophora, *Sophora flavescens* Aiton, a legume from which various bioactive compounds have been reported. Of these compounds, matrine, a quinolozidine alkaloid, is bioactive against various insect pests, pathogenic fungi, bacteria, and nematodes. To test whether matrine can effectively control flower thrips, *Thrips hawaiiensis* (Morgan), which causes corky scabbing on banana fruit, an experiment was conducted through bud injection. Matrine at 0.5, 1.0, and 1.5 ml/L of water was statistically comparable to the commercial insecticide Abamectin 1.8SL at 4.0 ml/L of water, in managing the thrips population on Cavendish banana three days after bud injection. In terms of percentage of fruits with thrips oviposition damage, fruits applied with matrine at 1.5 ml/L obtained the highest mean with slight damage and the least with severe damage. In terms of brown scab/water soak damage, Abamectin 1.8SL at 4.0ml/L of water and matrine at 0.5ml/L of water gave superior result obtaining the highest clean fruits recovered. Among treatments, matrine at 0.5 ml/L and 1.0 ml/L of water gave superior results obtaining the highest Class A fruits. Thus, matrine can effectively control blemishes caused by *T. hawaiiensis* and is a potential alternative to synthetic commercial insecticides.

Key words: blemishes, Cavendish banana, matrine, *Sophora flavescens*, *Thrips hawaiiensis*

2. MANAGEMENT OF RICE PESTS BY ECOLOGICAL ENGINEERING IN FARMERS’ FIELD IN NUEVA ECIJA, PHILIPPINES

Belen Punzal, Gertrudo S. Arida, Leonardo V. Marquez & Josef Settele, PhilRice, Maligaya, Muñoz, Nueva Ecija; bs.punzal@philrice.gov.ph

A pioneering study was conducted in farmers’ fields to determine the effect of planting flowering plants in field margins close to rice fields on the population of the different functional groups of arthropods, key insect pests, and natural enemies, and damage caused by stemborer and defoliators in farmers’ fields. Sampling rice arthropods using sweep net and Blow-vac suction machine showed that rice fields close to field margins with flowering plants had lower population of herbivores compared to fields without flowering plants. Parasitoids collected using yellow sticky traps were higher in fields close to flowering plants compared to those without. This was recorded in both locations. In addition, damage caused by defoliators and stem borer were higher in fields without flowering plants compared to fields close to flowering plants. Ecological

engineering offers immense opportunities to rice insect pest management using non-chemical methods leading to economic, health and environmental benefits.

Key words: arthropods, Ecological Engineering, flowering plants

3. ENHANCING THE USE OF PEST MANAGEMENT TECHNOLOGIES AMONG SELECTED IRRIGATION ASSOCIATIONS (IAs) IN CARAGA

Gerardo F. Estoy, Jr.¹, Milflor S. Gonzales² & Abner T. Montecalvo¹,
¹PhilRice Agusan, Basilisa, Remedios T. Romualdez, 8611, Agusan del Norte;
²Food and Nutrition Research Institute, DOST Compound, General Santos Avenue, Taguig City, Metro Manila; gf.estoy@philrice.gov.ph

The study examined how institutional factors influencing the promotion of pest management technologies introduced to rice farmers in Caraga region, have impacted farmers' adoption behavior. The institutionalization of the collaborative approach proposed by the study would ensure a more decisive rice crop management system in preventing crop losses due to pests. There should be constant and sustainable interaction among partner agencies and the Irrigators Association (IA) officers with its members (rice farmers) in ensuring the right decision in any rice production activity to prevent pest problems to occur in the field. To sustain the gains of the study, lessons learned and recommendations for its sustainability were also discussed. Recommendations for the study's sustainability revolve around five enabling factors: 1) cooperation of the Study Team members, 2) Study orientations in all partner agencies, 3) development and approval of a Memorandum of Agreement among partner agencies and IAs, 4) partner agencies continuous support, and 5) establishment of linkages with and among partner agencies.

Key words: Caraga region, Collaborative approach, Irrigators Association, Pest management technologies

4. SEASONAL FLUCTUATION OF MAJOR INSECT PESTS OF RICE AT PHILRICE CES

Evelyn M. Valdez & Gilely dC. Santiago, PhilRice, Muñoz, Nueva Ecija; evelynvaldez_11@yahoo.com

Management of insect pests employs several tactics compatible with each other to become effective. Generally, insect pests are widely distributed and oftentimes their population is overlapping, hence management is difficult. Management strategies vary from one pest to another and also with the different growth stages of the insect. Knowing the right time to apply intervention is necessary to better manage a particular pest. Several tools are being used to determine the population fluctuation of these pests. One is through light trapping. Light trap catches provide a significant clue to the diversity of nocturnal insects and how populations fluctuate. Determination of population fluctuations or incidence of insect pests in the field is useful not only to determine the activity of insect pests in relation to several weather factors but also to study the population dynamics of insects during the particular period. A light trap was installed at the PhilRice

CES to obtain data on the population dynamics of the major insect pests, to aid in decision-making in insect pest management. The weekly light trap collections that started in January 2016 were brought in the laboratory for sorting, identification and counting. The population of the insect pests peaked in March and September during the dry and wet seasons of 2016, respectively.

Key words: fluctuation, light trap, major insect pests, population dynamics

5. RESISTANCE STABILITY OF HIGH YIELDING VARIETIES TO MAJOR INSECT PESTS OF RICE

Gilely Santiago, Evelyn M. Valdez & Ma. Salome V. Duca, PhilRice, Muñoz, Nueva Ecija; gc.santiago@philrice.gov.ph

Use of resistant rice varieties reduces losses caused by pests in irrigated rice. The stability of resistance depends on the genetic interaction between the rice host, insect herbivore and pathogen. The expression and long-term stability of resistance to a herbivore insect and pathogen in a plant species depend on the genotype of the host, the genotype of the insect and pathogen, and their interaction to environmental conditions. Durable resistance is expected to relieve rice farmers of the need to change varieties often. Durability combined with multiple pest and disease resistance will further reduce the need to apply pesticides. A field experiment was conducted during the dry and wet seasons of 2016 to evaluate the resistance stability of 43 high yielding/popular rice varieties to major insect pests. The re-evaluation showed that majority of the varieties had maintained the reactions against the major insect pests that they had during the time of their release.

Key words: durability, insect pest, resistance, stability

6. PHILIPPINE RICE INFORMATION SYSTEM'S PAPERLESS DATA COLLECTION FOR CROP HEALTH SURVEY

Ulysses G. Duque¹, Joselito E. Villa², Darlyne Kaye R. Bumagat¹ & Leonardo V. Marquez¹, ¹Crop Protection Division, PhilRice, Muñoz, Nueva Ecija; ²International Rice Research Institute; dkr.bumagat@philrice.gov.ph

Data collection is the process of gathering and measuring information on targeted variables in an established systematic fashion, which then enables one to answer relevant questions and evaluate outcomes. For the Philippine Rice Information System (PRiSM), one of its objectives is to provide timely and accurate information on the rice crop to support policy-making, decision-making and activity-planning related to food security. Crop health assessment is one of the components of PRiSM which is based on a characterization of the rice production situation and assessment of pest injuries in monitoring fields across the country. With the current usage of pen and paper in the data collection, the objectives of PRiSM cannot be met. When a data collector uses pen and paper to record data, encodes in a computer, and analyzes locally, a nationwide information set is difficult to compile and compare on a real time basis. For PRiSM, a standard data collection methodology is being followed where a data

collector uses a specifically programmed Open Data Kit software installed to an Android® based smartphone to directly encode and send data to a cloud server for archiving and analysis. Analyzed data are interpreted and sent to the Department of Agriculture in a form of bulletin and uploaded to PRiSM website which is available to the public.

Key words: crop health assessment, data collection, Open Data Kit, Philippine Rice Information System, PRiSM website

7. SAP-FEEDING INSECTS (INSECTA: HEMIPTERA) ASSOCIATED WITH SELECTED NUTRACEUTICAL PLANTS

Jessamyn R. Adorada¹, Joel L. Adorada², Jeminiano Q. Perez³ & Constancio C. de Guzman⁴, ¹IWEP, ³NCPC, ⁴Institute of Crop Science, CAFS, UPLB, College, Laguna; ²Bureau of Plant Industry, Los Baños National Crop Research, Development and Production Support Center; jradorada@up.edu.ph

Sap-feeding insects were observed to cause damage to a number of plants with nutraceutical value, namely: lagundi (*Vitex negundo* L.), akapulko (*Senna alata* (L.) Roxb.), sambong (*Blumea balsamifera* (L.) DC.), guava (*Psidium guajava* L.), tsaang-gubat (*Carmona retusa* (Vahl) Masam.), and ipil-ipil (*Leucaena leucocephala* (Lam.) De Witt.). These hemipterans caused curling, stunting, and discoloration of leaves and shoots that reduce their quality and consequently their economic value. The sap-feeding insects were identified as *Nisia nervosa* (Motchulsky), *Tingis* sp., *Dictyla* sp., *Kallitaxilla* sp., *Ferrisia virgata* (Cockerell), *Heteropsylla cubana* Crawford, *Aleurodicus dispersus* Russell, *Ricania speculum* (Walker), and *Cicadulina bipunctata* (Melichar).

Key words: Hemiptera, nutraceutical plants, sap-feeding insects

8. POPULATION TREND OF RICE PLANTHOPPERS AND INCIDENCE OF HOPPERBURN DAMAGE

Genaro S. Rillon¹, Cesjoy Carl B. Encarnacion¹ & Hae-Ryun Kwak², ¹Crop Protection Division, PhilRice, Maligaya, Muñoz, 3119 Nueva Ecija; ²Crop Protection Division, National Academy of Agricultural Science, Rural Development Authority, Korea; gs.rillon@philrice.gov.ph

One of the recent serious constraints to the rice production in Asian countries are rice planthoppers such as brown planthoppers (BPH) and whitebacked planthoppers. Rice planthoppers also transmit viruses that devastate rice plants. For example, rice grassy stunt virus and rice ragged stunt virus are persistently transmitted by BPH. In the Philippines, planthopper outbreaks have damaged about 6,700 has in Iloilo and significant yield losses were reported during the wet season of 2010. This study monitored planthopper populations using light and yellow sticky traps and the associated damage in PhilRice CES, Muñoz, and Mabini, Sto. Domingo, Nueva Ecija including damage assessment in farmers' fields. Rice planthopper population patterns in 2014-2016, and the assessment of associated damage (hopperburn) were discussed.

Key words: hopperburn, rice planthoppers, population

9. EFFECTS OF INCREASING TEMPERATURE ON THE INCUBATION OF YELLOW STEMBORER EGGS AND EMERGENCE OF ITS PARASITIDS

Cesjoy Carl B. Encarnacion¹, Genaro S. Rillon^{1*}, Mark Jude P. Ancheta², JG Tallada³ & RF Jorge³, ¹Crop Protection Division, PhilRice, Maligaya, Muñoz, 3119 Nueva Ecija; ²Institute of Graduate Studies, CLSU, Muñoz, 3119 Nueva Ecija; ³Rice Engineering and Mechanization Division, PhilRice, Maligaya, Muñoz, 3119 Nueva Ecija; gs.rillon@philrice.gov.ph

Among the expected climate change events, the predicted increase in temperature could influence behavior, development, and interaction of insect pests and their natural enemies. This study determined the effect of increasing temperature on the incubation of yellow stemborer (YSB) eggs and parasitoid emergence. YSB egg masses were collected in the field and exposed to ambient temperature and inside fabricated Insect Growth Chamber with +2°C above ambient temperature. YSB egg incubation and parasitoid emergence were observed and recorded. When egg masses were exposed at additional 2°C temperature, egg incubation and parasitoid emergence decreased. Thus, increase in temperature may have detrimental effect or cause mortality to YSB and its parasitoids. Also, YSB egg incubation and emergence of parasitoids were prolonged with increased temperature.

Key words: incubation, parasitoid emergence, rice, temperature, yellow stemborer

10. REDISCOVERING HIDDEN HELMETS: THE PHILIPPINE CASSIDINAE (COLEOPTERA: CHRYSOMELIDAE)

Maureen de Roxas¹ & Jessamyn R. Adorada², ¹NCPC & ²IWEP, CAFS, UPLB, College, Laguna; mdderoxas@up.edu.ph

Cassidinae (Coleoptera: Chrysomelidae), known as tortoise beetles are gregarious foliage feeders of crops and weeds. This economically important group is rarely studied in the Philippines. Specimens were examined and identified to 12 species belonging to all four tribes in the Philippines. Seven of these species were found to be endemic. High endemicity of the species described needs further exploratory studies and recollection for further verification. A key to Philippine cassidine tribes is provided.

Key words: Cassidinae, Chrysomelidae, Philippines, taxonomy, tortoise beetles

11. EVALUATION OF WHITEFLY RESISTANCE IN TOMATO USING NO-CHOICE BIOASSAY

Jedeliza B. Ferrater, Carlito M. Yarte, Jun M. Ramos, Caleb Orchard¹, Cherry R. Belagantol & Conrado H. Balatero, East-West Seed Company, Inc., San Rafael, 3008 Bulacan, Philippines; ¹Hortigenetics Research (S.E. Asia Limited), 50290 Chiang Mai, Thailand; jun.ramos@eastwestseed.com

Whitefly, *Bemisia tabaci* (Gennadius) is one of the most economically important insect pests in agriculture, particularly among solanaceous crops like tomato.

This insect causes direct damage by feeding and indirect damage through virus transmission and sooty mold growth. Whitefly control is costly, especially in open field cultivation, as commonly found in the tropics. The exploitation of constitutive plant defenses present in domesticated tomato and wild relatives, may offer a solution for the control of *B. tabaci*. To identify plant materials with high levels of resistance, we screened 16 accessions of tomato and a BC1F2 population using a no-choice clip-on cage bioassay. Based on insect performance parameters such as female adult survival and oviposition (egg count) rate, we found *Solanum galapagense* S.C. Darwin & Peralta and *S. habrochaites* S. Knapp to be highly resistant. This bioassay also detected differences in insect performance in a segregating population of BC1F2 plants. This new protocol will provide researchers a more reliable phenotyping method compared to the free-choice bioassay in evaluating plant materials for whitefly resistance.

Key words: host plant resistance, no-choice bioassay, phenotyping, whitefly

12. INSECTICIDAL ACTIVITY OF FIVE ETHANOLIC EXTRACTS AGAINST DIAMONDBACK MOTH, *Plutella xylostella* (Linnaeus) (LEPIDOPTERA: PLUTELLIDAE)

Abigaile Mia V. Javier¹, Virginia R. Ocampo², Flor A. Ceballo² & Pio A. Javier², ¹Philippine Nuclear Research Institute; ²IWEP, CAFS, UPLB, College, Laguna; avjavier@pnri.dost.gov.ph

Ethanollic extracts from leaves of *Lantana camara* L., *Plectranthus amboinicus* (Lour.) Spreng., and *Catharanthus roseus* (L.) G. Don., and rhizomes of *Alpinia galanga* (L.) Willd. and *Curcuma longa* L. were evaluated for their contact toxicity through topical method and leaf residue film method (LRFM), antifeedant activity and repellency through LRFM, and insect growth regulatory (IGR) through topical application against second instar larvae of diamondback moth (DBM), *Plutella xylostella* (Linnaeus). Among the five ethanollic extracts, *L. camara* was the most toxic against DBM by topical application (LD₅₀= 98.78 µg/g) and also showed the highest antifeedant activity at 125 ppm. Using LRFM, ethanollic extracts from *Cu. longa* was the most toxic against DBM (LC₅₀= 203.37 ppm) and also showed the highest repellency at 125 ppm. *Cu. longa* and *Ca. roseus* exhibited high antifeedant activity when concentration was increased to 500 ppm. *L. camara*, *Cu. longa*, and *A. galanga* showed remarkable IGR activities against DBM expressed in high larval and pupal mortalities, and short adult life span; highest repellency; and highest adult mortality, respectively. Among the ethanollic extracts, *L. camara* was the most promising since it consistently showed high contact toxicity, antifeedant and remarkable IGR activities against DBM.

Key words: botanical insecticide, ethanollic extracts, insecticidal activity, *Plutella xylostella*

13. POTENTIAL ENCYRTID PARASITOIDS (HYMENOPTERA: ENCYRTIDAE) OF ARMORED AND SOFT SCALE INSECTS (HEMIPTERA: DIASPIDIDAE & COCCIDAE) FROM LUZON, PHILIPPINES

Jessamyn R. Adorada¹, Ireneo L. Lit, Jr.² & Frances Coleen M. Laserna, Entomology Section, Museum of Natural History, UPLB; ²IWEP, CAFS, UPLB, College, Laguna; ³IBS, CAS, UPLB, College, Laguna; fmlaserna@up.edu.ph

Scale insects infest a wide variety of crops. One way of controlling these pests is through the use of biological control agents. Parasitoids such as encyrtids are known to control population of diaspidids and coccids. Encyrtid parasitoids of scale insects were surveyed and collected in Luzon. Three genera identified as new records are *Encyrtus*, *Anagyrus*, and *Parablatticida*. One known record parasitizing scale insects is *Comperiella*. A key to the genera is provided.

Key words: Coccidae, Diaspididae, Encyrtidae, parasitoids, scale insects

14. LIST OF ZYGOPTERAN NAIADS IN THE MIDSTREAM AND UPSTREAM OF PINACANAUAN DE TUGUEGARAO (LAGUM AREA) IN PEÑABLANCA, CAGAYAN PROVINCE, PHILIPPINES

Wei Ann A. Mercado & Jessamyn R. Adorada, IWEP, CAFS, UPLB, College, Laguna; wamercado@up.edu.ph

A preliminary survey to determine the zygopteran naiads present in the Lagum Area of Pinacanauan de Tuguegarao was studied. Naiads were collected using surber, kicknet and D-frame samplers. Six families were identified, namely: Platycnemididae, Protoneuridae, Platystictidae, Chlorocyphidae, Euphaeidae, and Coenagrionidae. These insects are important bioindicators known to be pollution-sensitive particularly Euphaeidae and Chlorocyphidae. On the other hand, Platystictidae are forest species and bioindicators of fresh water. A key to the zygopteran naiads is provided. Further studies on conservation is recommended for Lagum Area.

Key words: aquatic insect, Cagayan River, Northern Luzon, Odonata, Zygoptera

15. THE SASSY MANGOES: MANGO CULTIVARS RESISTANT TO FRUIT FLIES

Ana Kristine Barcos, Carolyn E. Alcasid & Maria Luz J. Sison, IPB, CAFS, UPLB, College, Laguna; anabarcos@gmail.com

The Philippines is a major exporter of 'Carabao' mango in the world. In 2012-2014, the Institute of Plant Breeding started the field evaluation of different mango varieties for resistance to different insect pests. The potential resistance of different mango varieties, specifically to the mango fruit fly *Bactrocera dorsalis* (Hendel) were identified under field conditions. This resulted to three varieties with field resistance to fruit flies that had a less than 15% of the fruits infested. These were further identified to have potential resistance against the mango fruit fly. In 2015, a new study commenced to reconfirm the resistance of 'Carabao' and other mango varieties to the mango fruit fly. The mango genotypes were evaluated under laboratory conditions, wherein mango fruit samples were enclosed in a screen cage. Gravid female fruit flies were released and allowed to oviposit on their preferred mango variety. Seven field resistant mango varieties

were further evaluated in the laboratory under caged conditions with laboratory-reared gravid female fruit flies. Attempts at oviposition and number of adults emerging from each fruit were recorded. Under laboratory conditions, the mango variety 'Haden' maintained its resistance while 'Carabao' 12-081 lost its resistance and was susceptible to mango fruit fly attack. 'Tommy Atkins', which was highly susceptible during the field evaluation, was least susceptible in a choice test under laboratory conditions.

Key words: *Bactrocera dorsalis*, host plant resistance, mango fruit fly preference tests

16. PATHOGENICITY OF *Heterorhabditis indica* Poinar et al. PBCB STRAIN ON MANGO FRUITFLY, *Bactrocera philippinensis* Drew & Hancock (DIPTERA: TEPHRITIDAE)

Jose Emmanuel I. de Luna, Romnick A. Latina & Barbara L. Caoili, IWEP, CAFS, UPLB, College, Laguna; jeideluna@gmail.com

Heterorhabditis indica Poinar et al. is one of the most common entomopathogenic nematodes used to manage soil-borne insect pests. In this study, the pathogenicity of the Philippine *H. indica* PBCB strain was evaluated in the laboratory at different infective juvenile (IJ) concentrations (0, 4, 8, 16, 32, 64, 128) on mango fruitfly, *Bactrocera philippinensis* Drew & Hancock. Results showed that at 128 IJs, *H. indica* could cause 82.22% and 88.89% mortality after 24 and 48 hours post infection (HPI), respectively. There is a strong positive linear association between *H. indica* concentration and *B. philippinensis* mortality ($\rho=0.83$ (24-hrs) and $\rho=0.78$ (48-hrs)). On the other hand, LC_{50} was 52.68 IJs and 32.01 IJs at 24 and 48-HPI, respectively. Some treated larva exhibited pink-red coloration, a typical sign of *Heterhabditis* infection. Also, there is a strong negative linear association between *H. indica* concentration and *B. philippinensis* emergence ($\rho= -0.77$). This study proved that *H. indica* is indeed a promising biological control agent against *B. philippinensis*.

Key words: *Heterorhabditis indica*, entomopathogenic nematode, *Bactrocera philippinensis*, mortality, biological control

17. SCHOOL-BASED MOSQUITO ABUNDANCE MODEL (SMAM): A PUBLIC HEALTH APPROACH FOR THE PROTECTION OF CHILDREN AGAINST DENGUE IN THE PHILIPPINES

Lilian A. De Las Llagas, Lisa Grace S. Bersales¹, Myra S. Mistica & Arlene G. Bertuso, Department of Parasitology, College of Public Health, University of the Philippines Manila, Ermita 1000, Manila City; ¹School of Statistics, UPD, Quezon City; msmistica@up.edu.ph

A statistical model that readily predicts mosquito density as indicator of threat of dengue outbreaks in public elementary and high schools in the Philippines is needed. Given the threat of climate change and the association of climate, mosquito density, and dengue incidence, the model is necessary to respond to the major challenges facing dengue prevention and control program of the

Philippines. The predictive model is based on actual data estimating mosquito density in schools not requiring active vector surveillance. A theoretical framework of the ovitrap system was utilized and provided the model's needed inputs to capture the link between mosquito development and its environment. The model is a fixed-effect panel data with seasonal multiplicative autoregressive terms. Data collection was conducted from July 2015 to September 2016 in 21 public elementary and high schools selected across six cities representing the four climate types of the Philippines. The overall mean ovitrap index (OI) during the pronounced dry (51.53%) and dry (59.39%) season were lower than that of the wet (63.47%). The model's prediction performance showed a Mean Absolute Percentage Error (MAPE) of 13.09%, noting that the model can more easily predict in areas under climates 2 and 4 with an overall MAPE of 10.01% and 8.71%, respectively. The R-squared value was 74.28% and adjusted R-squared value was 63.61%. These measures indicate that the model is fit to predict monthly OI across climates, and the information on forecasted OIs will facilitate better implementation of vector control programs to prevent dengue outbreaks.

Key words: climate, dengue, mosquito density, ovitrap index, predictive model

18. SPIDERS ASSOCIATED WITH FLOWERING PLANTS AND THEIR POTENTIAL PREYS

Leslie Ann Ormenita & Alberto T. Barrion, Sr., DLSU, 2401 Taft Avenue, Manila; leslie_ormenita@dlsu.edu.ph

A spider's microhabitat preference in plants may depend on the structure of flowers and vegetative parts. In order to find possible mutualistic conditions, random sampling among local flowering plants and spider-prey species near a nature reserve (University of the Philippines Los Baños) and an area with high anthropological influence (secondary forest of the De La Salle-Science and Technology Complex) was done. The families Araneidae, Salticidae, Thomisidae, Theridiidae, and Clubionidae were found to be dominant in both flowers and vegetative parts of surveyed plants. The age structure and families of the arthropods may vary depending on the rewards that a plant species can provide. There is an abundance of immature spiders among inflorescences which can provide refuge and protection from extreme environmental conditions as well as ensnared pollens that could be used as their food substitute during scarcities of arthropod prey. Most spider species were observed in plants with white, followed by violet, red, and yellow flowers. Plant species surveyed exhibited pollination syndromes and the structure and color of their reproductive structures can serve as visual cues in guiding pollinators which are the spiders' potential preys. Further study on the effect of spiders on reproductive success of the plants should be done in order to verify and confirm our initial survey results.

Key words: flowers, inflorescences, microhabitat preference, mutualism, pollination syndrome, reproductive success

19. SPIDERS ASSOCIATED WITH RIVERS AND STREAMS AND THEIR DIVERSITY BASED ON THE ELEVATION OF THE AREA

Sharin Albacete & Alberto T. Barrion, Sr., DLSU, 2401 Taft Avenue, Manila; sharin_albacete@dlsu.edu.ph

This study focused on spiders associated with rivers and streams, their age structure and guild composition, and the relationship of study site elevation on their diversity. The survey was conducted in two sites: Molawin Creek in UPLB and the river along the secondary forest of the Science and Technology Campus of DLSU (STC-DLSU). *Orsinome vethi* (Hasselt) (Tetragnathidae) dominated the samples (154 individuals) for Molawin Creek and STC-DLSU rivers combined. Other tetragnathid species were found to be the most dominant in the entire collection period. It was noted that female adults and sexually-undetermined immatures dominated the Molawin Creek samples. On the other hand, for STC-DLSU river samples, only the sexually-undetermined immatures were noticeable. The spiders collected were further classified into six different guilds. It was confirmed that species diversity increases with elevation.

Key words: diversity, elevation, river, spider guilds, tetragnathid

20. SEARCHING FOR POTENTIAL KAIROMONES FOR COCONUT SCALE INSECT, *Aspidiotus rigidus* Reyne

Mary Angelique A. Tavera, Jose Isagani B. Janairo, Divina M. Amalin, Billy Joel M. Almarinez, Jose Santos R. Carandang VI & Demi Jane Cruz, DLSU, 2401 Taft Ave., Manila; mary_angelique_a_tavera@dlsu.edu.ph

Coconut is one of the major crops of the Philippines. However, the infestation of the scale insect, *Aspidiotus rigidus* Reyne, presents a threat to the coconut industry. In response to this problem, Integrated Pest Management (IPM) is practiced. Part of IPM is the utilization of semiochemicals. Identification and characterization of a kairomone, the chemical responsible for attraction to a host, may be used to develop a lure. The plant hosts of the *A. rigidus* are: mangosteen (*Garcinia mangostana* L.), fan palm (*Licuala grandis* (Hort. ex W. Bull) H. Wendl.), lady palm (*Rhapis excelsa* (Thunb.) A. Henry), and betel nut palm (*Areca catechu* L.). By headspace analysis using Solid Phase Microfiber Extraction and Gas Chromatography - Mass Spectrometry, a volatile profile of each of the plant hosts were made. Results showed that a common ester compound was present in all hosts, possibly the kairomone of interest.

Key words: coconut, gas chromatography – mass spectrometry, integrated pest management, kairomone, solid phase microfiber extraction

21. LIFE HISTORY AND HOST RANGE OF *Helopeltis bakeri* Poppius (HEMIPTERA: MIRIDAE), A MAJOR PEST OF *Theobroma cacao* L. IN LUZON, PHILIPPINES

Joeselle M. Serrana^{1,2}, Billy Joel M. Almarinez^{2,3}, Alberto T. Barrion^{2,3} & Divina M. Amalin^{2,3}, ¹Ehime University, Matsuyama, Japan; ²Biological Control

Research Unit, Center for Natural Sciences and Environmental Research, DLSU, Manila, Philippines; ³Biology Department, CS, DLSU, Manila, Philippines; billy.almarinez@dlsu.edu.ph

Four species of *Helopeltis* Signoret have been reported in the Philippines, among which *H. bakeri* Poppius has been identified as a major pest of *Theobroma cacao* L. in Luzon. This particular mirid species prefers to feed and oviposit on cacao pods, causing characteristic feeding lesions through which pathogens such as *Phytophthora* spp. can easily enter. In this study, we describe the life history and host range of *H. bakeri*. The biology of mirid bugs reared on shoots of *Ipomoea batatas* (L.) Lam. was observed and documented from egg to maturity. Preferred and alternate host plants were identified through field observations and laboratory feeding tests. The egg stage takes 7.49 ± 0.43 days, after which five nymphal instars last for 3.11 ± 0.53 , 1.51 ± 0.37 , 2.07 ± 0.11 , 4.40 ± 0.32 , and 4.45 ± 0.17 days, respectively. Adults live for up to 45 days, and longevity was found not to be significantly different between males and females. *Polyscias scutellaria* (Burm.f.) Fosberg and *I. batatas* have been confirmed as preferred hosts, with *H. bakeri* feeding primarily on these plants' leaves and ovipositing on the petioles. No-choice tests revealed five other alternate host plants, whose association with *H. bakeri* in the Philippines has not yet been reported. These findings on the life history and host plant associations of *H. bakeri* provide very important insights that can be considered in managing populations of this pest in cacao-growing areas in the country.

Key words: alternate hosts, biology, *Helopeltis bakeri*, life history, host preference, *Theobroma cacao*

22. TOWARD THE UTILIZATION OF OMICS TECHNOLOGY IN PHILIPPINE ENTOMOLOGICAL RESEARCH: OPTIMIZATION OF TRANSCRIPTOME AND METAGENOME SEQUENCING IN SELECTED INSECT SPECIES

Ma. Anita Mascareñas-Bautista^{1,2*}, Jessa Mae T. Camposano^{1,2}, Alfredo Jose C. Ballesteros^{1,2}, Maria Almira S. Cleofe^{1,2}, Kim Ivan Abesamis^{1,2}, Jo-Hannah S. Llames^{1,2}, Shamdee N. Nahar^{1,2}, Emilia Sabban¹, Maria Dulce J. Mostoles³, Marcela M. Navasero⁴ & Mario V. Navasero⁴, ¹NIMBB, NSC, CS, UPD, Diliman, Quezon City 1101; ²PGS, NSC, CS, UPD, Diliman, Quezon City 1101; ³CANS, CBSUA, Pili, Camarines Sur; ⁴NCPC, CAFS, UPLB, College, Laguna; mambautista@mhb.up.edu.ph

Omics research has paved its way in the Philippines through the advent of next generation sequencing (NGS) technologies available at the Philippine Genome Center. This study aims to add strength to the omics technique adopted in the institute by facilitating studies on transcriptomics and metagenomics of organisms with less complex genomes such as insects. Conducting these techniques that are more feasible for the NGS platforms would then enhance utility. Insect transcriptomics and metagenomics enable the generation of molecular toolbox that can be used to understand various biological processes in insects. Organisms of interest include a parasitoid (*Comperiella* sp.) and stingless bees (*Tetragonula* sp.) for transcriptomics, and a termite (*Microcerotermes* sp.) for metagenomics. Optimization of nucleic acid template

preparation was done to ensure good quality output for high-throughput sequencing and bioinformatics.

Key words: *Comperiella*, genomics, metagenomics, *Microcerotermes*, stingless bees, transcriptomics

23. IDENTIFICATION OF POTENTIAL NATURAL PREDATORS OF CATTLE FEVER TICKS, *Rhipicephalus microplus* (Canestrini), IN SELECTED AREAS IN NUEVA ECIJA

Kimverly Hazel Coronel, Nancy S. Abes, Mary Jane C. Flores, Alberto T. Barrion & Divina Amalin, DLSU, 2401 Taft Avenue, Manila; kimverly_coronel@dlsu.edu.ph

The biggest challenge in the control of ticks, such as cattle fever tick (CFT), *Rhipicephalus microplus* (Canestrini), is the development of resistance in ticks to common acaricides, as well as environmental pollution and food contamination. This study aimed to identify possible predators of CFT as potential biological control agents to complement the existing integrated tick management strategy. Natural predators were collected in selected areas in Nueva Ecija, by using pitfall traps. Preserved samples were brought to the laboratory for identification and determination of their potential ecological role. Out of 52 species of insects and other arthropods collected, only 14 have been identified as possible CFT predators. Two species are recommended for feeding efficiency test on CFT. Four species of spiders belong to Lycosidae: *Pirata* sp., *Pardosa birmanica* Simon, *Pa. sumatrana* (Thorell), *Pa. pseudoannulata* (Bösenberg & Strand) and *Pardosa* spp. Other species of spiders were *Oxyopes javanus* Thorell (Oxyopidae), *Heteropoda* sp. (Sparassidae), and *Cyclosa mulmeinensis* (Thorell) (Araneidae). There were four species of ants (Formicidae), namely: *Solenopsis geminata* (Fabricius), *Tetramorium* sp., *Monomorium* sp., *Technomyrmex* sp. Other insect species identified as potential predators were *Euborellia philippinensis* Srivastava (Dermaptera: Anisolabididae) and *Chlaenius* sp. (Coleoptera: Carabidae). Natural enemies of CFT need to be identified and evaluated for their efficiency as biological control agents, and using them for pest management could lessen the burden on the increasing cost of acaricides and the detrimental effect of acaricides on human health and the environment.

Key words: biological agents, cattle fever ticks, natural enemies, predators, tick management

24. EVALUATION OF *Metarhizium anisopliae* (Metchnikoff) Sorokin AND *Beauveria bassiana* (Bals.-Criv.) Vuill. AGAINST SNOOT BEETLE (*Metapocyrtus* (*Trachycyrtus*) spp.) ON STRAWBERRY AND CITRUS IN THE CORDILLERA

Maritess Alimurung, Trenesie Lorezco, Nancy Aspuria & Rhonda Oloan, DA-BPI, Guisad, Baguio City; tess_alimurung@yahoo.com.ph

Snout beetle (*Metapocyrtus* (*Trachycyrtus*) spp.) is a destructive pest affecting strawberry and citrus production in the highland areas of the Northern

Philippines. The white grubs feed on the root system of both fruit crops while the adult beetles feed on the shoots and young leaves. Infested plants become stunted and severe damage could result to wilting and death of infested plants. To develop measures to manage the pest and prevent further problems on the side effects of toxic chemicals, the effects of two fungal species as biological control agents were evaluated against the white grubs. *Beauveria bassiana* (Bals.-Criv.) Vuill. and four isolates of *Metarhizium anisopliae* (Metchnikoff) Sorokin were evaluated on strawberry and citrus. Both fungi were applied into the soil one week before transplanting the strawberry runners and citrus seedlings. Based on white grub population and their damage on sample plants, *B. bassiana* and *M. anisopliae* isolates MA-RB and MA-RBB were found effective against white grubs. Plants applied with the fungi significantly had lower white grub populations and degree of root damage, resulting to better growth and development and lower percentage of infested plants. These fungi could be integrated with other pest management methods for better strawberry and citrus production.

Key words: *Beauveria*, citrus, *Metarhizium*, snoutbeetle, strawberry

25. EVALUATION OF MANAGEMENT STRATEGIES AGAINST TWO SPOTTED MITES (*Tetranychus urticae* C.L. Koch) UNDER ORGANIC STRAWBERRY PRODUCTION IN THE CORDILLERA

Maritess A. Alimurung, Allan Adrian B. Galao & Donald R. Namuro, DA-BPI, Guisad, Baguio City; tess_alimurung@yahoo.com.ph

Strawberry is a high valued fruit crop in the Cordillera and commercial production is mostly found in La Trinidad, Benguet. At present, organic production is being promoted. One limiting factor is the attack of two-spotted spider mites (*Tetranychus urticae* C.L. Koch), one of the major pests attacking strawberry. To manage the pest, the effect of *Beauveria bassiana* (Bals.-Criv.) Vuill. and *Metarhizium anisopliae* (Metchnikoff) Sorokin as biological control agents, three agricultural oil sprays, wood vinegar, and eight plant extracts were evaluated. The evaluated strategies significantly reduced *T. urticae* population resulting to less damaged strawberry plants and higher yield compared to untreated plants. *B. bassiana* and *M. anisopliae* using MA-RBB and MA-RB isolates at 300g of each fungus grown in cracked corn kernels per 16 L water, mineral oil at 1-1.5%, and hot pepper and ginger extracts at 30-40 ml/L water sprayed at 1-2 weeks interval were found more effective against two-spotted spider mites. These management strategies should be applied at early stage of mite infestation where population is still low and should be integrated with other existing organic pest management practices. For organic strawberry fruit production, integrating organic pest management practices results to safe and quality fruits. Also, a grower cultivating a limited area of 500 sq.m. could have a net income of PHP43,325.00 with ROCE of 88.77%.

Key words: Cordillera, organic, pest management, strawberry, *Tetranychus urticae*, two-spotted spider mites

26. EMERGING LEAF-EATING BEETLE PEST ON SINEGUELAS (*Spondias purpurea* L.) IN SAN JUAN, BATANGAS

Russ-Uzi Mayenne Eborá, Wilma R. Cuaterno, Nestor E. Rivera, Remigio C. Tabil, Russ-Uzi Mayenne A. Eborá & Lisa P. Tagaan, DA-BPI, San Andres, Manila; uzi.russ@gmail.com

The fruit of sineguelas (Spanish plum) is considered as source of income in Batangas. Some farmers and households were quite alarmed of the pest infesting their plum trees. A field validation was conducted by the Bureau of Plant Industry, Crop Pest Management Division on August 17, 2016 in Barangay Bulsa and in other adjacent farms in San Juan, Batangas. An insect belonging to Order Coleoptera, Family Chrysomelidae and also known as leaf-eating beetle or spotted beetle infested their plum trees. Both larvae and adults feed on and skeletonize the leaves. Initially, it was identified as *Podontia* sp. Moreover, initial rearing was conducted in the laboratory. The eggs were laid in clusters of 20-40 and incubation period was 7-8 days while larval period was 11-18 days and pupal period, 10-29 days. Life cycle ranged from 30-60 days.

Key words:, Leaf eating beetle, *Podontia*, sineguelas, Spanish plum, Spotted beetle

27. PATHOGENICITY OF *Heterorhabditis* sp., AN ENTOMOPATHOGENIC NEMATODE INFECTING SWEET POTATO WEEVIL (*Cylas formicarius* Fabricius)

R. Gapasin, J.L. Lim, M.J.C. Ceniza, E.L. Oclarit, L.T. Ubaub¹, M.C.Alde¹, A.G. Junio & H.E. Trazona, Visayas State University (VSU), Department of Pest management, College of Agriculture, Visca, Baybay City, Leyte; ¹ University of Southeastern Philippines (USEP) Tagum Campus, Tagum City; rubengapasin53@gmail.com

The study aims to determine the in vitro and in vivo pathogenicity of different isolates/strains of entomopathogenic nematodes (EPN) in controlling the sweet potato weevil in the laboratory and greenhouse. There were four (4) EPN isolates used in the pathogenicity test against the larvae and pupae of sweet potato weevil namely: UBD (Bacong, Neg. Or.), AVD (Valencia, Neg. Or.), HO1 (Barili, Cebu), and CP (Pangasugan). Result of the laboratory evaluation showed that the four (4) EPN were equally promising for the control of both larvae and pupae in three (3) populations/concentrations used (100/ml, 200/ml, and 300/ml). Mortality on larvae and pupae was observed 24 hrs after treatment and 24 hrs of incubation of cadavers. A 50% mortality of population of weevil larvae treated with the four (4) EPN was observed at a minimum of 2 days at 300/ml populations/concentrations and a minimum of 3 days for 200/ml and 3-4 days on 100/ml. Fifty percent (50% mortality) of pupae was observed 5-6 days after treatment regardless of the populations/concentrations of EPN used. Percent infection on the other hand, is as high as 96% on larvae and 83% on pupae. On the other hand, three (3) of the EPN were tested against sweet potato weevil in a pot experiment using a 300/ml population/concentration of EPN. Result showed that there is no significant difference among the three isolates in the damage

rating of tubers and was found comparable to the effect of the chemicals used in the experiment suggesting their potential as biological control agents against the sweet potato weevil. Field experiment to evaluate their efficacy is underway.

Key words: *Heterorhabditis* sp., Entomopathogenic Nematode (EPN), Sweet potato weevil, *Cyclas formicarius*, isolates

28. THE INVASIVE COCONUT SCALE INSECT, *Aspidiotus rigidus* Reyne: LIFE CYCLE AND MASS REARING

Cris Q. Cortaga, Maria Luz J. Sison. Don Serville R. Reynoso, Joseph P. Lagman¹, Ambrosio Raul Alfiler¹ & HaydeF. Galvez, IPB, CAFS, UPLB, College, Laguna; ¹Philippine Coconut Authority-Albay Research Center, Guinobatan, Albay; mljsison1224@yahoo.com

The life cycle and mass rearing of the Coconut Scale Insect (CSI), *Aspidiotus rigidus* Reyne were studied. Mass rearing was successfully conducted on mangosteen wherein *A. rigidus* completed its development and reproduction. Pure culture was also possible on mangosteen due to non-preference of other CSI species such as *A. destructor*, as validated by the DNA sequencing of the reared insects. The life cycle study was conducted on mangosteen seedlings in a greenhouse at 18°C and 52% RH. CSI underwent several stages: egg (2.3 ± 0.18 days), crawlers (1st instar) (2.03 ± 0.18 days), white cap (3.50 ± 0.81 days), nipple stage (9.53 ± 1.61 days), 2nd instar (11.60 ± 1.91), 3rd instar and adult - female (24.87 ± 2.32 days); pre-pupa and pupa - male (10.67 ± 1.01 days) adult - male inside the scale (4.36 ± 0.77 days). The female *A. rigidus* completed its life cycle in 52 days; the male in 42 days. Female CSI produced an average of 48 eggs. The information gathered was used in the conduct of studies on identifying resistant variety(ies) for coconut breeding program.

Key words: *Aspidiotus rigidus*, invasive coconut scale insect, mass rearing

29. INSECTICIDAL ACTIVITY OF MARINE TOAD *Rhinella marina* (L.) SKIN SECRETIONS AGAINST DENGUE MOSQUITO *Aedes aegypti* (L.) (DIPTERA: CULICIDAE)

John Ruben C. Valeza¹, Maria Dalisay Giron-Maligalig¹ & Pio A. Javier², ¹IBS, CAS, UPLB, College, Laguna; ²NCPC-IWEP, CAFS, UPLB, College, Laguna.

The insecticidal activity of skin secretions of the marine toad *Rhinella marina* (L.) was assayed against the dengue mosquito *Aedes aegypti* (L.). Ether (EF) and aqueous fractions (AF) were prepared through solvent fractionation. Ovicidal and larvicidal activities were determined against *A. aegypti*. Growth inhibition and oviposition deterrent assays were also done. Distilled water (negative control) and black pepper ethanolic extract at 14 ppm (ovicidal) and 3.97 ppm (larvicidal) were included for comparison. The EF had significantly higher 24-h ovicidal toxicity ($LC_{50} = 22.32 \pm 1.98$ ppm) and larvicidal toxicity ($LC_{50} = 3.79 \pm 0.20$ ppm) than the AF with LC_{50} eggs of 230.28 ± 29.36 ppm) and AF with LC_{50} larvae of 9.06 ppm. The higher amount of bufadienolides in the EF of the skin secretions explains the ovicidal and larvicidal activity against *A. aegypti*. Treated larvae produced abnormalities which include ruptured abdomen, damaged exoskeleton, disintegrated internal organ, and in the subsequent adult, enlarged abdomen and extended wing span. Meanwhile, oviposition deterrent activity was

100% for AF and 79% for EF. These findings suggest that the skin secretions of *R. marina* can be a potent source of insecticidal bioactive compounds.

Key words: *Aedes aegypti*, insecticidal activity, marine toad skin secretions, *Rhinella marina*

30. INCIDENCE OF TOBACCO STEMBORER, *Scrobipalpa aptatella* (Walker) (Lepidoptera: Gelechiidae) IN MINDANAO WITH NOTES ON ITS BIOLOGY

Mario V. Navasero, Marcela M. Navasero, Maricon dP. Javier, Randolph N. Candano, Wilson N. de Panis & Regine N. Candano, NCPC, CAFS, UPLB, College, Laguna; marnavasero@yahoo.com

Scrobipalpa aptatella (Walker) is a reported pest of tobacco from various countries including the Philippines. It is considered a minor pest in the Ilocos Region where tobacco is normally grown once a year. Recently, there has been increased level of importance of *S. aptatella* in tobacco grown in Mindanao due to unlimited food resource where tobacco is planted year-round. Swelling or galling of damaged plant parts, stunting, and unusual branching of young plants are common field symptoms of feeding damage of the larvae. High incidence of the pest reduced yield by 50% in 2016, which is expected to decline even more in the absence of an effective management protocol. The life history of *S. aptatella* from Mindanao was studied on tobacco under laboratory conditions. The incubation period ranged from 4-5 days. Development time of the larva was about 16 days and pupa, 4-5 days. Total development time (egg to adult) was about 24 days. Fecundity ranged from 3-127 eggs per female. Longevity of male ranged from 5-28 days while the female had shorter lifespan ranging from 3-15 days.

Key words: life history, *Scrobipalpa aptatella*, tobacco, tobacco stem borer

31. TRANSCRIPTOMICS REVEALED FIELD PARASITISM OF COCONUT SCALE INSECTS, *Aspidiotus* sp., BY HYMENOPTERAN SPECIES

Ma. Anita Mascareñas-Bautista^{1,3*}, Maria Almira S. Cleofe^{1,2}, Adria Gabrielle D. Lao, Justin William Duran, John Michael Egana, Barbara L. Caoili & Don Pietro B. Saldajeno, ¹NIMBB, CS, NCS, UPD, Diliman, Quezon City 1101; ²IWEP, CAFS, UPLB, College, Laguna; ³PGC, NSC, UPD, Diliman, Quezon City 1101; mambautista@mhb.up.edu.ph

Transcriptomics or the global profiling of transcripts or expressed genes in an organism through next generation sequencing may offer support to the effort of investigating field parasitism. Through transcriptome analysis, transcripts from both the host and the natural enemy can easily be detected. Additionally, transcript sequences of other species of potential parasitoids may appear from the transcriptome sequencing data. This study aims to investigate the presence of natural enemy transcripts in a field population of the coconut scale insect (CSI), *Aspidiotus rigidus* Reyne (outbreak species) and *A. destructor* (the non-outbreak species) through transcriptome sequencing. Results show that transcripts from field samples of CSI have similarity to some known parasitoids indicating parasitism in the field. Transcriptomics of *Comperiella* sp., a new

species of a parasitic wasp discovered in a survey for natural enemies of the cocolisap in Calauan, Laguna in 2017, also revealed similarities to the same species in parasitoids.

Key words: *Aspidiotus* sp., *Comperiella*, parasitoids, transcriptomics

32. COCKROACHES: NOTORIETY TO VITALITY

Alice Geraldine S. Hernando^{1,2} & **Aimee Lynn A. Barrion-Dupo**³, ¹MMSU, Batac, Ilocos Norte; ²University of Santo Tomas, Sampaloc, Manila; ³IBS, CAS, UPLB, College, Laguna; alicegeraldin_hernando@yahoo.com

Cockroaches such as the American and German cockroaches are considered by most humans as pest. This is the tag concept of cockroaches in the Philippines. A review on the studies of cockroaches five years ago was undertaken. Most of the researches that had been conducted were influence on the parasitic effects of cockroach to human society and its role as a vector in transmitting unwanted medical diseases. Later, there were studies conducted on controlling these insects using entomopathogenic nematodes. Subsequently, researchers went into the *in vivo* aspect wherein they studied the antibiotic resistance of bacterial strains isolated in the body regions (tagmata) of these cockroaches. They also isolated protozoans and macroscopic nematodes associated with these cockroaches. Recently, entomologists are concentrating on the mechanical and physiological aspect of these creatures. They dwell on the mechanical features on the tracheal tubes of cockroaches using innovative ring system. Scientists also researched on the different enzymes associated in the gut of cockroaches and their synergistic effect on their body system as well as their industrial purposes. Also, they subjected internal organs exposed to some extracts into histopathological studies. Finally, their ecology (diversity and abundance) and systematics (nomenclature and taxonomy) are still the main focus of entomologists nowadays to further elucidate their noteworthiness in society and not just a “nuisance” species in the locality.

Key words: annotation, bibliography, cockroaches, vitality

33. THERMAL RESISTANCE OF COMMON HOUSE FLY (*Musca domestica* L.) FOUND IN BATAC PUBLIC MARKET, BATAc, ILOCOS NORTE

Alice Geraldine S. Hernando, MMSU, Batac, Ilocos Norte and University of Santo Tomas, Sampaloc, Manila; alicegeraldin_hernando@yahoo.com

Common houseflies have a widespread distribution in which humans and other terrestrial animals live. They maybe parasitic in a sense as well as vectors of diseases. At optimum conditions, they have a high rate of survival. Thus, this study aimed to gather first-hand information about the thermal resistance of the common houseflies found in the public market at extreme temperature. It initially sought to give answers to what maximum temperature can houseflies withstand; the time or duration that can survive, and some morphological responses to temperature changes. Houseflies were collected in public market with insect net and placed in a container ready for treatment. There were five

treatments, namely: the sunlight with 40°C temperature; open flame with various temperatures such as 45°C; 50°C; 55°C and 60°C. Houseflies can tolerate the heat of the sun rays with 2 hours duration; some flies died at 45°C with 30 minutes duration and most of the flies died with exposure to 50°C for about 3-5 minutes. Their exposure to this temperature cracked their antennae into pieces, their wings discolored, the thorax and abdomen divided into two but their pro-mid-hind legs remained in contact to the sternum. This study provided necessary initial data or references to future studies of houseflies at elevated temperatures such as diversity, ecology and evolution.

Key words: common housefly, *Musca domestica*, temperature, tolerance

34. INSECTAWAY UV LIGHT TRAP, AN EFFICIENT NON-CHEMICAL METHOD OF CONTROLLING STORAGE INSECT PESTS IN WAREHOUSES

Karina C. Ybañez¹, Pio A. Javier^{2*} & Mark Lester Revilloza¹, ¹IWEP, & ²NCPC, CAFS, UPLB, College, Laguna; pio.javier@yahoo.com

The potential of InsectAway UV light trap in capturing stored product insect pests was evaluated in three different warehouses in Calauan, Laguna. Its drip tray was filled with 1.5 L of tap water, with 0.5 g detergent added. A mirror was placed on the drip tray to increase the area reflected by the InsectAway. Trapping was done from 6 pm to 6 am. The proportion of captured stored product pests and natural enemies was determined. A very high number of stored product pests was captured using the InsectAway UV light trap. In all the warehouses, the proportion of the storage product pests was about 98% and only 2% are natural enemies. The lesser grain borer, *Rhyzopertha dominica* (Fabricius), a primary pest of stored products, was consistently the most dominant among the captured pests while the warehouse pirate bug, *Xylocoris flavipes* (Reuter), a generalist predator, was the most dominant natural enemy captured. These suggest that the use of InsectAway UV light trap, having captured high numbers of stored product pests, can be recommended for pest management in rice mill/warehouses.

Key words: InsectAway, *Rhyzopertha dominica*, storage pests, UV light trap, *Xylocoris flavipes*

35. BUTTERFLIES IN BT CORN FIELDS: MAINTENANCE OF NON-TARGET ARTHROPOD BIODIVERSITY IN A BIOTECHNOLOGY-PROTECTED AGROECOSYSTEM

Ireneo L. Lit, Jr.¹ & Merdelyn T. Caasi-Lit², ¹IBS, CAS, UPLB and Entomology Section, MNH, UPLB; ²IPB, CAFS, UPLB, College, Laguna; illit@up.edu.ph

Data on the abundance and diversity of naturally occurring butterflies (Lepidoptera: Papilionoidea and Hesperioidea) in Bt corn fields, including those gathered during a previous series of studies on non-target organisms of various Bt corn hybrids (single-trait and stacked) were consolidated. The consolidated data provided further scientific data on the safety of Bt corn technology to butterflies as part of the non-bee pollinator guild and attest to the compatibility

of Bt corn with maintaining biodiversity in the agroecosystem.

Key words: biosafety, Bt corn, butterflies, non-target organisms, terrestrial arthropod biodiversity

36. PEST POPULATION AND YIELD COMPARISONS OF RECOMMENDED ORGANIC AND CONVENTIONAL PRACTICES IN LOWLAND RICE AND EGGPLANT-POLE SITAO

Marilyn G. Patricio & Rovel S. Melegrito, Research Office, CLSU, Muñoz, Nueva Ecija; mgpatricio@yahoo.com

One main challenge in organic farming is to be competitive with conventional farming. In both systems, insect pests and diseases pose major threats that negatively impact crop health and yield. A 2-year study (April 2014-May 2016) was conducted at the Research Experimental Field, CLSU, Muñoz, Nueva Ecija. Pest population and yield of three crops were compared, thus: T1- recommended organic practices (ROP) using developed organic input (microbial inoculants + plant-based pesticides); T2- farmers' organic practices (FOP); and T3- conventional chemical practices (CCP). Rice at 37 and 45 days after planting had significantly lower green leafhopper population in ROP than in CCP and FOP by 32.71% and 34.21%, respectively. Natural enemies (spiders, wasps, damselflies, coccinellids) were more numerous in FOP plots. Rice blast and bacterial leaf blight were comparably low in organic and conventional plots. Eggplants in ROP and CCP had less damage from leafhoppers and fruit-shoot borer compared to FOP. Pole sitao had significantly lower leafhopper and coccinellids in CCP plants. Rice yield (wet season) showed no significant difference between ROP (6.50 t/ha) and CCP (6.96 t/ha) and lowest in FOP (4.43 t/ha). However, in the dry season, CCP obtained significantly the highest (6.41 t/ha) yield, followed by ROP (4.40 t/ha); the lowest, in FOP (3.09/ha). For eggplant, comparable marketable fruit weight was obtained in ROP (8.95 kg/12m²) and CCP (8.58 kg/12m²); FOP had the lowest (3.09kg/12m). For pole sitao, heaviest pod weight was obtained from CCP plot (15.32 kg) followed by ROP (11.20 kg).

Key words: eggplant-pole sitao, lowland rice, natural enemies, organic farming, pest population